Minutes of the ISO/IEC JTC1/SC21/WG7/E-LOTOS meeting
Ottawa, 20th-26th of July 1995

0. Attendance list

Daniel Amyot, University of Ottawa, Canada, damyot@csi.uottawa.ca [1]
Robin Barker, NPL, United Kingdom, rmb@ditc.npl.co.uk
Hubert Garavel, INRIA, France, Hubert.Garavel@imag.fr [2]
Alan Jeffrey, University of Sussex, United Kingdom, alanje@cogs.susx.ac.uk [3]
Sungwon Kang, Korea Telecom, Korea, kangsw@sava.kotel.co.kr
Guy Leduc, University of Liège, Belgium, leduc@montefiore.ulg.ac.be [2]
Luc Léonard, University of Liège, Belgium, leonard@montefiore.ulg.ac.be [2]
Luigi Logrippo, University of Ottawa, Canada, luigi@csi.uottawa.ca [1]
Elie Najm, E.N.S.T., France, najm@res.enst.fr
Juan Quemada, Tech. Univ. of Madrid, Spain, jquemada@dit.upm.es
Jacques Sincennes, University of Ottawa, Canada, jack@csi.uottawa.ca [1]

1. Appointment of a secretary

Guy Leduc volunteers.

2. Agenda

The following agenda is agreed on:

- List of input documents
- Rapporteur's report
- Presentation of input documents
- Technical discussions (data model, behavioural model)
- Progression of the work item
- Planning of the PDAD (Proposed Draft Addendum)
- Liaison and co-ordination
- Closing

3. List of input documents

OTT1: A Building Blocks Approach for the Specification of ODP Binding Objects using MT-LOTOS (French experts)
OTT2: An ET-LOTOS Description of an ODP Binding Object (Belgian experts)
OTT3: Belgian Comments on ISO/IEC JTC1/SC21/WG7 N1001 (Belgium)
OTT4: Towards a Proposal for Datatypes in E-LOTOS (UK and Belgian experts)
OTT5: Minutes of the COST 247 WG1 Meeting on Data Type Issues in Extended LOTOS (European experts)
OTT6: French-Romanian Proposal for a Correct Flattening of LOTOS Parameterized Types (French and Romanian experts)
OTT7: Contribution to the Design of Datatypes in E-LOTOS (French expert)
OTT8: Comments from Japanese Experts on "Revised Working Draft on Enhancements to LOTOS" (Japanese experts)
OTT9: Extending Gate Typing to Mobile LOTOS (French experts)
OTT10: Alternative Definition for Internal Action Prefix in TE-LOTOS (Spanish experts)

---

[1] In the framework of ISC 45 (EUCALYPTUS 2)
[2] Supported by ISC 45 (EUCALYPTUS 2)
[3] Supported by EC BRA 7166 (CONCUR 2)

OTT11: Integrating Time Extended LOTOS with Tagged Generalized Termination, Enabling ad Disabling (Spain)

4. Rapporteur's report

An interim meeting took place in Paris (February 6-8, 1995). A revised working draft has been output. The change from WG1 to WG7 is now completed. The ELOTOS group is willing to provide an increased support to ODP. As the specification of the Trader is available, it is considered important to provide support to describe parts of the ODP trader in LOTOS. There has been another meeting in Warsaw in June (COST 247 European Action) where datatype issues have been discussed.

5. Datatypes

Relevant documents: OTT4, OTT5, OTT7, OTT8.

5.1. Overview of section 2 of OTT4

Alan Jeffrey briefly introduces this section. It identifies some problems associated with ACT ONE. It also presents the Paris meeting decision to replace the datatypes by a two-level language based on an ML-like functional approach and an equational approach (e.g. ACT ONE or EML). Finally, the section proposes a list of requirements the new language should satisfy.

5.2. Overview of section 2.1 of OTT8

Alan Jeffrey briefly introduces the Japanese comments about the data part. They will be considered in the next version of the revised draft. In particular, some unification between proposals on typed-tagged gates and between proposals on modules are requested. They also suggest to look at other languages like Scheme (for numbers) and Z (for characters).

5.3. Overview of OTT7

Hubert Garavel presents this contribution which addresses some issues not covered in OTT4. Drawbacks of describing complex data structures (e.g. discriminated unions) in languages like Pascal, ADA, … are pointed out. Types recursively defined by free constructors offer a better alternative from a semantic point of view.

It is also argued that being able to give names to the formal parameters of constructors (e.g. fields in record data structures) is necessary, and cannot be achieved in ACT ONE.

Then the contribution concentrates on the definition of (the body of) functions. It suggests to extend the LOTOS value expressions by introducing new constructs (e.g. if-then-else, andthen, orelse, case, …).

We agreed that the evaluation of value expressions should be deterministic.

5.4. Review of sections 4 and 5 of OTT4

Alan Jeffrey presents this contribution.

We agreed to add a section on types recursively defined by free constructors and to include such types in the language. The SML recursive type declarations, the proposals in OTT7 and in IS 10746-3 (annex A) provide this feature.

We agreed to include a unit type. The SML unit type is a good candidate.

We agreed to include a Boolean type. The SML Boolean type is a good candidate.

We agreed to include an abstract character type, which is basically a finite enumeration of characters. We will also consider international character sets such as ISO 10646, as well as compatibility with other languages such as ASN.1. The SML/NJ and Z character types are good candidates.

We agreed to include an integer type with no minimum and no maximum values. The SML integer type is a good candidate, but numbers provided by Scheme will be considered.

We agreed to include a rational type with the semantics as a set of all rational numbers.

We agreed to include an external float type with no formal semantics.

We agreed to have a simple core language, completed by libraries of derived types, which are particular kinds of modules, and various shorthand notations. The Ottawa output document will be reviewed to reflect this structure.

Records and tuples were discussed, but no consensus was reached to include them as part of the core language. Hubert Garavel expressed concerns about having record and tuples as primitive types since these two constructs are redundant with constructors having multiple arguments, and suggests to have merely shorthand notations for them. Also tuples introduce anonymous types and require structural equivalence on types. On the other hand, Alan Jeffrey et al. pointed out that having tuples (or records) as primitive types is extremely important for the type theory, and also useful from an application point of view.

We agreed to include a list type in the standard library. The SML list type is a good candidate.

We agreed to include arrays with a functional semantics in the standard library, although tools may implement array updates in other ways for efficiency reasons. The SML/NJ vector and array types are good candidates. Some syntactic sugar may also be useful.

We agreed to include associative arrays in the standard library.

We agreed to restrict the language to first-order functions.

We agreed not to include reference types (i.e. pointers), as well as any other kinds of side-effects.

We agreed to have a let-construct in the datatypes language (e.g. let D in e). D could contain pattern matching on expressions, but other local declaration constructs (e.g. type declarations, modules, infixity) allowed by SML are much more questionable. Local function declarations and local process declarations (using where-clauses) should also be harmonized.

We agreed to have strong typing and a static, decidable type system. However, we did not reach an agreement to include either polymorphism or overloading. Polymorphism supports the ‘proposition as type’ paradigm and Curry-Howard isomorphism, and allows implicit types, which leads to more compact specifications. On the other hand, implicit types may reduce the readability, and is partially redundant with generic modules. If polymorphism is chosen, it will remain to decide whether we accept type inference or not. It has been

decided that two groups will prepare separate proposals advocating respectively the use of polymorphism and overloading.

We have studied the implications of having abstract datatypes such as a type T whose structure is hidden (not exported) in a module. Several problems occur when the values of T are not in normal form. For example, if sets are implemented by unsorted lists, 2::3::nil and 3::2::nil are equivalent representatives for the same value. In such a case, the "syntactic" equality is not appropriate to compare values, and it would be suitable not to export this equality from the module. This leads to "non-equality" types for which the semantics of value matching cannot be defined. Another related semantic problem was found when the operator is used for choice x:S [] … with a sort S whose representation is hidden. This problem is left for further study.

We agreed not to reject non-terminating functions. The semantic problems caused by non-terminating functions will be studied as well as the relation with the behavioural part. A dynamic semantics based on the 'big-step' semantics for the data part will be worked out. The precise treatment of divergence, e.g. based on divergence-sensitive bisimulation, is left for further study.

We agreed to investigate the inclusion of a restricted kind of exceptions in the datatypes language. Concurrent systems like ODP make use of so-called 'named termination' which could be advantageously modelled by exceptions. If exceptions are supported in the datatype language, then a clean semantics should exist to propagate them to the behavioural part.

We agreed to adopt modules in ELOTOS for data and behaviours, including generic modules. Abstraction facilities are also required, which would allow to prevent the export of equality from a module. We should investigate further in this direction. The SML module system has clear separation of signatures and structures. It also supports sharing constraints on instantiated structures. The SML module system will thus be considered and compared with the ACT ONE formal types.

We agreed with the Japanese comment in OTT8 (section 2.4): it should be clear that a formal semantics for modules will be provided.

We agreed to include a syntax for external declarations with no defined semantics. The same feature will be investigated for behaviours. The external declarations should be nicely integrated with the module system, by allowing for example function bodies in modules to be external. We discussed the possibility of having "standardized" pragmas for interfacing particular external languages (C, ASN.1, …) so as to provide for tool inetroperability in communication with the external world. This topic was left for further study.

Regarding syntax two possibilities are retained: either the syntaxes for the datatype and behaviour parts will be unified, or the SML and LOTOS syntaxes will be kept distinct to allow for easier code reuse from both worlds. We agreed to resolve syntactic conflicts between LOTOS and the datatype language in favour of LOTOS.

We agreed to develop two proposals for static semantics. The first one will be similar to SML, will use the ODP type system as a reference and include polymorphism and possibly type inference. The second one will be based on document OTT7.

We agreed to adopt a deterministic big-step dynamic semantics.

We agreed that expressions defined in the data language will be used in the behaviour part. We also agreed to use patterns at some places such as let or case statements. We will investigate the replacement of experiment offer lists by some syntax for extended patterns (with ! and ? and possibly a selection predicate).

The discussion on gates is postponed and will be discussed together with other input documents on mobility and gate typing.

We agreed not to allow higher-order processes.

We agreed to find a static semantics either based on inference rules as the SML static semantics or on attribute grammars, and which includes the behaviour part.

We agreed not to allow any side-effects.

We agreed to postpone the study of the relationship with ACT ONE until the core functional datatype language is ready.

6. Joint meeting with ODP

Relevant ODP references are:

- DIS 10746-1: Overview ODP - RM (ITU-T X901)
- IS 10746-2: Foundations ODP - RM (ITU-T X902)
- IS 10746-3: Architecture ODP - RM (ITU-T X903)
- DIS 10746-4: Architectural semantics (ITU-T X904)
- WD Amendment to DIS 10746-4
- DIS …: ODP Trader (ITU-T X950)
- Amendment to X950: SDL'92 spec. of the ODP Trader.

They are available by ftp at ftp.dstc.edu.au.

Jean-Bernard Stefani gives an overview of these documents with a special emphasis on the ODP computational model and its relation to CORBA and its IDL (Interface Description Language). An information specification of the ODP trader exists in Z. A full specification of the trader also exists in SDL'92.

Then Jean-Bernard Stefani presents an overview of the ODP computational model, the IDL abstract syntax and the main features of the computational model such as types and objects (with multiple interfaces).

We agreed to make sure that the ELOTOS type system will be as compatible as possible with the ODP type system while remaining as compatible as possible with ACT ONE.

7. Time

Guy Leduc presents OTT3. The first comment consists of replacing an inference rule in annex C to get time additivity. The second comment refers to annex A of annex C and outlines that this alternative semantics is incomplete and should contain additional information at node labels.

Juan Quemada presents OTT10. It consists of proposing a new semantics for internal time choice by introducing a new transition $>\!\!\rightarrow$ in the original semantics to get congruence of the weak bisimulation. This proposal is presently limited to basic TE-LOTOS. However, several problems were identified, such as the definition of the Stb function for unguarded

processes, the divergence of choice x:nat [] i{x..∞}; P(x), and the non weak bisimilarity between Wait (2); i{0..2}; stop and i{2..4}; stop. Also, the Stb function adds complexity in the semantics.

The Japanese comments in OTT8 (section 2.2) were reviewed. It was agreed to clarify the use of the Age operator and the distinction between TE-LOTOS and TE-LOTOS+. The discussion on the infinite parallel operator led to a more general discussion about the introduction of a generalized parallel operator. It was decided to keep this discussion separate from annex C. As a result the inf ||| operator will be removed from annex C and contributions on generalized parallel operators will be provided in separate annexes. Finally, it has to be noted that TE-LOTOS can code up different clocks with possible drifts, and also supports a dense time domain which allows for design by refinement.

8. Gates as first-class citizen and mobility

Alan Jeffrey presents an example of a router process which makes use of gates as first-class citizen. Problems related to the static determination of the sort of a process are also pointed out.

Elie Najm presents document OTT1. It is a specification of an ODP multicast and multimedia binding object in MT-LOTOS.

Guy Leduc presents document OTT2. It is the specification of the same example using ET-LOTOS.

It was agreed to align the two specifications so that they can be compared more closely. Also, further examples are welcome such as the ODP trader.

Regarding the mobility extension, the possibility of having it at a higher language level has been discussed. This possibility will be investigated further. It was then realized that this approach could be used for the timed extension as well. This would lead to a hierarchical ELOTOS language with a kernel, a timed extension and a mobility extension.

9. Tagged termination

Juan Quemada presents OTT11. It is a proposal to add termination tags to LOTOS events, and merge it with a generalized enabling operator as proposed in annex F of the revised draft. It solves the intermediate state problem.

However, there are difficulties in expressing the LOTOS enable operator in terms of the generalized enabling operator. Also, this semantics is such that when two parallel processes want to synchronize on a gate with different termination tags, the synchronization cannot occur. The consequence of this should be investigated in relation with exceptions in the datatype language.

The generalized disabling operator proposed in the final part of OTT11 was also discussed. This operator leads to difficulties once time is introduced in the model. It is unclear whether time has to pass in the suspended process. It also leads to a complex semantics. Concrete examples that the proposed generalized disabling should be able to specify will be provided by H. Garavel on the e-lotos mailing list.

10. Typed-Tagged gates

There is a broad agreement to include pattern matching on gates in ELOTOS. The technical details will be further investigated, and in particular the relation with polymorphism and overloading. When ready this proposal is intended to replace the annex B of the revised draft.

11. Planning

11.1 Future meetings

The next ISO/IEC JTC1/SC21 meeting is scheduled on May 13-24, 1996 in Kansas City, USA.

The new target is to issue a PDAD (Proposed Draft Addendum) as the output document of this Kansas meeting. This requires a change in the ELOTOS project which was supposed to output this document in Ottowa. It might also be necessary to change the PDAD into a CD.

An interim meeting is scheduled on December 18-21, 1995 in Liège, Belgium. A new working draft will be issued as an output document of this meeting (February 1996).

It is also possible to hold an additional expert (unofficial) meeting in Budapest on October 26-27 as part of the WG1 meeting of the European COST 247 action.

11.2. Future documents

Contributions to be input to the second working draft will be due by September 29th 1995 (in electronic form by email) as an output document from the Ottawa meeting, with the following structure:

- Annex A: Data types: Integration of OTT4 and OTT7
- Annex B: It is kept as is with the addition of a reference to annex A
- Annex C: Time: Updated according to comments in OTT3, OTT8 and section 7, with a clear separation between untimed and timed aspects
- Annex D: Mobility: Updated with a clear separation between static and mobile aspects.
- Annex E: Modules: This annex will contain a reference to annex E of the revised draft and to annex A of this second draft
- Annex F: Operators: It will be composed of two documents:
  - A revised version of annex F of the revised draft without introducing time, nor termination tags
  - Annex G of the revised draft
- Annex G: Integration issues: It will be composed of references to annex A and two documents:
  - Integration of operators and time
  - Integration of mobility and time

By the end of November, inputs will have to be provided for the Liège meeting. In particular, two proposals for the core part of the datatype language will be input (e.g. the first one with polymorphism and the other one with overloading). It would be desirable to prepare the two proposals in a similar style and with common parts. The main objective of the Liège meeting is then to compare the proposals and try and select or merge them. Besides the datypes, the following input documents would also be useful:

- New operators as possible alternatives to those proposed in Annex F (part 1).

- A common document combining and aligning OTT1 and OTT2

By the end of December, a document will be issued as the Liège output document.

12. Miscellaneous

We were asked to give a recommendation for the five-year revision of ISO/IEC TR 10167 (Guidelines for the application of Estelle, LOTOS and SDL). Considering that the LOTOS standard has not been revised since the publication of this document, we recommend to keep it unchanged.

The rapporteur would like to thank all the participants for their active participation in the meeting.