Minutes of the ISO/IEC JTC1/SC21/WG7/E-LOTOS meeting

Kansas City, 13th-17th of May 1996

0. Attendance list

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Richard Sinnott, University of Stirling, United Kingdom

1. Appointment of a secretary

Mihaela Sighireanu volunteers.

2. Agenda

The following agenda is approved:

1. Opening
2. Appointment of secretary
3. Rapporteur´s report
4. List of input documents
5. Presentation of input documents
6. Selection of the data model of E-LOTOS
7. Selection of the behavioural model of E-LOTOS
8. Definition of the E-LOTOS Committee Draft
9. Meeting schedule
10. Liaison and co-ordination issues
11. Closing

3. List of input documents

KC1: A Core Data and Behaviour Language for E-LOTOS (UK expert)
KC2: Position Statement Regarding E-LOTOS User Language (AFNOR)
KC3: French-Romanian Integrated Proposal for the User Language of E-LOTOS (French/Romanian experts)

KC4: French-Romanian proposal for Capture of Requirements and Expression of Properties in E-LOTOS Modules (French/Romanian experts)

KC5: General Study on the Definition of a E-LOTOS Suspend/Resume Operator (Belgian/French experts)

KC6: Defining Equivalences between Time/Actions Graphs and Timed Actions Graphs (Spanish experts)

KC7: Comments from Japanese Experts on “Time Extended LOTOS” (Japanese experts)

4. Rapporteur´s report

Juan Quemada informs that, since the last E-LOTOS meeting in Liège (December 1995), a meeting took place in Liège in April, organised in the framework of the COST 247 Action with the support of the European Commission.

Two of the input documents, KC1 and KC3 are the result of this meeting and have been submitted as input documents to the E-LOTOS Committee.

Juan Quemada informs that design decisions about E-LOTOS have to be taken during this meeting. It is agreed that the output document will contain parts on which consensus exists.

The Committee agrees that when the complete CD is available, coordinated effort should be taken to present it to a wide audience, to use it for applications, and to develop tools for E-LOTOS.

5. Presentation of input documents

Hubert Garavel presents document KC2. The three requirements contained in this document are felt to be sensible goals for E-LOTOS design. Guy Leduc proposes to add a requirement concerning semantic properties of E-LOTOS.

Guy Leduc presents document KC1.

1. It was agreed at the Liege meeting that the language would be structured into two levels: a user level language and a core level language. A mapping function between these two levels should be provided. This function makes syntactical translations and uses semantic information (mainly for solving overloading).
2. Unification of data and behaviour at core level. Three justifications are given: (1) functions can be viewed as deterministic processes, without gates, (2) there are similar constructs of language for data and behaviour (e.g. case statement), (3) exception mechanism.
3. Data types of the core language are presented. Declarations (of types and processes), type expressions (anonymous records with subtyping, “none” type) are presented. Record subtyping is explained. The decoration of fields of records can be useful for a simpler semantic, but it is pointed out that, at the user level, a positional feature for upward compatibility should be provided. In this case the translation function should constrain the use of subtyping in positional arguments. Another feature provided by the data types is the pattern matching. In conclusion, the data types part provides declaration (of types and processes), type expressions, patterns, pattern matching, and constants.
4. Behaviour expressions of the core language are presented. It is pointed out that the weak bisimulation equivalence is not a congruence for the new atomic enable operator, but there are other operators of LOTOS (e.g. choice, disabling) which do not preserve this congruence either. It remains to be studied if the observational congruence remains a congruence in the context of new atomic operator. Hubert Garavel demonstrates that this operator is a generalisation of “general termination” mechanism, and argues in favour of a unified treatment of normal termination (delta gate). The renaming operator proposed in KC1 was discussed. It is also pointed out that at the core level exceptions and gates are unified. However, at the user level language they might be differentiated.
5. Over problems, such as genericity, patterns, abstract data types, and patterns with abstract data types are postponed until the design of module system.

Hubert Garavel and Mihaela Sighireanu present KC3, an improved version of two annexes (A.2 and F.2) of the Liege output document. Some features have been improved (e.g. exception mechanism, merging of expressions and instructions, sequential composition); semantics of user language is given in operational way; LOTOS libraries have been in translated in the proposed language. The language proposed in the document has the following features:

- upward compatibility: the proposed behaviour operators are a superset of LOTOS behaviour operators; the ACT ONE equations can be allowed in the module system.
- in/out parameters and others features which allow simple integration with IDL specifications.

- exceptions and gate typing.
- simple specification-oriented operators: generalised parallel composition and easy sequential composition.

Three language levels are used in KC3: (1) a full user language (data, behaviour, gate typing), (2) a reduced user language and (3) a minimal core language. Mapping functions between these levels are given. The relation with the core language proposed in KC1 is discussed. Two differences between the two core languages are:

1. Unlike KC1, the core language of KC3 does not support subtyping.
2. The dynamic semantics of KC1 is based on transitions with labelled records, while the core language of KC3 is based on tuples as in LOTOS.

Hubert Garavel presents KC4. The document addresses the problem of symmetry between equational specification of properties for functions and the specification of properties for processes at the module level. For this purpose, specification of relations (between processes) and properties (of processes) can be written in modules. To specify properties, the modal µ-calculus and the temporal logic ACTL are proposed. However, it was pointed out that another temporal logic has to be used due to the presence of time in E-LOTOS.

14/05/96

Christian Hernalsteen presents KC5. Three proposals for suspend-resume are actually on the table: (1) Canadian one, denoted by |[> (LG11), (2) Spain/Canadian one, which integrate generalised termination, denoted by [t>, (3) Belgium/France one, denoted by <g | B> and [g|B] (LG9). In order to define an operator which captures all proprieties wanted for S/R operator, the mains concepts of S/R operator are highlighted:

- aging: two approaches exist, which are continue semantics and stop semantics
- arity of operator: two possibilities exist: extend disabling or context operator
- self-interruption:
- suspend-resume actions: using of special actions or using normal actions.
- it is able to simulate disabling operator.

A new binary operator is proposed, noted [g>, which supports self-interruption and generalises the disable operator. A comparison with others operators is presented.

Juan Quemada presents KC6. The document completes the mathematical proof of equivalence between the two semantics propose for time: time/actions graphs and timed actions graphs.

Document KC7 is discussed. Its suggestions have been considered for integration in the new version of the output document.

6. Selection of the user data language of E-LOTOS

A discussion based on KC3 addresses the following points:

- The exception mechanism is analysed. There are two approaches: (1) exceptions and gates are unified at user level language, (2) exceptions and gates are distinct at user level language. The first approach is closer to the core language proposed in KC1 and KC3. In the second approach, gates and exceptions are different concepts, they can be only raised and trapped, but not synchronised. Some experts believe that merging exceptions and gates in the user level language will create confusion and therefore support the second choice above.
- The patterns are discussed and agreed in current form. The introduction of redundant keywords is discussed.
- The match expressions are accepted in their form.
- The value expressions are discussed: function calls, the general case operator and its derived form, the trap and raise operators, the equality, non-equality , select, and update operators are

agreed. It is agreed that a loop operator is useful for behaviour expressions to avoid unnecessary recursion and to improve readability. For symmetrical reason it can be introduced in the data part. The variable assignment and sequential composition and some use examples are presented by Hubert Garavel. Juan Quemada proposed to remove one of let or local constructs to reduce the complexity of language.

15/05/96

7. Selection of behavioural model E-LOTOS

Hubert Garavel and Mihaela Sighireanu present the guidelines of the behaviour part of user language. The new constructs proposed by KC3 are presented in parallel with the old LOTOS operators.

The following main points have been presented:

- Action and sequential composition: These constructs provide an intuitive form of sequential composition and support value passing.
- Process instantiation with out parameters: is a good choice for interfacing with ODP-IDL and other programming languages.
- Parallel composition and value passing is discussed. Non-synchronised termination is allowed by using the trap operator.

An overview of all operators proposed is made:

- exit operator should disappear from E-LOTOS because it can introduce ambiguities and faulty specifications; a proper translation will be provided.
- the form of n-ary sequential composition is left to a concrete syntax decision;
- the old action prefix and enabling should be also removed and a translation will be provided;
- the n-ary choice operator is left for the concrete syntax;
- the binary choice is kept in the user level language (without translation to the trap construct),
- the old choice over values should be removed and a translation will be provided;
- the disabling operator should be kept, maybe generalised by suspend resume operator;
- the parallel composition operator Bf17 is more powerful than all others, but the set of indexes is considered less convenient;
- for the parallel operator over values, the problem of finite domains of values is discussed. It is an agreement that a solution to restrict domains to finite domains as enumerate types, non-recursive type;
- there are some concerns about the multiplication of parallel operators; it is suggested to substitute the (Bf17) and (Bf20) operators with an improved variant of (Bf18) operator, which integrates the n among m synchronisation of (Bf20) operator. The old LOTOS operators (Bf21), (Bf22), and (Bf23) should be provided in the new abstract syntax as shorthands of (Bf18) operator.
- there is an agreement on the form of the case operators.
- it is agreed that guard operator should be removed from the final syntax.

16/05/96

A joint meeting with the ODP architectural group takes place. Richard Sinnott presents an overview of problems expected to be solved by E-LOTOS group to adapt LOTOS to ODP needs. A list of concerns addressed by the E-LOTOS proposals has been pointed out:

1. Synchronisation: Juan Quemada presents the parallel operator agreed in the discussion of the previous day.
2. Gate sub-typing: Guy Leduc presents the record sub-typing of KC1. No agreement exists on whether this notion of record subtyping is relevant for ODP. Some experts believe that it is. Some experts (including Richard Sinnott) believe that ODP subtyping should be expressed by preorder relations between labelled transition systems. Hubert Garavel mentions that a such proposal exists in KC4.

3. Service constraints (QoS): a comparison between Z and LOTOS is made in order to see how these languages can express QoS. Z language can be used to express some QoS properties and environmental contracts. For E-LOTOS, the problem of specifying global properties (absence of deadlock or synchronisation) is addressed in KC4.
4. IDL interfacing with LOTOS: the correct mapping between IDL interfaces and E-LOTOS functions and processes is discussed. The in/out parameters of the user language have been included to allow such a mapping.

The discussion about the behaviour part of user level language is continued:

- A possible unification between local and let statements is discussed. A decision about the mandatory initialisation of all variables will be taken at the end of the meeting.
- The loop construct is discussed, and out variables should be added for symmetry with the process declaration.
- The continue constructs should be replaced by a break loop construct with an appropriate semantics.
- The post-renaming operator is discussed. There are some concerns about the dynamic characteristic of this operator , but it is agreed that this operator is a powerful one, and some examples are given in KC3.

The KC5 document is then discussed. The relation of proposed semantics with the coroutine semantics is analysed. The atomic passing of control from resuming behaviour to resumed one is proposed. The relation of suspend/resume operator with the trap operator should be studied, in order to unify them.
A semantics that integrates time is discussed for the following operators:

- trap operator, and
- sequential composition operator.

8. Definition of the E-LOTOS Committee Draft

To achieve convergence in the language the following list of operators has been agreed for being included in the core language definition. The criteria used for selecting these operators have been twofold: reducing the differences between the two levels to obtain a simpler translation of the user language into the core language, and improving the readability of the core language:

- actions (Bf1) with time
- stop (Bf3)
- assignment (Bf5)
- trap (Bf6)
- sequential composition (Bf8)
- choice (B12)
- generalised choice (Bf13-14)
- disabling (Bf16) with possible extension to suspend/resume operator
- general parallel composition (Bf18), (Bf20)
- parallel over values (Bf19)
- case statement (Bf24) or (Bf25)
- let statement (Bf29)
- hide (Bf32)
- process instantiation (Bf33)
- renaming (Bf34)
- delay
- block
- internal time choice

The integration of mobility was postponed until the core language is finalised, and until clarifications on the consequences of mobility inclusion are presented.

17/05/96

The following points were discussed with the following results:

1. Concerning exceptions and gates: the gates and exceptions are unified at the core level language. At the user level, the decision about separation between exceptions and gates is postponed until the next meeting. Parts of the output document dealing with the user language should explore both solutions.
2. Shared variables in parallel composition: the Committee agreed that static semantics constraints should be enforced to ensure that variables shared by several parallel processes are read-only.
3. Let statement: experts want to ensure that variables are properly initialised before use by static semantics constraints. If this is not proven, then variable initialisation will be required.
4. Suspend/resume operator: it is agreed that KC5 is a good basis, but it should be integrated with other operators (disabling, trap,…) and its definitions should be made in such a way that a second derived operator is not needed.

Juan Quemada proposed that a meeting report which appends the following documents be produced in order to inform WG7 about the progress of the work:

- Minutes of Kansas City meeting
- KC1
- KC3
- KC4
- KC5

The output document of Kansas City meeting, entitled "Revised Working Draft on Enhancements to LOTOS (V4)", will have the following contents and will be distributed by the SC21 before the end of July 1996:

- Chapter 1: INTRODUCTION (Spain)
- Chapter 2: SYNTAX OF USER LEVEL LANGUAGE (France &Romania)
- Chapter 3: STATIC SEMANTICS (France & Romania)
- Chapter 4: SYNTAX OF CORE LEVEL LANGUAGE (United Kingdom & Belgium)
- Chapter 5: TRANSLATION (United Kingdom & Belgium & France & Romania)
- Chapter 6: CORE DYNAMIC SEMANTICS (United Kingdom & Belgium)
- Annex A: TUTORIAL WITH RATIONALE FOR THE LANGUAGE (why needed, areas of application) (Spain & France & Romania & Belgium & Canada)
- Annex B: UPWARD COMPATIBILITY WITH LOTOS (France & Romania)

Contributions should be sent to the Rapporteur by 15 of July 1996, by e-mail including source versions and PostScript versions.

Concerning static semantics, overloading should be solved by the translation function. The Committee agrees not to have two different static semantics. Static semantics should be made by the translation function. The core will provide only requirements for static semantics and a dynamic semantics.

Several organisations issues, concerning planning are discussed with the convenor of WG7, Eng Chew.

9. Meeting schedule

The next interim meeting will be held in Grenoble (France), from December, 9, 1996 to December, 12, 1996.

10. Liaison and co-ordination issues

The minutes of the meeting held on 16/05/1996 with the architectural semantics group are attached.