An Example of Software Development Modelling

Anthony Finkelstein
Imperial College of Science, Technology & Medicine
(University of London)
acwf@doc.ic.ac.uk

1. Overview

Outlined below is a short example of modelling requirements specification. The example is not taken from a live software development project but is cooked to illustrate our approach. The example reflects our interest both in the support of requirements specification and in what might be termed "fine-grain" software development modelling.

By fine-grain software development modelling we mean the analysis and description of the detailed structure and organisation of development activities. In general this structure and organisation is ignored by those who are concerned with modelling software development at the level of tool invocation and interworking. We suggest that many important gross features of software development such as verification, validation and cooperation arise from the complex interplay of fine-grain activities. These features of software development are not simply embedded in a matrix of routine "house-keeping" tasks. Rather they are emergent properties that derive from the underlying fine-grain organisation.

To follow the example a brief outline of our approach is required. We have developed a model of requirements specification from multiple viewpoints in which the construction of a requirements specification is presented as a conversation. In this model the viewpoints - treated as agents - negotiate, establish responsibilities and cooperatively construct an agreed description of a domain. The model deploys some formal apparatus - dialogue logics - taken from work on the foundations of logic and an approach - cooperation and negotiation - of work on distributed artificial intelligence.

2. Example

Jeff, Tom, Mike and Sue are involved in the specification of software to support the preparation and assembly of user manuals for a range of widget production tools. Jeff is a technical editor, he knows all about how documents are prepared. Tom is the librarian, he knows all about the categorisation, versioning and storage of documents. Mike is a salesman, he knows all about how manuals are assembled from the collected documents to meet the requests of customers. Sue is a software engineer, she knows about the needs of the software designers and, because she is experienced in dealing with technical documentation systems, she knows some possible problems which may occur in such systems.

151

Jeff, Tom, Mike and Sue meet to write the specification. After introductions and preamble the meeting gets seriously underway.

[A]   Jeff: *Documents can either cover new features or be a modification of a document that has already been issued.*

In our model we distinguish two parts to [A]: a locution act, in this example an assertion - it is the case that documents can either..., and a statement, in this example - documents can either cover new features or be a modification of a document that has already been issued.

[B]   Tom: *All documents are assigned a category.*

[B] can also be broken down into a statement and a locution act but we can make some further observations. Tom follows Jeff and there has been a change in roles. Jeff, who was the speaker, is now the hearer (assuming he has not left the room) and Tom has assumed the role of speaker. We model this as a succession of events in which each event is denoted by some indicator of it's position, the identity of it's initiator, and of course the relevant locution act and statement.

[C]   Sue: *Are modified documents assigned a category?*

[D]   Tom: *No, modified documents are not assigned a category.*

In [C] Sue asks a question - is it the case that...?, it is immediately followed by an answer in the form of a denial. We note that there are syntactic relations between these events. It would not make any sense for Tom to follow Sue's question by a statement on some completely different topic, or in certain circumstances by another question. We model these syntactic relations in the form of dialogue rules or norms.

[E]   Tom: *There may be many current releases of any given document.*

[F]   Mike: *A manual consists of all the current releases of documents in the categories associated with the tool owned by the client making the request.*

[G]   Sue: *So, duplicate documents are allowed in a manual!*

What is happening in this exchange? Tom makes a statement [E] which is heard by Mike, Sue and Jeff. Nobody objects and Sue feels it is safe to assume that everybody is committed to that statement and it's consequences - duplicate current releases. In other words Sue feels that Tom, Mike and Jeff have "signed-off" the statement and taken some responsibility for it's consequences. We note that locution acts, such as the assertion of a statement establish (and remove) commitments. This is modelled in the form of commitment rules which define the relation between locution acts and commitments.

Mike now makes a statement about how a manual is constructed [F]. Sue thinks she has spotted a potential inconsistency and trys to probe it by attempting to get Mike to commit himself to the statement that duplicate documents are allowed in a document [G]. The conversation continues.

[H]   Mike: *No, I am not committed to duplicate documents being allowed in a manual.*

[I]   Sue: *Well in that case resolve your inconsistency with Tom.*

[J]   Mike: *I no longer hold that there may be many current releases of any given document.*

In [H] Mike refuses to accept the direct consequences of his commitments and Sue pounces by demanding that Mike resolves his inconsistency. Mike resiles from his previous position [J]. This now leaves Mike free to challenge Tom and sort out the confusion over current releases.

[K]   Sue: *Why are modified documents not assigned a category?*

[L]   Tom: *Because modified documents are automatically given the category of the originating document.*

In [K] we can observe Sue challenging, a special way of requesting an explanation of, a statement about document modification. Tom provides an answer to the challenge [L]. Sue now knows (and is committed to) that modified documents are not assigned a category and that modified documents are automatically given the category of the originating document. She also knows that the two are logically related, the fact that modified documents are not assigned a category implies that modified documents are automatically given the category of the originating document. The way in which these logical relations are established and maintained are modelled in argument rules.

[M]   Sue: *Why are modified documents automatically given the category of the originating document?*

In [M] we can see Sue making another challenge. This repeated request for an explanation, familiar to parents of small children, is a typical elicitative tactic. Tactics of this form are modelled as special dialogue rules.

3.   Conclusion

We have seen in very crude outline how we might begin to model the "fine-grain" of requirements specification. For more detail, some fully worked examples and an account of the limitations and shortcomings of our approach see Finkelstein & Fuks 1989.

References

Finkelstein, A. & Fuks H. (1989); Multi-Party Specification; Proc 5th International Workshop on Software Specification & Design, pp 185-195; IEEE CS Press (also as Special Issue of ACM Software Engineering Notes).