

Extraction of state machines of legacy C code with Cpp2XML

Citation for published version (APA):

Brand, van den, M. G. J., Serebrenik, A., & Zeeland, van, D. (2008). Extraction of state machines of legacy C code with Cpp2XML. In A. Serebrenik (Ed.), *7th Belgian-Netherlands Software Evolution Workshop (Benevol 2008, Eindhoven, The Netherlands, December 11-12, 2008, Informal pre-proceedings)* (pp. 28-30). (Computer Science Reports; Vol. 08-33). Technische Universiteit Eindhoven.

Document status and date:

Published: 01/01/2008

Document Version:

Publisher's PDF, also known as Version of Record (includes final page, issue and volume numbers)

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

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Extraction of State Machines of Legacy C code with Cpp2XMI

Mark van den Brand, Alexander Serebrenik, and Dennie van Zeeland

Technical University Eindhoven, Department of Mathematics and Computer Science,
Den Dolech 2, NL-5612 AZ Eindhoven, The Netherlands
m.g.j.v.d.brand@tue.nl, a.serebrenik@tue.nl,
d.h.a.v.zeeland@student.tue.nl

Introduction Analysis of legacy code is often focussed on extracting either metrics or relations, e.g. call relations or structure relations. For object-oriented programs, e.g. Java or C++ code, such relations are commonly represented as UML diagrams: e.g., such tools as Columbus [1] and Cpp2XMI [2] are capable of extracting from the C++ code UML class, and UML class, sequence and activity diagrams, respectively.

New challenges in UML diagram extraction arise when a) additional UML diagrams and b) non-object-oriented programs are considered. In this paper we present an ongoing work on extracting state machines from the legacy C code, motivated by the popularity of state machine models in embedded software [3]. To validate the approach we consider an approximately ten-years old embedded system provided by the industrial partner. The system lacks up-to-date documentation and is reportedly hard to maintain.

Approach We start by observing that in their simplest form UML state machines contain nothing but states and transitions connecting states, such that transitions are associated with events and guards. At each moment of time the system can be in one and only one of the states. When an event occurs the system should check whether the guard is satisfied, and, should this be the case, move to the subsequent state. Observe, that implementing a state machine behaviour involves, therefore, a three-phase decision making:

- What is the current state of the system?
- What is the most recent event to be handled?
- Is the guard satisfied?

Based on this simple observation, our approach consists in looking for *nested-choice patterns*, such as “if within if” or “switch within switch”. As guards can be omitted we require the nesting to be at least two. As we do not aim to discover all possible state-machines present in the code, validation of the approach will consist in applying in the case study and comparing the state-machines detected with the results expected by the domain experts.

Implementation We have chosen to implement the approach based on the Cpp2XMI tool set [2]. Since Cpp2XMI was designed for reverse engineering C++, we first had to adapt the tool for C. Second, we added a number of new filters to detect the nested-choice patterns in the abstract syntax trees. Finally, we had to extend the visualisation component to provide for state machine visualisation.

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