

# Reactive-C and related formalisms for reactive programming

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Reactive-C is a preprocessor for reactive programming in C. Reactive-C is used as a "reactive assembly language" to implement several reactive formalisms, as the synchronous language SL, Reactive Scripts, or Icobjs Programming. All these formalisms, together with Reactive-C, are described at <http://www.inria.fr/mimosa/rp>.

## Overview

The basic idea of Reactive-C is to propose a programming style close to C, in which program behaviors are defined in terms of reactions to activations. Reactive-C programs, called reactive procedures, can react differently when activated for the first time, for the second time, and so on. Thus a new dimension appears for the programmer: the logical time induced by the sequence of activations, each pair of activation/reaction defining one instant. Reactive-C gives the possibility to dynamically create and run new components during execution, which eases the task of programming, as it does not force a system to have a static maximum number of running components, and because it makes scripting possible. Moreover, it is possible in Reactive-C to decompose reactions into micro-steps, which opens the way to the programming of systems with special instants (for example made out of phases or of oscillations). The present Reactive-C compiler is the rcc version 3 compiler. It works as a pre-processor of C, and it consists of 2500 lines of ANSI-C.

## History

Reactive-C [2] has been designed in the 1990's in the group that was developing the synchronous language Esterel at the same time.

The RLib library written in Reactive-C provides primitives to program event-driven systems made of reactive agents. RLib was developed by a small company called Soft Mountain. Parts of the Process Control tool used to pilot several cement factories of the Lafarge company have been written in RLib and Reactive-C.

The approach of Reactive-C has been used in the context of Java and has led to SugarCubes [2], which is a set of classes for reactive programming in Java. The REJO language [1] is another proposal for reactive programming in Java. Icobj Programming [6] is a simple and fully graphical way to build reactive programs. This kind of programming is based on the notion of an icobj which has a behavioral aspect (object part), a graphical aspect (icon part), and which can be animated at screen. The initial version of Icobjs is implemented in Reactive-C and the last version is implemented in SugarCubes.

FairThreads [4] is an alternative to Reactive-C for reactive programming in C. FairThreads offers a very simple thread-based framework for concurrent and parallel programming in C. Basically, it defines schedulers which are synchronization servers, to which fair threads are linked. All threads linked to the same scheduler are executed in a cooperative way, at the same pace, and they can synchronize and communicate using broadcast events.

Threads which are not linked to any scheduler are executed by the OS in a

preemptive way, at their own pace. FairThreads offers specific programming constructs for dynamically linking and unlinking threads. There exists an implementation of FairThreads in the Scheme Bigloo compiler (<http://www.inria.fr/fp>).

## Future

The FunLoft proposal [5] currently developed in the Mimosa team is a descendent of Reactive-C and FairThreads, in which the focus is put on static checks to insure strong properties such as termination of instants, bounded memory, and safety (all of these being unachievable in Reactive-C or FairThreads). The objective of FunLoft is also to give syntactic means for the parallel programming of multicore machines.

## References

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- [5] Boussinot, F. and Dabrowski, F. -- [Safe Reactive Programming: the FunLoft Proposal](#) -- Proc. of MULTIPROG -- First Workshop on Programmability Issues for Multi-Core Computers. Göteborg, January, 2008.
- [5] Brunette, Christian -- [A Visual Reactive Framework for Dynamic Behavior Creation](#) - - 2nd Workshop on Domain Specific Visual Languages, OOPSLA, Seattle, 2002.