# Realisability of message sequence charts

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Message Sequence Charts (MSCs) are sequence diagrams to represent different scenarios of interaction between several processes communicating asynchronously through messages sent into point to point channels. The specification language SDL defines them and gives their semantics through a norm of the International Telecommunication Union. MSC languages allows keeping a really asynchronous communication scheme (unlike Petri Nets, Mazurkiewicz traces), at the expanses of technical difficulties when handling message channels. In order to represent MSC languages in a finite way, the norm defines graphs of MSCs (MSC-graphs), basically by using finite state systems. The MSC-graph formalism is interesting practically because it offers intuitive (sequential) descriptions of otherwise deeply distributed systems. It is thus theoretically crucial to consider the realization problem, that is the study of which distributed systems corresponds to which class of MSC-graphs, and how to automatically transform one into the other. In order to describe distributed systems, we will use Communicating Finite State Machine (CFM, also called communicating automata), another standard of SDL, because they are really close to distributed implementation.

There is certainly not a unique best answer to this question of comparing MSC-graphs with CFMs: Different settings fit different scenarios, and variety of restrictions on control (and in particular on channels) could be made and variety of equivalences between the two formalisms could be defined. This technical talk will thus present several results tackling this question under several settings, which have been obtained during the 2000 decade. A particularly interesting technique that we will present is the one to define a fixed independent alphabet [3, 2], in order to lift results from Mazurkiewicz trace theory [1] to MSCs (and in particular, Zielonka Theorem).

## References

[1] Volker Diekert and Grzegorz Rozenberg (editors). *The Book of Traces.* World Scientific Publ. Co. (1995).

[2] Blaise Genest, Dietrich Kuske, Anca Muscholl. *A Kleene theorem and model checking algorithms for existentially bounded communicating automata.* Inf. Comput. 204(6): 920-956 (2006).

[3] Dietrich Kuske. *Regular sets of infinite message sequence charts.* Inf. Comput. 187(1): 80-109 (2003).

Additionally, two very interesting papers overviewing the results of this talk could be found in:

[4] Philippe Darondeau. Synthesis and Control of Asynchronous and Distributed Systems. In *Proceedings of Application of Concurrency to System Design (ACSD 2007).* pp. 13–22, IEEE Computer Society, 2007.

This survey is much more general, tackling the problem of control and implementation of asynchronous distributed systems.

And

[5] Benedikt Bollig, Joost-Pieter Katoen, Carsten Kern, Martin Leucker: Learning Communicating Automata from MSCs. IEEE Transactions on Software Engineering, 2010. To appear.

which, in order to tackle the problem of learning CFMs from MSCs, needs to use (and thus review) the different realization techniques.