

Compositional Design, Implementation, and Verification of Swarms (Artifact)

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Abstract

Swarm protocols are a recently-introduced formalism for specifying and verifying the behaviour of distributed ensembles of machines that interact in a swarm. The machines communicate by emitting events that propagate asynchronously throughout the swarm while adhering to a *local-first* paradigm — meaning that a machine can make progress even without always-active connections to other machines. A swarm behaves correctly if its machines are *eventually faithful* to a swarm protocol, i.e., if they eventually reach a consensus on a valid execution of the protocol. Previous work presents verification methods to ensure eventual fidelity.

Unfortunately, the existing techniques for designing, implementing, and verifying swarm applications based on swarm protocols are *not compositional*. Consequently, such techniques do not support the modular design and development of

large and complex swarm applications as compositions of simpler swarms. They also do not support the reuse of machine implementations and they lead to inefficient verification performance.

The paper introduces novel theory and techniques for the compositional specification and verification of swarm protocols, and for the composition of swarms. It also presents a compositional method to ensure that a swarm is eventually faithful to a composition of swarm protocols, allowing the reuse and adaptation of pre-existing machines. Correspondingly, the artifact contains software tools for the compositional design, implementation and verification of swarms together with runnable examples from the paper. Additionally, the artifact contains scripts that run the experiments reported in the paper and generates corresponding figures.

2012 ACM Subject Classification General and reference → General literature; General and reference

Keywords and phrases Dummy keyword

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Related Article John Q. Open and Joan R. Access, “A very nice paper”, in Proceedings of the 30th Conference on Very Important Topics (CVIT 2016), LIPIcs, Vol. 0, pp. 0:1–0:2, 2016.

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1 Scope

The artifact contains the customized version of the Actyx toolkit described in the paper (described in Section 7.1 and 7.2) and scripts to perform the experiments presented in the paper (in Section 7.3) and generate the related figures (Figure 7 and 8). Additionally, the artifact contains example

¹ Optional footnote, e.g. to mark corresponding author



1:2 A Sample DARTS Research Description (Artifact)

12 implementations of the swarm protocols presented as examples in the paper including machine
13 implementations of the projections shown in Figure 5 and 6.

14 2 Content

15 The artifact package consists of a docker image, which contains:

- 16 ■ A checkout of <https://github.com/lucas874/machines/tree/ecoop25-artifact>.

17 3 Getting the artifact

18 The artifact endorsed by the Artifact Evaluation Committee is available free of charge on the
19 Dagstuhl Research Online Publication Server (DROPS). In addition, the artifact is also available
20 at: <https://to.be.specified>.

21 4 Tested platforms

22 Please specify the platforms on which the artifact is known to work, including requirements beyond
23 the operating system such as large amounts of memory or many processor cores.

24 5 License

25 The artifact is available under license

26 6 MD5 sum of the artifact

27 XXX

28 7 Size of the artifact

29 x.xx GiB

References

- 1 16th Annual Symposium on Foundations of Computer Science, Berkeley, California, USA, October 13-15, 1975. IEEE Computer Society, 1975.
- 2 Edsger W. Dijkstra. Letters to the editor: go to statement considered harmful. *Commun. ACM*, 11(3):147–148, 1968. doi:10.1145/362929.362947.
- 3 Jim Gray and Andreas Reuter. *Transaction Processing: Concepts and Techniques*. Morgan Kaufmann, 1993.
- 4 John E. Hopcroft, Wolfgang J. Paul, and Leslie G. Valiant. On time versus space and related problems. In *16th Annual Symposium on Foundations of Computer Science, Berkeley, California, USA, October 13-15, 1975* [1], pages 57–64. doi:10.1109/SFCS.1975.23.
- 5 Donald E. Knuth. Computer Programming as an Art. *Commun. ACM*, 17(12):667–673, 1974. doi:10.1145/361604.361612.