

# Synthetic Behavioural Typing: Sound, Regular Multiparty Sessions via Implicit Local Types (Artifact)

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## Abstract

Programming distributed systems is difficult. Multiparty session typing (MPST) is a method to automatically prove safety and liveness of protocol implementations relative to protocol specifications.

In the related article (“Synthetic Behavioural Typing: Sound, Regular Multiparty Sessions via Implicit Local Types”, in ECOOP 2023, LIPIcs, Vol. 263, pp. 42:1–42:30), we introduce two new techniques to significantly improve the expressiveness of the MPST method: projection is based on *implicit* local types instead of explicit; type checking is based on the *operational semantics* of implicit local types instead of on the syntax. That is, the reduction relation on implicit local types is used not only “a posteriori” to prove type soundness (as usual), but also “a priori” to define the typing rules – *synthetically*.

Classes of protocols that can now be specified/implemented/verified for the first time using the MPST method include: recursive protocols in which different roles participate in different branches; protocols in which a receiver chooses the sender of the first communication; protocols in which multiple roles synchronously choose both the sender and the receiver of a next communication, implemented as mixed input/output processes. In the related article, we present the theory of the new techniques, as well as their future potential, and we demonstrate their present capabilities to effectively support regular expressions as global types (not possible before).

As evidence that the new techniques are implementable, we implemented them; this implementation is available in this artifact.

**2012 ACM Subject Classification** Theory of computation → Concurrency

**Keywords and phrases** behavioural types, multiparty session types, choreographies

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**Related Article** Sung-Shik Jongmans and Francisco Ferreira, “Synthetic Behavioural Typing: Sound, Regular Multiparty Sessions via Implicit Local Types”, in 37th European Conference on Object-Oriented Programming (ECOOP 2023), LIPIcs, Vol. 263, pp. 42:1–42:30, 2023.

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**Related Conference** 37th European Conference on Object-Oriented Programming (ECOOP 2023), July 17–21, 2023, Seattle, Washington, United States

**Evaluation Policy** The artifact has been evaluated as described in the ECOOP 2023 Call for Artifacts and the ACM Artifact Review and Badging Policy.

## 1 Scope

The claim corroborated by the artifact is that “as evidence that the new techniques are implementable, we implemented them” (Sect. 6). To this end, the instructions in **README** allow the user to reproduce all examples in Sect. 2 of the related article. These examples demonstrate not only that “the new techniques are implementable”, but also that they offer “distinct expressive power” (Sect. 2) relative to existing techniques.



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## 18:2 Sound, Regular Multiparty Sessions via Implicit Local Types (Artifact)

### 2 Content

The artifact package includes:

- `artifact.ova`
- LICENSE
- `paper.pdf`
- README

### 3 Getting the artifact

The artifact endorsed by the Artifact Evaluation Committee is available free of charge on the Dagstuhl Research Online Publication Server (DROPS).

### 4 Tested platforms

The artifact is a VM, based on the TACAS 2023 Artifact Evaluation VM<sup>1</sup>, based on Ubuntu (64 bit). It requires VirtualBox 7.0 (or higher) to be run; we tested with VirtualBox 7.0.6. All third-party dependencies are installed inside the VM, so no network connection is needed (disabled by default). For completeness, the dependencies are:

- Java Runtime Environment 18 (or higher)
- Scala 3.2 (or higher)

### 5 License

The artifact is available under the MIT license.

### 6 MD5 sum of the artifact

040f9231263af8b0ef74fd29219b0d2e

### 7 Size of the artifact

9.287818240002 GiB (9,972,718,898 B)

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<sup>1</sup> <https://zenodo.org/record/7113223#.ZAj8sS8w1pR>