# The Frontier of Microservice Programming

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## 1 Introduction

Cloud Computing and containerization are changing the way we conceive software artefacts. In the last years, they had a big impact at the infrastructure level, by facilitating the offer of virtual computational resources both in the form of virtual machines and containerization. In particular, containerization technologies offer an abstraction of computational resources that is no more related to the idea of a machine.

Containers facilitate the adoption of different technologies in a cloud environment, which has motivated the application of different tools and languages for each specific microservice. Nevertheless, in the programming of microservices, some common aspects always emerge, independently of the specific microservice that is being developed. These aspects include, for example, the programming of communications, monitoring, fault management, and architectural patterns (like API gateway).

Over the years, the teams behind the programming languages Ballerina [2] and Jolie [3] have developed linguistic primitives to deal with these aspects. The starting point of our presentation is: while the two languages have been developed independently, many of their features are strikingly similar. This realisation came out of a recent meeting between the two teams, and inspires the question:

**Is it a coincidence, or are we facing a new generation of programming languages?**

In this presentation, we will go over the common aspects of microservice programming that we have identified, discuss how these aspects are supported linguistically by Ballerina and Jolie, and engage with the audience on our previous question. We give an overview of these aspects in the next section.

## 2 Microservice programming concepts

We list the concepts of microservice programming that we will present. These concepts support the overarching concern that microservice languages should aid in the analysis and understanding of complex systems.

**Service orientation** Services are native constructs, and services can be compositions of other services [4, 10].

**Communication primitives** Communication actions (like send and receive) are supported by native primitives [4, 9].

**Manifest workflows** The workflows enacted by a service are made explicitly manifest by the language [5, 8].

**Access points** The access points by which a service can receive messages are declared explicitly [4, 10].

**Dependencies** The dependencies of a service on other services are declared explicitly [10].

**APIs** Access points and dependencies are typed with interfaces that include the types of messages that can be exchanged [4, 10].

**Message types and values** Types and values are designed with network transmission in mind (marshalling/unmarshalling) [7, 10].

**Interoperability** Interoperability with other technologies over network communications and different transport protocols is a first-class citizen [1, 8].

**Architectural design extraction** The overall architecture of a complex microservice system should be automatically extractable.

**Architectural programming** Common architectural design patterns like proxy-based access control are natively supported [11].

**Built-in observability** A service always offers a way to monitor their states and the actions that they perform, also remotely [6].

# References


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