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Title: A 25-Years Long Journey with Software Components: From SOFA to DEECo and Reckoning Further

Abstract:

Software components and component-based software engineering (CBSE) have been around for more than a quarter of century. In the era where software complexity had scaled exponentially, software components emerged as a key paradigm of efficiency, enabling the construction of reusable, manageable, and maintainable complex software systems. In this talk, we delve into the fascinating trajectory of software components and CBSE over the past 25 years.

We base the talk on our experience with software components and their design. We will follow the idea of software components to their evolution into complete frameworks (such as Palladio, Fractal, SOFA), which shaped the landscape of software development and brought about a new era in software engineering. Further, we illustrate the evolution of software components on the evolution of our SOFA component model, which offered explicitly defined architectures and hierarchical component composition, and brought features like component versioning, dynamic update, formal behavior description, explicit connectors, etc. Even though SOFA (and similar component models) offered multiple benefits and advancements, the emergence of cyber-physical systems and the need for self-adaptiveness (and other self-* aspects) have shown their limitations, like relatively static architectures, which cannot flexibly react to changes in a system and its environment. This resulted in the need to update the CBSE concepts and introduce new component models. These, our DEECo model included, have brought to the CBSE field features like component ensembles, indirect communication knowledge sharing, dynamic reconfiguration, and self-adaptation.

Nevertheless, since evolution has been steady and continuous, even DEECo and other novel component models cannot deal with currently “hot” concepts, like ECC (Edge-Cloud Continuum) requiring support for “liquid” components seamlessly and transparently running on and moving between end-devices and (edge-)cloud nodes, close integration of AI and ML, etc. We overview these challenges and outline what, in our view, the way forward for the field of CBSE is.