The Coming-of-Age of Software Architecture Research

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Abstract

Over the past decade, software architecture research has emerged as the principled study of the overall structure of software systems, especially the relations among subsystems and components. From its roots in qualitative descriptions of useful system organizations, software architecture has matured to encompass broad explorations of notations, tools, and analysis techniques. Whereas initially the research area interpreted software practice, it now offers concrete guidance for complex software design and development. We can understand the evolution and prospects of software architecture research by examining the research paradigms used to establish its results. These are, for the most part, the paradigms of software engineering. We advance our fundamental understanding by posing research questions of several kinds and applying appropriate research techniques, which differ from one type of problem to another, yield correspondingly different kinds of results, and require different methods of validation. Unfortunately, these paradigms are not recognized explicitly and are often not carried out correctly; indeed not all are consistently accepted as valid.

This retrospective on a decade-plus of software architecture research examines the maturation of the software architecture research area by tracing the types of research questions and techniques used at various stages. We will see how early qualitative results set the stage for later precision, formality, and automation and how results build up over time. This generates advice to the field and projections about future impact.

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Her research interests in computer science lie primarily in the areas of programming systems and software engineering, particularly software architecture, programming languages, specifications, and abstraction techniques. She has participated in developing innovative curricula in Computer Science from the introductory to the doctoral level. Dr. Shaw has received the Warnier prize for contributions to software engineering and is a Fellow of the Association for Computing Machinery, the Institute for Electrical and Electronics Engineers, and the American Association for the Advancement of Science.