

Applied Software Architecture

By Christine Hofmeister, Robert Nord, Dilip Soni

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"Designing a large software system is an extremely complicated undertaking that requires juggling differing perspectives and differing goals, and evaluating differing options. Applied Software Architecture is the best book yet that gives guidance as to how to sort out and organize the conflicting pressures and produce a successful design." -- Len Bass, author of Software Architecture in Practice. Quality software architecture design has always been important, but in today's fast-paced, rapidly changing, and complex development environment, it is essential. A solid, well-thought-out design helps to manage complexity, to resolve trade-offs among conflicting requirements, and, in general, to bring quality software to market in a more timely fashion. Applied Software Architecture provides practical guidelines and techniques for producing quality software designs. It gives an overview of software architecture basics and a detailed guide to architecture design tasks, focusing on four fundamental views of architecture--conceptual, module, execution, and code.Through four real-life case studies, this book reveals the insights and best practices of the most skilled software architects in designing software architecture. These case studies, written with the masters who created them, demonstrate how the book's concepts and techniques are embodied in state-of-the-art architecture design. You will learn how to: *create designs flexible enough to incorporate tomorrow's technology; *use architecture as the basis for meeting performance, modifiability, reliability, and safety requirements; *determine priorities among conflicting requirements and arrive at a successful solution; and *use software architecture to help integrate system components. Anyone involved in software architecture will find this book a valuable compendium of best practices and an insightful look at the critical role of architecture in software development. 0201325713B07092001

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Editorial Review

From the Inside Flap

Software architecture is a recently emerged technical field, but it's not a new activity; there have always been good designers who create good software architectures. However, now the consensus is that what these designers do is qualitatively different from other software engineering activities, and we've begun figuring out how they do it and how we can teach others to do it.

Software architecture is not just a new label for an old activity; software architects today face new challenges. They are asked to produce increasingly complex software. Using the latest technologies, but these technologies are changing faster than ever. And they are asked to produce better quality software with a shorter time-to-market. Instead of seeing the architecture as necessarily complicated by these staggering requirements, we need to realize that the architecture is our most powerful tool in meeting them.

This book is a practical guide to designing, describing, and applying software architecture. The book began as a study of software architecture in industry, specifically at our company--Siemens. The study told us how practitioners define software architecture, what problems they are trying to solve with it, and how and why they choose particular architectural solutions.

We examined how architects design systems so that today's technology can be replaced with tomorrow's. We saw how the experts abstracted the essential aspects of their real-time, safety-critical reliability and performance requirements so that they could make good architectural decisions consistently. We also saw how good architecture descriptions improved the development process, making it easier to develop high-quality software in a shorter time. We saw how managers' understanding of the architecture was critical in organizing and scheduling the project. We saw how developers depended on the architecture to define interfaces and boundaries between their component and others, and to target maintenance activities.

This book also grew from our experience with software architecture as we applied the principles and techniques we saw the experts use. The description techniques helped uncover architectural problems in existing systems. The design principles guided us in defining architectures for new systems and for proposing solutions to problems in existing systems. Road Map

Part I of this book provides important background information for understanding what we mean by software architecture, and how we structure the architecture design tasks. In Part II we define the architecture design tasks, and use a running example to show how they are applied to the design of a software architecture. The example system, IS2000, is an image acquisition and processing system. We don't provide its complete architecture design, but instead describe one of its subsystems in detail. The Additional Reading section at the end of each chapter in Parts I and II dives references to sources of more information on software architecture.

Part III contains detailed descriptions of four industrial systems. These systems come from our original industrial study and they represent the state-of-the-art in software architecture. Each chapter in Part III gives a broad overview of the software architecture of a case study; These studies don't have the same level of detail as IS2000. The four systems are

Safety Vision--A half-million lines of code (LOC) instrumentation and control system for nuclear power plants Healthy Vision--A million LOC embedded patient monitoring system Central Vision--A half-million LOC centralized patient monitoring system Comm Vision--A multimillion LOC telecommunications system

The architects of these systems faced and solved some of the most difficult challenges confronting today's architects: designing large-scale, real-time, safety-critical, highly reliable systems.

In Part IV, we examine the software architect's role, describing what an architect must do beyond the software architecture design.

A Glossary and a Quick Reference to the architecture design tasks and artifacts are included at the end of the book. The four Quick Reference architecture views can also be found on the front and back endpapers.

We have selected the Unified Modeling Language (UML) to describe the software architecture, supplemented by tables or other notations when appropriate. We chose UML because it expresses well most of what we were trying to capture, and it is widely understood. Although the architecture notation is not the essential contribution of this book, we believe that a common notation and a common agreement about what is described will further the field of software architecture by improving our ability to communicate.

The main thing you'll learn from this book is a new way to tackle the problem of architecture design. You will learn what the issues are, when they should be addressed, and how they can be addressed. This book will increase your ability to recognize good solutions. Even if it does not change your eventual architectural solutions, it will help you arrive at those solutions more quickly. Guide to the Reader

There are a couple of different ways you can read this book. To get a general overview, we recommend you read Parts I and IV. For managers or others who are interested in understanding what software architecture is and how it is used, this is sufficient.

Project managers, system architects, software developers, testers, and those who want a better understanding of the four software architecture views should read, in addition, at least some of Part II. You can get this overview by reading Part II; you may skip the sections that cover the example system. Thus, read the first few pages of Part II, then the first and last sections of chapters 3 through 7. Skip Chapter 2 and Sections 3.2 through 3.7, 4.2, 5.2, 6.2, and 7.2.

After this overview, you will be well prepared to read the case studies. This is an option for students of software architecture or others who want to see the architecture of a range of applications. As you would expect, the case studies are all independent, so you can pick any or all to read. Read the introductory pages of Part III to find out more about the characteristics of each case study.

The final option is to read the whole book. This is, of course, what we recommend for software architects and all others who want a thorough understanding of software architecture. However, we don't expect you to digest Part III all at once, The case studies can be read over time, as the need or interest arises.
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From the Back Cover

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About the Author

Christine Hofmeister is a project manager at Siemens Corporate Research (SCR) in Princeton, New Jersey. Since joining Siemens, Dr. Hofmeister has balanced research in software architecture with design and development of industrial applications, focusing in particular on applications for the power generation industry. Her other research interests are distributed programming environments, software reconfigurability, and re-engineering software architectures.

Robert L. Nord, a member of the software architecture program at SCR, designs and evaluates software architectures for large-scale industrial systems. Dr. Nord, currently the Siemens industrial resident affiliate at the Software Engineering Institute (SEI) in Pittsburgh, is working on methods for architecture trade-off analysis and product-line practices. His other interests include transitioning software design practices, improving architecture practices using software architecture improvement groups, and architecture-based development.

Dilip Soni holds the position of Distinguished Member of Technical Staff at SCR where he designs and evaluates software architectures for industrial systems. His focus of interest has been medical, power generation and distribution, and industrial automation systems. Dr. Soni is currently working on design and verification of component-based control systems and architectures for integrated enterprises. His other interests include traditional music, folk dancing, and nonviolent communication.

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Mildred Shaw:

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