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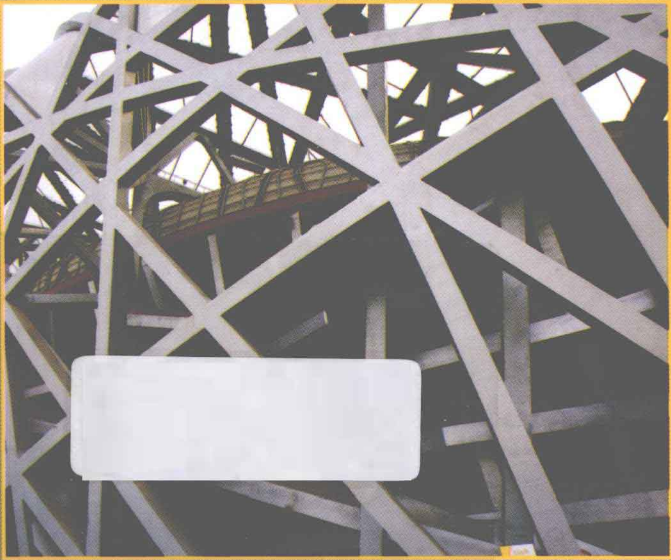
软件构架实践

（第3版 影印版）

Len Bass
Paul Clements 著
Rick Kazman



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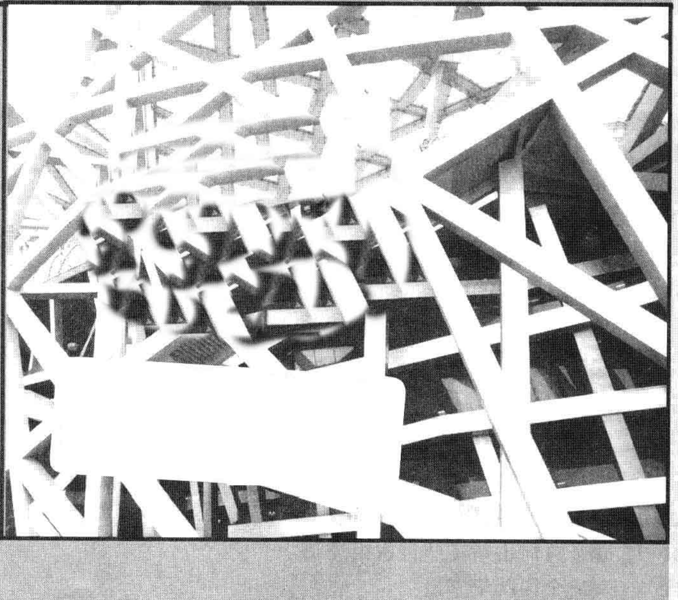

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PART ONE

INTRODUCTION

What is a software architecture? What is it good for? How does it come to be? What effect does its existence have? These are the questions we answer in Part I.

Chapter 1 deals with a technical perspective on software architecture. We define it and relate it to system and enterprise architectures. We discuss how the architecture can be represented in different views to emphasize different perspectives on the architecture. We define patterns and discuss what makes a "good" architecture.

In Chapter 2, we discuss the uses of an architecture. You may be surprised that we can find so many—ranging from a vehicle for communication among stakeholders to a blueprint for implementation, to the carrier of the system's quality attributes. We also discuss how the architecture provides a reasoned basis for schedules and how it provides the foundation for training new members on a team.

Finally, in Chapter 3, we discuss the various contexts in which a software architecture exists. It exists in a technical context, in a project life-cycle context, in a business context, and in a professional context. Each of these contexts defines a role for the software architecture to play, or an influence on it. These impacts and influences define the Architecture Influence Cycle.

1

What Is Software Architecture?

Good judgment is usually the result of experience. And experience is frequently the result of bad judgment. But to learn from the experience of others requires those who have the experience to share the knowledge with those who follow.
—Barry LePatner

Writing (on our part) and reading (on your part) a book about software architecture, which distills the experience of many people, presupposes that

1. having a software architecture is important to the successful development of a software system and
2. there is a sufficient, and sufficiently generalizable, body of knowledge about software architecture to fill up a book.

One purpose of this book is to convince you that both of these assumptions are true, and once you are convinced, give you a basic knowledge so that you can apply it yourself.

Software systems are constructed to satisfy organizations' business goals. The architecture is a bridge between those (often abstract) business goals and the final (concrete) resulting system. While the path from abstract goals to concrete systems can be complex, the good news is that software architectures can be designed, analyzed, documented, and implemented using known techniques that will support the achievement of these business and mission goals. The complexity can be tamed, made tractable.

These, then, are the topics for this book: the design, analysis, documentation, and implementation of architectures. We will also examine the influences, principally in the form of business goals and quality attributes, which inform these activities.

In this chapter we will focus on architecture strictly from a software engineering point of view. That is, we will explore the value that a software architecture brings to a development project. (Later chapters will take a business and organizational perspective.)

1.1 What Software Architecture Is and What It Isn't

There are many definitions of software architecture, easily discoverable with a web search, but the one we like is this one:

> The software architecture of a system is the set of structures needed to reason about the system, which comprise software elements, relations among them, and properties of both.

This definition stands in contrast to other definitions that talk about the system's "early" or "major" design decisions. While it is true that many architectural decisions are made early, not all are—especially in Agile or spiral-development projects. It's also true that very many decisions are made early that are not architectural. Also, it's hard to look at a decision and tell whether or not it's "major." Sometimes only time will tell. And since writing down an architecture is one of the architect's most important obligations, we need to know now which decisions an architecture comprises.

Structures, on the other hand, are fairly easy to identify in software, and they form a powerful tool for system design.

Let us look at some of the implications of our definition.

Architecture Is a Set of Software Structures

This is the first and most obvious implication of our definition. A structure is simply a set of elements held together by a relation. Software systems are composed of many structures, and no single structure holds claim to being *the* architecture. There are three categories of architectural structures, which will play an important role in the design, documentation, and analysis of architectures:

1. First, some structures partition systems into implementation units, which in this book we call *modules*. Modules are assigned specific computational responsibilities, and are the basis of work assignments for programming teams (Team A works on the database, Team B works on the business rules, Team C works on the user interface, etc.). In large projects, these elements (modules) are subdivided for assignment to subteams. For example, the database for a large enterprise resource planning (ERP) implementation might be so complex that its implementation is split into many parts. The structure that captures that decomposition is a kind of module structure, the *module*

decomposition structure in fact. Another kind of module structure emerges as an output of object-oriented analysis and design—class diagrams. If you aggregate your modules into layers, you've created another (and very useful) module structure. Module structures are static structures, in that they focus on the way the system's functionality is divided up and assigned to implementation teams.

2. Other structures are dynamic, meaning that they focus on the way the elements interact with each other at runtime to carry out the system's functions. Suppose the system is to be built as a set of services. The services, the infrastructure they interact with, and the synchronization and interaction relations among them form another kind of structure often used to describe a system. These services are made up of (compiled from) the programs in the various implementation units that we just described. In this book we will call runtime structures *component-and-connector* (C&C) structures. The term *component* is overloaded in software engineering. In our use, a component is always a runtime entity.
3. A third kind of structure describes the mapping from software structures to the system's organizational, developmental, installation, and execution environments. For example, modules are assigned to teams to develop, and assigned to places in a file structure for implementation, integration, and testing. Components are deployed onto hardware in order to execute. These mappings are called *allocation* structures.

Although software comprises an endless supply of structures, not all of them are architectural. For example, the set of lines of source code that contain the letter "z," ordered by increasing length from shortest to longest, is a software structure. But it's not a very interesting one, nor is it architectural. A structure is architectural if it supports reasoning about the system and the system's properties. The reasoning should be about an attribute of the system that is important to some stakeholder. These include functionality achieved by the system, the availability of the system in the face of faults, the difficulty of making specific changes to the system, the responsiveness of the system to user requests, and many others. We will spend a great deal of time in this book on the relationship between architecture and quality attributes like these.

Thus, the set of architectural structures is not fixed or limited. What is architectural is what is useful in your context for your system.

Architecture Is an Abstraction

Because architecture consists of structures and structures consist of elements[1] and relations, it follows that an architecture comprises software elements and

1. In this book we use the term "element" when we mean either a module or a component, and don't want to distinguish.

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