软件**采办**管理
——开放系统和 COTS 产品

Managing Software Acquisition
Open Systems and COTS Products

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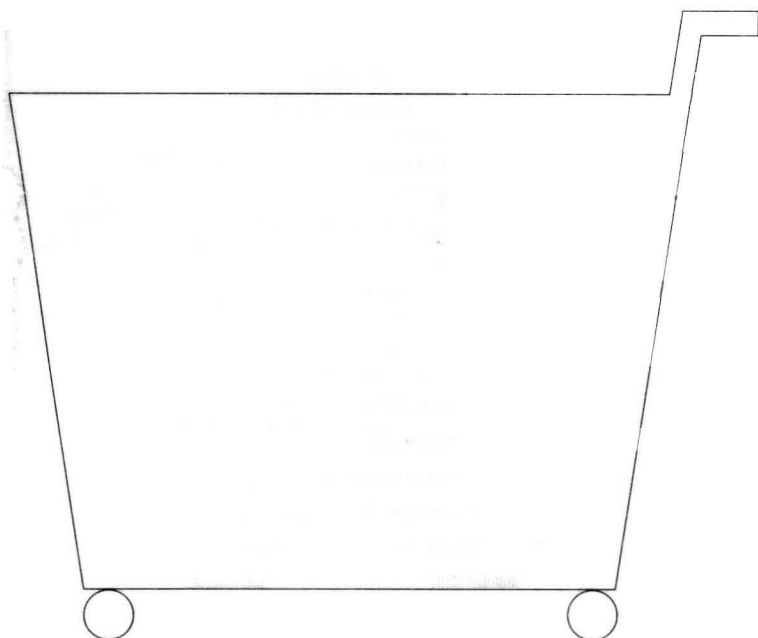
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内 容 简 介

本书阐述了基于 COTS 产品系统的、开放的、成功的采办基本原则和最佳措施。探讨了这种新的采办方法带来的众多机遇和挑战；对这种采办方法可能存在的潜在问题进行了预测；论述了这种采办方法对项目经理的工作所造成的影响。

本书读者对象主要是政府部门或企业的计算机系统项目经理及技术人员，他们负责系统的设计、采购、维护与评测，以及与计算系统开发有关的资金问题。

出 版 说 明

　　1984 年，美国国防部出资在卡内基·梅隆大学设立软件工程研究所(Software Engineering Institute，简称 SEI)。SEI 于 1986年开始研究软件过程能力成熟度模型（Capacity Maturity Model，CMM），1991 年正式推出了 CMM 1.0 版，1993 年推出 CMM 1.1版。此后，SEI 还完成了能力成熟度模型集成（Capability Maturity Model Integration，简称 CMMI）。目前，CMM 2.0 版已经推出。

　　CMM 自问世以来备受关注，在一些发达国家和地区得到了广泛应用，成为衡量软件公司软件开发管理水平的重要参考因素，并成为软件过程改进的事实标准。CMM 目前代表着软件发展的一种思路，一种提高软件过程能力的途径。它为软件行业的发展提供了一个良好的框架，是软件过程能力提高的有用工具。

　　SEI 十几年的研究过程和成果，都浓缩在由 SEI 参与研究工作的资深专家亲自撰写的 SEI 软件工程丛书（SEI Series In Software Engineering）中。

　　为增强我国软件企业的竞争力，提高国产软件的水平，经三联四方工作室和清华大学出版社共同策划，全面引进了这套丛书，分批影印和翻译出版，这套丛书采取开放式出版，不断改进，不断出版，旨在满足国内软件界人士学习原版软件工程高级教程的愿望。

前　言

开放系统和 COTS 产品变化迅速的软件采办行业中，开放系统与 COTS（commercial off the shelf，商用现货）产品的重要性日益增加，因为使用它们不仅能够更好地达到预期目标，而且还能降低开发费用。本书将介绍与开放系统和 COTS 产品有关的问题，这些内容将帮助你更好地开展工作。尽管本书侧重于介绍与软件采办有关的问题，但是书中的一些原则同样适用于硬件采办以及系统采办。当然，还要弄清开放系统与 COTS 产品之间的关系，弄清这一关系以及本书所讲的软件采办原则，就能够轻松处理采办环境的最新情况。

读者对象

本书较适合负责政府部门或私营公司的计算机系统项目经理及其员工使用，他们负责系统的设计、采购、维护与评测，以及与计算系统开发有关的资金问题。项目经理是指政府部门或工业企业中对整个系统采办负责的人员，员工指对项目经理负责的技术人员。他们有各自不同的职责、不同的任务和不同的技术特长，但是开放系统和 COTS 产品的使用，将会对他们每个人的工作方式和工作方法产生影响。

部分读者在基础项目管理方面的经验可能已经十分丰富，但是作为基础，本书还是介绍了一些简单的管理知识，目的是让所有读者能从同一起点上开始阅读本书。然而，在利用以前的管理技巧进行基于开放系统和 COTS 产品的软件采办管理时，不同的读者可能会遇上不同的问题，这也是本书要解决的问题。

本书主要目的

本书主要目的为：

- 定义与开放系统和 COTS 产品有关的基本术语、概念和过程；

- 解释基于开放系统和 COTS 产品进行软件采办的潜在益处和困难；

- 描述开放系统和 COTS 产品对项目经理及其员工的影响；

- 示范软件采办过程中如何使用开放系统和 COTS 产品；

- 重点解决政府部门的项目经理所关心的问题。

有关开放系统和 COTS 产品的术语有多种定义，有些专家可能还不认可这些定义，也可能许多定义有些夸大其辞。因此，在对这些术语下定义时应该格外地谨慎，以便大家能对这些术语的真正含义达成共识。

使用开放系统和 COTS 产品进行软件采办，既有一定的潜在益处，同时也潜伏着一些困难，本书涵盖了这两方面的内容，并侧重于软件采办方法对工作方式的影响。衷心地希望本书能够帮助大家认识到使用这一方法将带来的新的挑战，并能够成功地应对这些挑战。

突出强调原则

编写本书的主要目的是介绍使用开放系统和 COTS 产品进行软件采办的一些原则问题，因为理解了这些原则，就能够更轻松地处理使用这一方法可能带来的问题。因此，本书的重点不在于：

- 详细的技术问题。本书不去专门讨论某一个或某一套标准，比如说本书没有深入讲解所有的网络标准，相反只是深入讨论"标准"和"配置标准文件"这两个术语真正的含义是什么、标准是如何形成的、如何选择标准，以及这些标准与 COTS 产品有什么关系等内容。

- 任务清单。使用开放系统和 COTS 产品进行软件采办是一项特别复杂、特别具有挑战性的任务，尽管把这一复杂的任务简化成一张任务清单极具诱惑力，但是我们反对这种做法。相反，本书详细阐明了使用开放系统和 COTS 产品进行软件采办的一些原则，以及如何应用这些

原则，因为这些原则决定着软件采办的整个过程。

我们坚信，与详细讨论一些技术细节相比，这些原则对读者的帮助更大，因为通常情况下，一个特定的方法是否适合于软件系统取决于：现状、目标以及处理新问题的方法。

政府部门应注意的问题

开放系统和 COTS 产品的使用给政府部门的软件开发带来了独特的挑战，因为政府部门的商业运作本身就不同于工业部门，本书因此特别重视政府部门所关心的问题。希望本书在政府部门与工业界之间架起一座桥梁，以便他们能够就使用开放系统和 COTS 产品进行软件采办的问题达成共识。

本书内容和结构

本书分为 6 部分，前 5 个部分分别由相关的章节组成，最后一部分包括有 4 个附录。

- 第 I 部分：采办入门。本部分由第 1～4 章组成，讲解了软件采办的方法，阐明了使用开放系统和 COTS 产品进行软件采办的承诺与陷阱，探讨了采办范式如何向开放系统和 COTS 产品转移，提出了使用开放系统和 COTS 产品进行软件采办的基本要素。

- 第 II 部分：深入理解新世界。本部分由第 5～8 章组成，讲解了与开放系统和 COTS 产品有关的各个方面的内容，包括：参照模型、体系结构、标准、COTS 产品和采办规程。

- 第 III 部分：管理转变。本部分由第 9～12 章组成，介绍了使用开放系统和 COTS 产品将如何影响我们的工作方式，讲解了项目经理特别关心的问题，阐述了在新的采办世界里如何进行工程管理、如何进行采购，这些内容将帮助采办人员成功处理在新的软件采办世界里所遇到的难题。

- 第 IV 部分：深入思考采办方法。本部分由第 13～15 章组

成，讲解了不同的采办模型，尤其是适合于用开放系统和 COTS 产品进行软件采办的模型，从而使大家对使用开放系统和 COTS 产品进行软件采办的现状与未来有一个更为清楚的了解。

- 第 V 部分：最后的思考。本部分由单独的一章组成，介绍了将来软件采办中可能会遇到的问题，既有发生在政府部门的问题，也有普通工业部门出现的问题。

- 第 VI 部分：附录。附录内容包括：术语表、首字母缩略语、帮助读者分析系统的样题和参考文献。

为便于阅读，本书使用了两种特殊符号。对于关键术语的定义，使用特殊格式。另外是一些补充材料，其中一些材料是我的同事的奇思妙语，大家会发现某些材料很有趣或者很幽默；某些材料很有启发性，能够激发我们的灵感。这一部分材料我们用灰色底纹的文字来表示。

所有的软件采办项目经理都想更好地管理他们所负责的部门，更好地带领员工完成既定的任务。1961 年 5 月，肯尼迪总统在就美国最急需解决的问题向国会发表演讲时说了这样一段话："我们认为在未来的十年内，我们国家必须想方设法实现这样的目标：把人送上月球，并让他安全地返回地球。其他任何太空项目都不会比这个项目更让人记忆深刻；对于探索外层空间来说，其他任何太空项目都没有这个项目更重要；而且其他任何太空项目更不会比这个项目更困难；其他任何太空项目更不会像这个计划一样耗资巨大。事实上，如果今天我们做出了斩钉截铁的回答，那么我们所做的就不仅仅是把一个人送上月球，而是把整个的国家送上了月球。因此，我们必须共同努力，实现把人类送上月球这一宏伟目标。"

思考题

每一章的思考题，都会提出一些具有启发性的问题。这些问题都是从过去几年教授这门课程的经验当中精心挑选的，有些学生的日常工作就是采办。提出这些思考题的目的是让读者认识到以后有可能会碰到同样的问题。

　　回答这些问题确实很难,因为几乎不可能有一个标准的正确答案适合于所有项目经理或所有软件采办。大多数情况下, 答案的正确与否取决于采办系统的实际情况。然而, 很有可能在尝试用不同方法来回答这些问题时, 会发现所找到的答案正是本书所讨论的一些基本原则, 因此, 在阅读完一章内容之后,请看每章提出的思考题, 并花点时间来深思一下如何解决这些问题。如果发现一些问题确实难以回答, 千万不要沮丧, 就像对待日常工作中碰到的其他麻烦事一样处理它就是了, 当然我们也鼓励采办人员与同事共同探讨这些问题。

Carnegie Mellon
Software Engineering Institute

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Craig thanks Donna and the boys—
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Preface

In the rapidly changing world of software acquisition, open systems and commercial off-the-shelf (COTS) products continue to grow in importance because of their expected functional and economic advantages. This book will help you understand the many issues surrounding acquisition of open, COTS-based systems. Although our focus is on software acquisition, this book can equally apply to hardware and system acquisition. You also need to understand the relationship between open systems and COTS products. If you understand these issues, you can more easily deal with the dynamics of today's acquisition environment.

Audience

The intended audience of this book is project managers and their staffs who are involved in designing, developing, procuring, maintaining, funding, or evaluating computer systems in both private and public sectors. We use the term *project manager* to denote the individual responsible for completion of the acquisition activities for systems in government and industry. We use the term *project staff* to denote the many professionals who support the project manager. Each of these professionals has different responsibilities, concerns, and technical expertise, but the use of open systems and COTS products will affect each person in some way.

We recognize that readers may very well have experience in basic project management. We include some basic management information as background so that we can get

all readers on the same page. The real difference arises, however, when we apply our management skills in the context of open, COTS-based systems. That's the challenge we want to help you address.

Purpose

The purposes of this book are to

- Define basic terms, concepts, and processes related to open systems and the use of COTS products
- Explain the potential benefits and difficulties of using an approach that relies on open systems and COTS products
- Describe how open systems and COTS products affect the project manager and the project staff
- Illustrate how to incorporate open systems and COTS products in the acquisition process
- Highlight special concerns for government managers

Terms associated with open systems and COTS products have many different definitions. Experts may not agree, and you may find a lot of hype. We need to share a common understanding of what these terms mean, and we take care in defining relevant terms.

The use of open systems and COTS products has both potential benefits and potential difficulties. In this book, we discuss both. Emphasis on an acquisition approach that uses open systems and COTS products will change the way you do your job. We hope that this book helps you identify—and be able to successfully deal with—the challenges that lie ahead.

Emphasis on principles

In writing this book, our emphasis is on *principles* related to the acquisition of systems that are based on open systems and COTS products. If you are able to understand the principles, you are more likely to be able to deal with management issues. Thus, our focus is *not* toward

- Detailed technical issues. A detailed discussion of particular standards or sets of standards is outside the

scope of this book. For example, we will not present a discussion of all the networking standards you may hear about. Instead, we concentrate on what such terms as *standard* and *profile* mean and discuss such topics as how standards are developed and selected and how they relate to COTS products.

- Checklists. An acquisition approach based on open systems and COTS products can be complex and challenging. Despite the temptation to reduce this complexity to a simple set of checklists, we resist such an approach. Instead, we place emphasis on the specification and application of principles that govern the acquisition process. Maybe you can develop your own checklists, appropriate to your system, based on what you will learn in this book. But don't confuse a checklist with the understanding of basic acquisition, open systems, and COTS principles.

We believe that emphasis on principles will help you more than lots of details will. In many cases, a particular approach for your system will *depend:* on your situation, your goals, and your approach to meet the problems you will face along the way.

Open systems and the use of COTS products present unique challenges for government programs. Because the government's business practices are inherently different from those of industry, we devote special attention to government concerns. We hope that, to some degree, we can build a bridge and develop a shared understanding between government and industry regarding acquisition issues related to open systems and COTS products.

Government concerns

Organization and Content

This book consists of five main parts, which contain related chapters, and four appendixes.

Organization

- Part One, Getting Started, consists of the first four chapters, which introduce the basic elements of open systems and the use of COTS products. These chapters

present an overview of acquisition, describe the promises and pitfalls of the open, COTS-based approach, explore the paradigm shift to open systems and COTS products, and present the elements of an open, COTS-based approach.

- Part Two, Understanding the New World, explores various aspects of open systems and COTS products. Chapters 5–8 look at reference models and architectures, standards, commercial off-the-shelf (COTS) products, and acquisition roadmaps.

- Part Three, Managing the Transition, provides information to help you maneuver successfully in the world of open systems and COTS products. Chapters 9–12 consider how open systems and COTS products can change your business, discuss special concerns for managers, describe engineering practices, and discuss procurement practices.

- Part Four, Considering Acquisition, focuses on the acquisition context for open systems and the use of COTS products. Chapters 13–15 describe an acquisition framework used to describe various acquisition models, particularly acquisition models for open, COTS-based systems.

- Part Five, Closing Thoughts, consists of one chapter, which looks at anticipated future acquisition issues, both general and specific to the government.

- Other information is provided in the appendixes: a glossary of terms, a list of acronyms used in the book and what they mean, sample questions to help you analyze your system, and references.

Notations

This book uses two types of special notations to help you as you read this book. When we define a key term, we present it as follows.

open system ➞ A collection of interacting software and hardware component implementations, and users

- Designed to satisfy stated needs
- Having the interface specification of components
  – Fully defined

- Available to the public
- Maintained according to group consensus
- In which the component implementations conform to the interface specifications

The second type of notation is for material that you may find interesting, enlightening, humorous, or thought provoking. Sometimes, we have included anecdotes from colleagues. We present this special information in a gray box like the following.

> ## Leadership
>
> All acquisition managers are expected to provide leadership to their organizations and their people, who must achieve the goals established by management. In a special message to Congress on urgent national needs in May 1961, President Kennedy gave a speech that included the following text: "I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the earth. No single space project in this period will be more impressive to mankind, or more important for the long-range exploration of space; and none will be so difficult or expensive to accomplish. In a very real sense, it will not be one man going to the moon—if we make this judgment affirmatively, it will be an entire nation. For all of us must work to put him there."

Each chapter includes a number of open-ended questions in a section titled Food for Thought. These items have been taken from our experience over a number of years teaching this material to audiences that include people who are involved in acquisition on a daily basis. We include these questions to illustrate some of the issues that may confront you as you conduct your job.

Food for thought

Few "right" answers apply universally to all project managers or systems. For this reason, it is difficult to give answers to these questions; in many cases, *it depends:* on the circumstances that are unique to your system. It is possible, however, to trace various approaches back to the

principles discussed in this book. When you complete a chapter, look at these questions and spend a bit of time thinking your way through them. You may find some of the questions difficult, but don't be frustrated by them. Deal with them in the same way you would deal with any other difficult issue. You're also encouraged to discuss them with your colleagues.

Acknowledgments