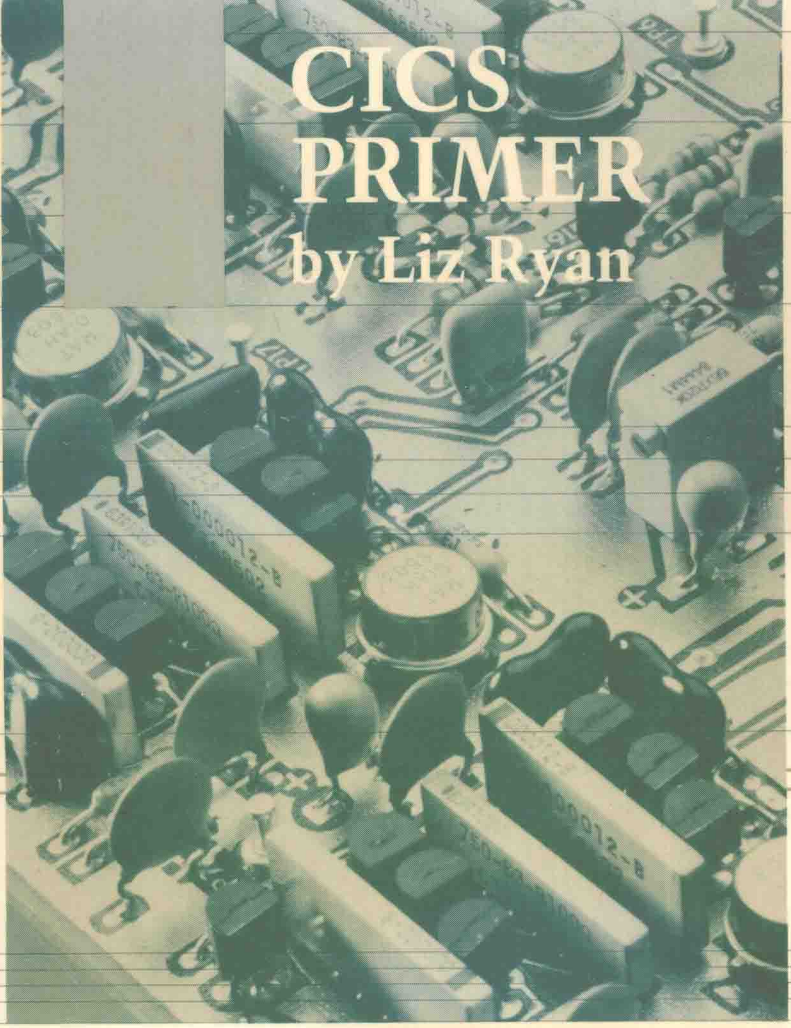
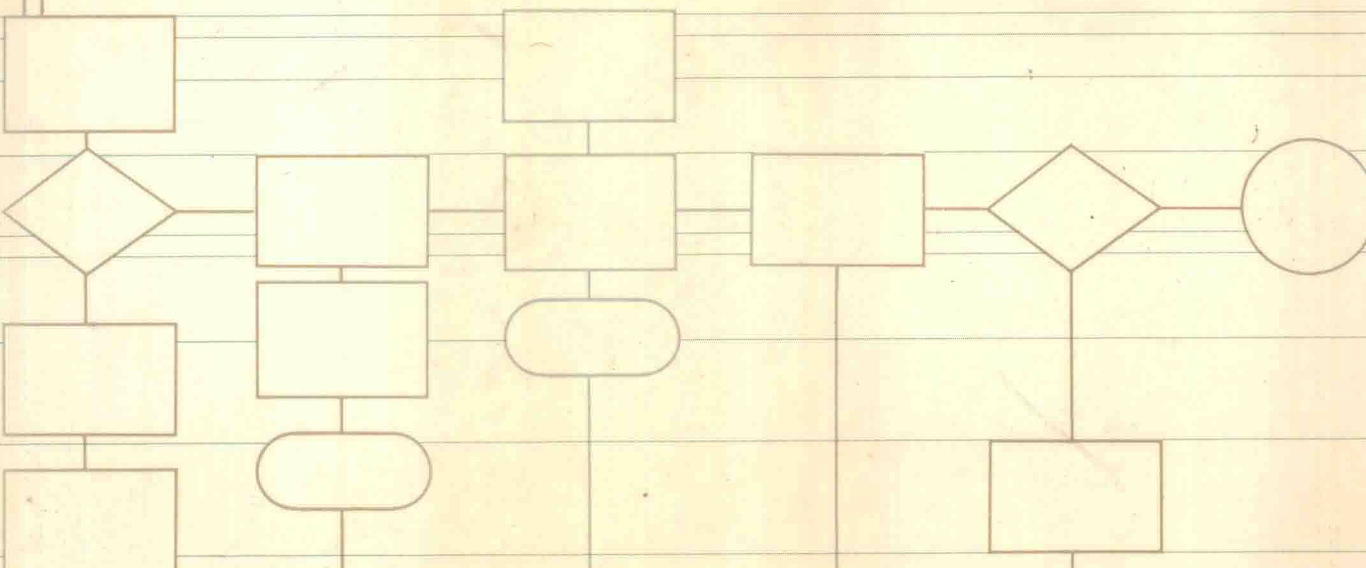
CICS PRIMER

by Liz Ryan





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Preface

The subject of this book is how to write application programs for use with CICS, a data communication system that many companies use to maintain and access large computerized data bases. CICS stands for Customer Information Control System. However you will probably never hear CICS called by this formal name. It is almost always referred to by the letters C-I-C-S, often spoken like the single word "kicks."

The book is designed to teach the concepts and programming skills that you would use in the first year or so if you were hired as an application programmer in a company that uses CICS. As a starting point, the book assumes that you have already learned to write computer programs in the COBOL language, that you understand basic computer terms like *compiler* and *debugging*, and that you know how data is represented within a computer. However, unless you have already worked in a fairly large computer installation, you probably aren't exactly sure what a data communication system actually does and why it's needed. The first two chapters of the book describe how a typical company uses computers to manage and communicate with its data base, and how CICS and similar systems fit in with other parts of the overall computer system.

When new programmers arrive on the job, they traditionally receive a brief introduction to the new environment and then are given an initial programming assignment. The first assignment isn't complicated and doesn't take long to complete. The idea is to get the programmers to use the computer system as soon as possible. They will learn the system fastest by using it to accomplish a defined task. This book uses the same philosophy. Beginning with Chapter 3, each chapter is followed by programming exercises that give you practice at the CICS commands you've learned so far.

To be successful as a programmer you need to know more than how to write correct COBOL statements. You also need to use good judgment about the way you design programs, test them, and prepare them for use by other people. Of course, good judgment requires experience that must be gained over a long period of time. However, to be useful the experience must be viewed against a background of general concepts. Therefore, as the text introduces CICS commands it also points out related concepts that apply to the data base and data communication environment in general. By keeping these concepts in mind you will be prepared to apply your skills to data systems other than CICS alone. Many of the discussion questions that follow each chapter are intended to help you see how these general concepts apply in real situations.

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1 Introduction to Data Base/ Data Communications

Introduction

We begin this book in the same way that programmers often begin a new job. If you report for work for the first time in a large computer installation, you can expect the first day to be devoted to introductions. Your manager will spend some time talking to you about the company and how the programs you will write fit in with the company's business. Then you will get a tour of the computing facility, be introduced to many of the people who work there, and be told the names or numbers of a great many devices that attach to the central computer. Your manager doesn't really expect you to remember the names of all these people or to be able to describe in detail what each piece of computing equipment does. The purpose of the tour is to help you form some general impressions that will become clearer as time goes on.

You can think of the first two chapters in this textbook as the written equivalent of that first day's orientation. The intent is to give you a general impression of the kind of business and computer facility that uses CICS, and to point out the people and parts of the computing system that will be most important to you as you work with CICS.

If you have worked in a large computer installation before, you may already be familiar with some of the introductory information. However, you may still benefit from a review of the *terminology* used to describe computer hardware and systems concepts in the CICS environment. Each computer manufacturer and system developer tends to coin new terms that may be used differently, or not at all, by other developers and manufacturers. This book uses the same terminology that you will encounter in IBM manuals that describe CICS and the system hardware and software used with CICS.

Of course no two computer facilities are alike, so this discussion will have to be more general than a tour of an actual facility. But you know that, in general, the CICS system is devoted to allowing users at terminals to access data stored on a central computer. This is a computing environment referred to as *data base/data communications* or DB/DC. There are some characteristics of the data base/data communications environment that are shared by virtually all facilities of this type. These are the characteristics that we want to point out in this chapter.

Objectives

After completing this chapter, you will:

- Be familiar with the hardware and system terminology used in CICS installations.
- Be able to describe the roles of other computer specialists you will work with as a CICS application programmer.
- Be able to discuss the factors that affect work activity in a company that uses CICS.

The Data Base and Data Files

As people describe the computing facility to you, they will refer again and again to the *data base*. You have probably heard and seen this term in several contexts since you began studying programming. For example, you may have seen advertisements for personal computer programs designed to manage data bases, or you may have seen descriptions of classes about data base design. And you may have heard bank tellers or airline reservations clerks explain that service is delayed because "the data base is down."

But you may have noticed that the term "data base" is not always used in exactly the same way. Sometimes it's used in a very general sense to mean any collection of data. In this general sense a list of the names, locations, and menu specialties of your favorite restaurants would be considered a data base. Unless you are in the business of reviewing restaurants, however, it's unlikely that you would use CICS to maintain your restaurant list.

On the other hand, when used in its most formal sense, data base applies only to a few special types of information collections. In this formal sense many of the data collections for which CICS is used cannot be considered data bases at all. Therefore, throughout this book, you will see the term *data file* much more often than *data base*. However, in the normal working environment, which we are describing here, you are apt to hear *data base* used to refer to any collection of information that has the following characteristics:

1. It's relatively large. Later we'll discuss the size of a typical data base. For now, we'll say simply that it occupies a significant amount of space.
2. It's stored on some type of direct access device in such a way that a computer program can find a particular data item without having to search through a lot of other items. A collection of data like this is called a *direct access file*.
3. It's important to the business of your company. (Many texts and manuals use the term *enterprise* in place of *company* in order to make clear that data bases can exist within private organizations, public institutions, and other "non-business" settings. For the sake of simplicity we'll use the term *company* although we also intend to include other types of settings.)
4. It's used by many people at once. For example, the computer operator may look at a display screen and tell you, "There are 200 users online to the data base right now."
5. It contains information needed throughout the business. For example, your tour might take you through the accounting department, the warehouse, and marketing research. In each of these areas you would see people at computer terminals using the same data base for their own job requirements. Because a data base permits information from different parts of the company to be combined, it is said to be *integrated*.

Many direct access files satisfy all the requirements except the last. That is, they can be large, important, and accessible to many people simultaneously, but not satisfy this definition of data base because they are not integrated. Such a file usually contains rather specialized data like personnel records or descriptions of parts used in manufacture. These are the kinds of data files that you will work with most often in the CICS environment. However, CICS can also be used with "true" data bases, such as data bases created by the IBM Information Management System (IMS). The chapter "Accessing DL/1 Data Bases" describes how CICS is used to manage access to IMS data bases.

Each of the characteristics of a data base makes a requirement upon the computer facility. It may affect the hardware or software required, the kinds and schedule of work performed, or the rules by which the computer is used. If you know that a company uses CICS, you can expect certain things to be true about its computer facility.

Hardware

Let's start with the computer hardware. First, of course, there is the computer itself. It actually consists of several separate "boxes" or units; for example, the central processing unit (CPU) and memory (also called *processor storage*) units. Attached to the computer are peripheral devices which perform various types of input and output functions. They include magnetic tape drives, printers, and direct access storage units such as you would see in any computer room. In a CICS facility, two types of peripheral devices are especially important: the direct access storage devices where the data base resides, and the transmission control devices which permit communication between the computer and online terminals.

Direct Access Storage

We said earlier that the data base is "relatively large" and that it resides on direct access storage devices. This is a good time to try to pin down what is meant by "relatively large."

The data base is recorded on direct access storage *volumes*. Although there are different types of direct access storage volumes, the most commonly used is the *disk* or *disk pack*. The common expression is that the data is *on disks*, so we will refer to "disk" instead of "volume."

You may be familiar with the *floppy–disks, diskettes,* used on many personal computers. One way to get a feeling for the size of data base you will find in a CICS facility is to compare the disks used there to the personal computer's floppy disk. The most common floppy disk is 5¼ inches in diameter. Information is recorded on one or both sides of the floppy disk, depending upon the type of personal computer system in use. A floppy disk with information recorded on both sides holds about 400 thousand characters.

The disks that you would find in most CICS facilities hold more than 160 *million* characters—about 400 times as much information as a floppy disk. A data base that fills only one of these disk volumes would be considered relatively small.

The largest disks in use today have capacities of more than 800 million characters, 2000 times the capacity of a floppy disk. Some CICS installations have data bases that fill twenty or thirty of these large direct access storage volumes.

You may not see any of the disks themselves; often, they are permanently sealed in the direct access drive that reads and writes them. Other types of disks can be moved from one drive to another. Direct access storage devices can differ in other ways besides whether or not their volumes can be removed. Your CICS facility may use several types of devices, and the CICS programs must be able to process data even if it is moved from one device type to another.

The device in which the volume is placed is called a direct access storage device or *disk drive*. The disk drive is attached to a storage controller, which in turn, is attached to a channel, and then to the computer. The storage controller and channel are examples of boxes which will be pointed out to you, but whose names and numbers won't be important to you at first. The point to remember is that there are several connections or links between the computer and the data. We will return to that point later when we discuss system reliability.

Transmission Control Devices

There are also several connections between the computer and the terminals used to access the data base. Figure 1-1 shows a typical arrangement.

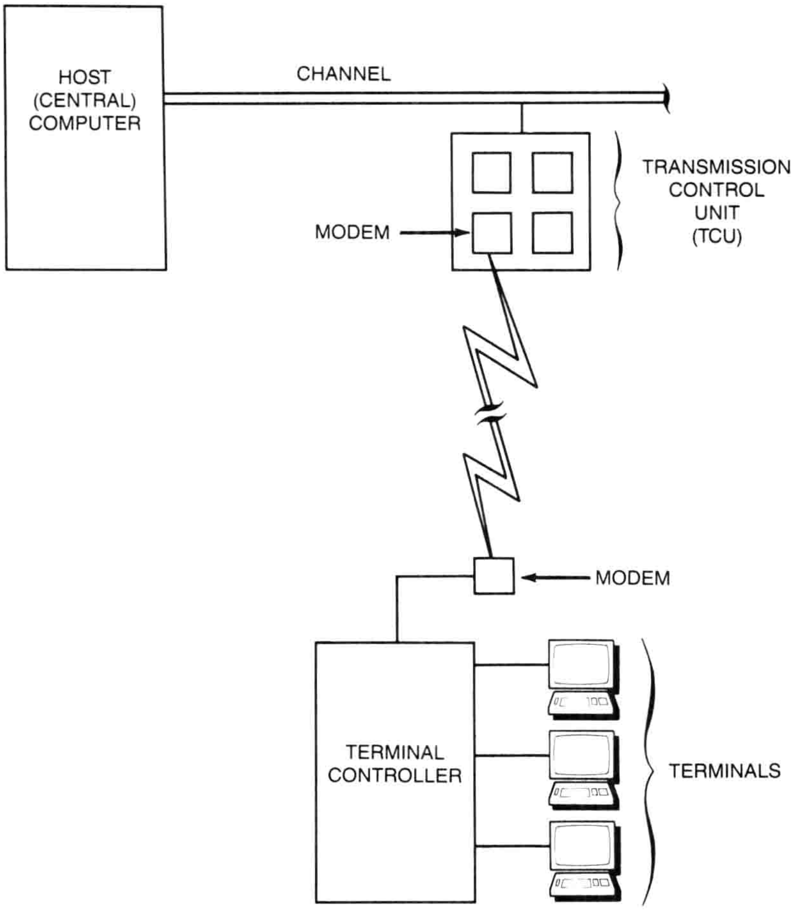

Figure 1-1 Communications Path from Central Computer

A *transmission control unit* is attached, via a channel, to the computer. The transmission control unit houses *modems* which encode and decode signals from a *phone line*. On the other side of the phone line is another modem which attaches to a *terminal controller*. The terminal controller can connect to one or several *terminals*.

On a typical tour you would see many different kinds of terminal devices.

Most would probably be some type of video display terminal, but you could also see printers, with or without keyboards, various types of computers, and special purpose terminals like optical scanners. Some would access the CICS computer by dialed phone connection, others would be directly cabled.

The point to keep in mind is that the application programs you write will have to communicate with users at many different types of terminals which can be connected in various ways to the central computer.

System Reliability

Remember that your company depends upon its data base in order to conduct its daily business. Consider this in light of the many links you observed between the computer and the data base, and between the computer and the users at their terminal devices. A failure in any of these links makes the data inaccessible to some or all users. With the data base inaccessible, work comes to a halt in many parts of the business. Sometimes the effect is dramatic. Picture a hundred or so impatient truck drivers, with their rigs in line at the warehouse, unable to load or unload because the warehouse management data base is down. Or picture a manufacturing process at a standstill because additional parts cannot be distributed.

To protect against such failures, the computing facility installs extra (or *redundant*) hardware to provide duplicate backup links. Figure 1-2 shows a direct access storage volume mounted on a drive that is connected to the computer through a single controller and channel. Figure 1-3 shows how the same drive would be installed to provide backup connections. Each device in the path has been duplicated. Additional drives are attached to the storage controller. But there is also an additional storage controller so that the drives can be reached through either controller A or B. The channel is duplicated in a similar way, so that each controller can be reached through two channels. Although not shown in the figure, the computer itself can also be duplicated.

You may want to trace out some of the possible paths between the computer and the direct access drive shown in Figure 1-3. Keep in mind that the CICS programs you will write must function correctly no matter which path may be in use.

As you would expect, hardware redundancy is also used for the communication links. Again, the CICS programs must function correctly even if a user must move from one terminal type to another.

Software

As the preceding description suggests, a CICS facility can be quite a complex environment. Its size, the number of users being served simultaneously, the variety and interconnections of the hardware, all contribute to the complexity. You may wonder whether your CICS application programs will also be very complex.

Fortunately, the operating system used to support CICS, and CICS itself, are designed to deal with much of the complexity. For example, CICS keeps track of what type of terminal was used to invoke your program, and translates your input and output statements into the correct form for the terminal. CICS and the operating system work together to simplify your program's access to the data base. Your program will refer to a data base or file by name. CICS keeps