

Chapter 2 How to navigate this book

This book is designed to cater to diverse reading approaches, tailored to your interests and background. Here's a quick overview of the chapters, followed by a guided tour to help you navigate this book effectively.

Chapter overview

Chapter 3: The mainframe defined

This section introduces the fundamental concept of mainframes, establishing the foundation for all subsequent discussions.

Chapter 4: Mainframe hardware

Explores the physical components that make mainframes unique, from their robust server architecture to specialized hardware components that deliver enterprise-grade performance.

Chapter 5: Mainframe

Provides a comprehensive overview of both legacy and current operating systems available for mainframe environments, tracing their evolutionary development.

Chapter 6: z/OS – the mainframe flagship operating system

Introduces IBM's premier mainframe operating system—the foundation for subsequent chapters exploring middleware, applications, and development practices.

Chapter 7: Middleware for z/OS

Examines the critical intermediary software layer, including application servers, database management systems, and integration tools that bridge applications with the z/OS infrastructure.

Chapter 8: Programming languages for z/OS

Surveys the diverse programming languages supported on z/OS, from traditional COBOL and PL/I to modern languages that extend the platform's capabilities.

Chapter 9: Integration technologies

Explores technologies that enable seamless communication between mainframe applications and distributed systems across the broader IT landscape.

Chapter 10: Application development for z/OS

Bridges traditional mainframe development with contemporary methodologies, including DevOps, agile practices, and automated testing frameworks.

Chapter 11: Security

Delves into z/OS security concepts, frameworks, and best practices for protecting mission-critical applications in a multi-tenant environment.

Chapter 12: System management

Examines tools and practices for efficiently managing and optimizing z/OS environments to ensure maximum availability and performance.

Chapter 13: Modern application architectures

Provides guidance on implementing contemporary architectural patterns within the z/OS environment, striking a balance between innovation and enterprise requirements.

Chapter 14: Transformation strategies

Provides pragmatic approaches for transforming legacy mainframe applications into future-ready systems, without compromising reliability or business continuity.

Chapter 15: Linux for the mainframe

Explores the versatility of running Linux and containerized workloads alongside traditional mainframe applications, creating hybrid operational models.

Chapter 16: Understanding mainframe cost

Essential reading for those with financial responsibilities or interests. This chapter breaks down the total cost of ownership and the long-term financial implications of mainframe systems. Technical readers may choose to revisit this later.

Chapter 17: Mainframes in the Cloud Era

Analyzes how cloud computing paradigms influence mainframe evolution and deployment strategies in contemporary IT environments with hybrid architectures.

Chapter 18: The future of mainframe computing

Synthesizes key insights and examines emerging trends shaping the continued evolution of mainframe technology.

Reading guide per role

To help you navigate the book efficiently, Figure 1 provides a reading guide tailored to different roles.

Chapters 3 and 4 give an overview of what a mainframe is at a minimum technical level. Chapter 18 summarizes the key insights and examines future trends. These chapters are recommended for all readers.

If you're a **CFO**, **IT Executive**, or **Business Leader**, you might start with the Executive Summary, thumb through Chapters 3 and 4, and jump to Chapter 16 (Costs), optionally Chapter 14 (Transformation), and read Chapter 18 (The future).

If you are an **Enterprise Architect**, apart from the Executive Summary, Chapter 3, 4, and 18, read Chapters 9 (Integration), 10 (DevOps), 11 (Security and Compliance) and 13

(Architecture). Chapters 15 (Linux and containers) and 16 (Mainframes and Cloud) may also be relevant to you.

As a **Technical Leader**, you can then review all the chapters, follow the book's flow, and explore those that align with your interests and needs. While each chapter builds on the concepts introduced earlier, they are also designed to stand alone, allowing you to focus on the topics most relevant to you.

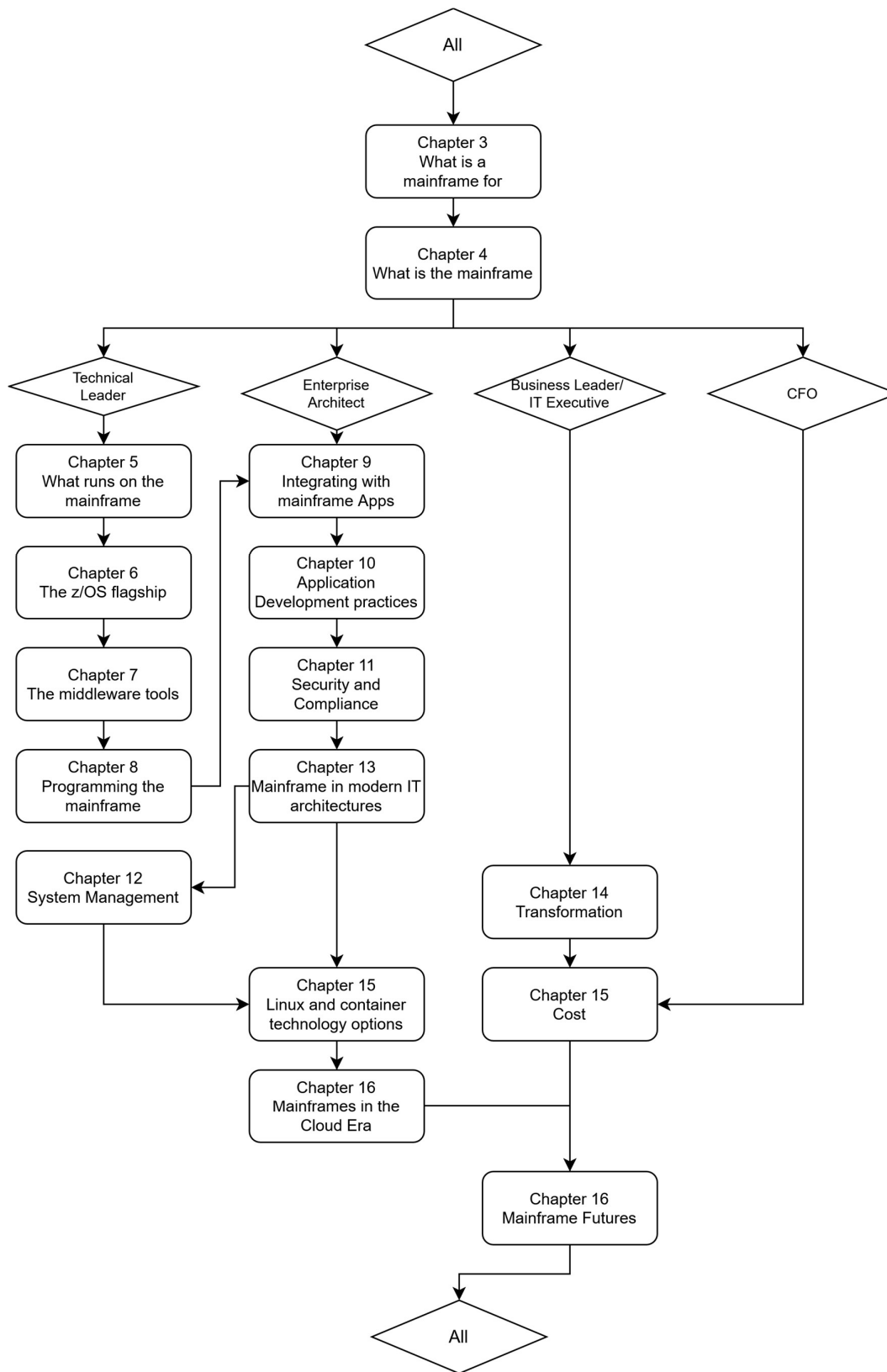


Figure 1 Reading guide by role

Chapter 3 The mainframe defined

To begin, let's define what a mainframe is. Following this definition, we will provide a brief historical overview of mainframes.

The mainframe: a definition

A mainframe is a large, central computer designed to run multiple computing tasks simultaneously in a stable and secure manner.

In this definition, I use the term “computer” to refer to all the hardware and software components necessary to run meaningful application software.

Several key aspects are specifically relevant in defining a mainframe.

Central. The mainframe's design goal is to provide a centralized function for many computing tasks. The mainframe shares computing resources, hardware, and software between applications. The other way around is that many applications use the same mainframe computer.

Many tasks at the same time. From the ground up, the mainframe operating system is designed to run many technical tasks and applications very efficiently.

Secure. Because many applications run on the same computing platform, the mainframe's operating system has sophisticated facilities to ensure that applications can not interfere with each other.

A very brief history

Mainframes date back to a time when computing equipment was costly, and a single central solution was the only way to run computing tasks efficiently.

The early users of the mainframe were primarily large organizations, including banks, insurance companies, government institutions, supermarkets, and numerous smaller organizations. These organizations have often utilized the mainframe since the 1960s or 1970s, and applications developed during that time are still in use today.

COBOL and PL/I are typical programming languages used to develop business applications for mainframes, although Java has also gained significant popularity, also on mainframes.

The mainframe platform supports an extensive ecosystem of cutting-edge technologies beyond traditional workloads. Organizations can use enterprise-grade application servers, sophisticated integration frameworks, advanced data analytics platforms, and modern artificial intelligence solutions, all optimized for the mainframe environment. The platform's specialized

hardware accelerators and software optimizations provide exceptional performance for computationally intensive workloads, including AI for large language models and inferencing. This convergence of established reliability with emerging technologies allows businesses to consolidate diverse workloads on a single platform while maintaining the security, availability, and transactional integrity that mainframes are renowned for delivering.

Mainframes are recognized for their unmatched ability to swiftly, reliably, and securely process and manage vast amounts of data. Their robustness ensures uninterrupted operation for critical applications, making them indispensable for industries such as banking and insurance. With seamless scalability, mainframes can handle growing workloads without compromising performance, providing a strong sense of security for large enterprises. They dominate in high-speed transaction processing, efficiently supporting thousands of applications and users simultaneously. Overall, mainframes are very good at managing large-scale data operations securely and efficiently, making them a cornerstone of many large enterprises.

Many companies have built mainframe computers in the past 70 years. Examples are ICL, Bull, Sperry, Tandem, Siemens, Unisys, and NEC. However, IBM has been by far the most successful mainframe manufacturer, and IBM mainframes have become synonymous with the term 'mainframe.' In this book, I will focus solely on the IBM mainframe.

Chapter 4 Mainframe hardware

In this chapter, I will discuss the main hardware concepts of IBM mainframes. I will not go into the tiniest detail, but this will be somewhat technical. I will compare the mainframe technology with more mainstream x86, Windows, and Unix technology to facilitate understanding. You will see there is often just a difference in terminology.

The box, a big box

The mainframe has a long history. Some hardware terminology dates back to the early days of computing and differs from today's usual usage. To understand mainframes, we need to discuss some jargon.

A box full of CPU and memory

A mainframe is a sizable, refrigerator-sized box with computing capacity. The box houses the computing units, the CPUs. These are not Intel x86 CPUs like on your Windows PC. Instead, a mainframe uses CPUs built following the processor architecture designed by IBM, called IBM z/Architecture.

In your PC, the various components, such as the CPU, memory, and other chips, are soldered onto a motherboard. Like your PC, you find a motherboard in the big mainframe box. The mainframe motherboard is called a drawer. The drawer is bigger than your PC's motherboard because it carries more components.

The mainframe's CPU and memory chips are manufactured together with more components in the drawer. A drawer can have several CPU chips. The z14 model, which I use as an example throughout the following sections, has six CPU chips per drawer.

Each CPU chip in the drawer has many processor cores, which are the actual CPUs. The number of processor cores varies per mainframe model. In the z14 mainframe model, there are 10 cores on a chip.

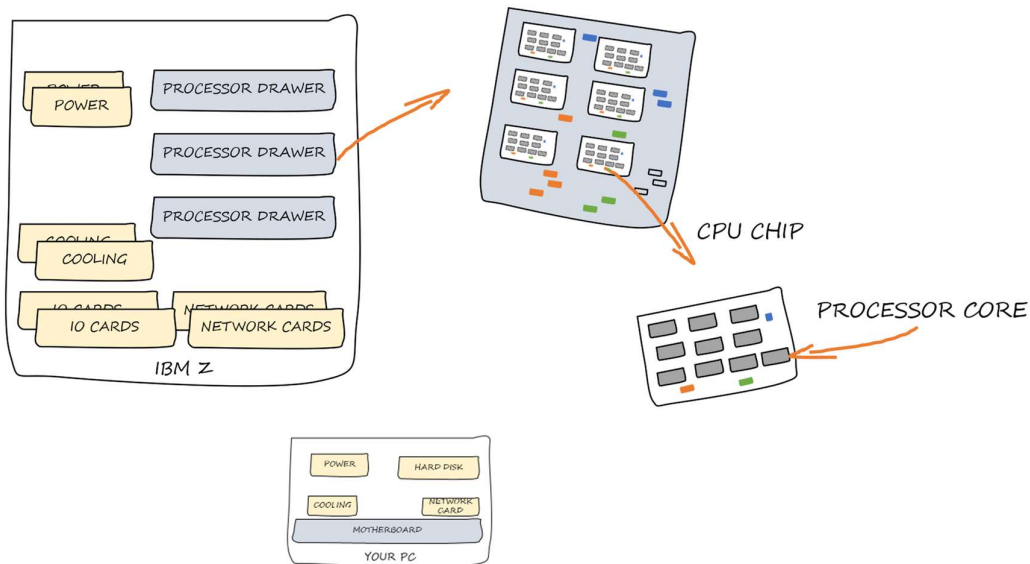


Figure 2 What's in a mainframe server

Finally, you can have multiple drawers in a mainframe box. A z14 mainframe model can have four drawers. All of this is illustrated in Figure 2.

Now, let's count. You can have up to 4 drawers, each with up to 6 CPU chips, each chip with 10 cores. This totals up to 240 processor cores in a mainframe box – the z14 model, to be precise. The mainframe uses a number of these 240 cores for internal processing. As a user, you can utilize up to 170 processor cores in a single mainframe box.

You also need memory. Each drawer on the z14 mainframe supports up to 8 TB of memory, for a total of 32 TB in your z14 mainframe.

A lot of computing power.

I am currently using the IBM z14 mainframe as an example. The latest model at the time of writing is the IBM z17, which features up to 4 processor drawers. Each drawer contains 8 processor chips, each housing 8 cores, delivering impressive computing power. The z17 supports a maximum of 64 terabytes (TB) of memory. That is a capacity equivalent to storing roughly 12 million high-quality digital photos or about 12,000 full-length high-definition movies.

What else is in the box?

In addition to the central computing elements, CPU, and memory, the mainframe server contains almost everything else needed: power supplies, network cards, cooling devices, I/O cards, and more.