



# Cisco IOS XR Fundamentals

By Mobeen Tahir, Mark Ghattas, Dawit Birhanu, Syed Natif Nawaz



**Cisco IOS XR Fundamentals** By Mobeen Tahir, Mark Ghattas, Dawit Birhanu, Syed Natif Nawaz

Cisco IOS XR Fundamentals is a systematic, authoritative guide to configuring routers with Cisco IOS® XR, the next-generation flagship Cisco® Internet operating system.

In this book, a team of Cisco experts brings together quick, authoritative, and example-rich reference information for all the commands most frequently used to configure and troubleshoot Cisco IOS XR-based routers in both service provider and enterprise environments.

The authors walk you through the details of the Cisco IOS XR architecture and explain commands in the new Cisco IOS XR CLI wherever required. They present concise explanations of service provider requirements and internetwork theory, backed by proven sample configurations for IOS XR services, MPLS, multicast, system management, system security, routing, and interfaces.

*Cisco IOS XR Fundamentals* is an indispensable resource for designing, implementing, troubleshooting, administering, or selling networks containing Cisco IOS XR–supported routers. This is the only Cisco IOS XR book that:

- Clearly explains how Cisco IOS XR meets the emerging requirements of both current and future networks
- Gives network professionals extensive information for simplifying migration and taking full advantage of Cisco IOS XR's new power
- Presents detailed, tested configuration examples that network professionals can apply in their own networks
- Walks through using new Cisco IOS XR features and the In-Service Software Upgrade (ISSU) process to minimize downtime and cost

Mobeen Tahir, CCIE® No. 12643 (R&S, SP), is a Cisco network consulting engineer with more than a decade of experience in designing and deploying service provider networks. He currently works for the WWSP practice team, which provides consulting services to Cisco NGN customers.

Mark Ghattas, CCIE No. 19706 (Service Provider), is a solution architect at Cisco and has been in the networking industry for more than 15 years. He

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Dawit Birhanu, CCIE No. 5602, is a technical leader at Cisco. He assists global service providers in deploying new NGN products and technologies. He specializes in IOS XR–based platforms, QoS, MPLS, and BGP.

Syed Natif Nawaz, CCIE No. 8825 (R&S, SP), has more than 10 years' experience in providing networking design, deployment, and escalation assistance to service provider customers. He is currently the IOS XE software development manager at Cisco, where he works on customer-focused software qualification, certification, and deployment; feature integration; release processes; and other software quality initiatives.

- Use Cisco IOS XR to deliver superior scalability, availability, security, and service flexibility
- Understand the Cisco IOS XR distributed, modular architecture
- Design, implement, and troubleshoot networks containing Cisco IOS XR–supported routers
- Configure Cisco IOS XR routing, including RIP, IS-IS, OSPF, and EIGRP
- Learn BGP implementation details specific to Cisco IOS XR and using RPL to influence policies
- Manage IP addresses and Cisco IOS XR services
- Secure Cisco IOS XR using standard and extended ACLs, prefix lists, and uRPF
- Master all facets of MPLS configuration, including LDP, L3VPN, and TE
- Configure PIM, IGMP, and static RP multicast
- Optimize networks using advanced Cisco IOS XR features, including secure domain routers
- Learn building blocks of Multishelf, and understand configurations and migration techniques

This book is part of the Cisco Press® Fundamentals Series. Books in this series introduce networking professionals to new networking technologies, covering network topologies, sample deployment concepts, protocols, and management techniques.

Category: Networking: Routing and Switching  
Covers: Cisco IOS XR

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# Cisco IOS XR Fundamentals

## Introduction

This book is intended to provide a reference to users who plan or have implemented Cisco IOS XR software in the network. *Cisco IOS XR Fundamentals* provides an overview of IOS XR operation system infrastructure and hardware architecture on the Carrier Routing System. The intention of this book is to provide general networking topics in IOS XR that service providers may implement in the core network. It is not feasible to cover every aspect of IOS XR; however, the key configurations have been explained that are typically deployed in core networks.

## Who Should Read This Book?

Readers who have a relatively strong working knowledge of Cisco IOS Software and routing protocols will benefit from the discussions and configuration examples presented.

## How This Book Is Organized

Although this book could be read cover to cover, it is designed to provide a configuration overview on Cisco IOS XR to support implementation configuration and features in IOS XR. Chapter 1 provides an overview of the evolution of operating systems and an understanding of the underlying QNX operating system. Chapters 2 through 12 are the core chapters and can be covered in order. If you do intend to read them all, the order in the book is an excellent sequence to use.

Chapters 1 through 12 cover the following topics:

- **Chapter 1, “Introducing Cisco IOS XR”:** This chapter discusses the evolution of network operating systems in service provider environments. It is important to understand the goals and requirements of service providers that influenced the goals of IOS XR.
- **Chapter 2, “Cisco IOS XR Infrastructure”:** This chapter discusses the interworkings of IOS XR. It helps you understand IOS XR microkernel architecture, process scheduling, interprocess communications, system database, and distributed services.
- **Chapter 3, “Installing Cisco IOS XR”:** This chapter discusses various procedures for installing IOS XR on the Carrier Routing System.
- **Chapter 4, “Configuration Management”:** This chapter provides a deeper insight into how IOS XR is different when configuring interfaces, out of band management, and features such as rollback and commit commands. Understanding these features will help you better manage the system.
- **Chapter 5, “Cisco IOS XR Monitoring and Operations”:** This chapter explores how monitoring works in IOS XR. As IOS XR operates as a real-time operating system, there are monitoring tools that provide deeper inspection of activities on the system.
- **Chapter 6, “Cisco IOS XR Security”:** This chapter examines inherent policies that provide a layer of security within the operating system. The importance of Local Packet Transport System (LPTS) is discussed.
- **Chapter 7, “Routing IGP”:** This chapter covers the basics of routing protocol configurations. It provides configuration examples to show how IGP features are configured in IOS XR.
- **Chapter 8, “Implementing BGP in Cisco IOS XR”:** This chapter introduces the IOS XR implementation of BGP. This chapter assumes that you have prior experience and knowledge of the BGP protocol and focuses on unique aspects of IOS XR BGP configuration. This chapter also provides details on Routing Policy Language as a vehicle for implementing BGP routing policies.

- **Chapter 9, “Cisco IOS XR MPLS Architecture”:** This chapter discusses Multiprotocol Label Switching (MPLS), an important technology for building converged network infrastructure and services. This chapter assumes that you are familiar with MPLS protocols and operations. This chapter discusses IOS XR MPLS architecture, features, implementation, and configuration. It covers LDP, Layer 3 VPN, VPWS, VPLS, and MPLS Traffic Engineering.
- **Chapter 10, “Cisco IOS XR Multicast”:** This chapter discusses when to use queuing and which queuing technique to use. This chapter also examines Weighted Fair Queuing (WFQ), Custom Queuing, and Priority Queuing and addresses the need for compression in today’s enterprise network.
- **Chapter 11, “Secure Domain Router”:** This chapter covers the concept of SDRs. It discusses the Distributed Route Processor (DRP) hardware needed to implement SDRs and provides configuration examples.
- **Chapter 12, “Understanding CRS-1 Multishelf”:** This chapter discusses the Cisco implementation of the CRS-1 multishelf system. The key components are discussed to understand the architecture and troubleshooting of a CRS-1 multishelf system. A fabric troubleshooting section is covered to support implementation and operation.

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