

**CCIE R&S Written Exam #350-001**  
**Blueprint with CertZone Tutorials**  
**1/25/05**

From the Cisco R&S Written Exam (350-001) Blueprint:

- I. General Networking Theory
  - A. OSI Models
  - B. General Routing Concepts
  - C. Standards
  - D. Protocol Mechanics
  - E. Commands
- II. Bridging and LAN Switching
  - A. Transparent
  - B. LAN Switching
  - C. MLS
  - D. Data Link Layer
  - E. Ethernet
  - F. Catalyst IOS Configuration Commands
- III. IP
  - A. Addressing
  - B. Services
  - C. Applications
  - D. Transport
  - E. IPv6
  - F. Network Management
- IV. IP Routing
  - A. OSPF
  - B. BGP
  - C. EIGRP
  - D. IS-IS
  - E. Route filtering and Policy Routing
  - F. DDR
  - G. RIPv2
  - H. The use of show and debug commands
- V. QoS
  - A. Traffic classification
  - B. Congestion management
  - C. Congestion avoidance
- VI. WAN
  - A. ISDN
  - B. Frame Relay
  - C. ATM
  - D. Physical Layer

- E. Leased Line Protocols
- VII. IP Multicast
  - A. IGMP/CGMP
  - B. Addressing
  - C. Distribution Trees
  - D. PIM-SM Mechanics
  - E. Rendezvous Points
  - F. RPF
- VIII. Security
  - A. Access Lists
  - B. LAN security
  - C. Device Security/Access
  - D. Spoofing
- IX. Enterprise Wireless Mobility
  - A. Standards
  - B. Hardware
  - C. SWAN
  - D. RF Troubleshooting
  - E. VoWLAN
  - F. Products

## I. **General Networking Theory**

### A. **OSI Models**

*OSI Reference Model, 2<sup>nd</sup> Edition*

*Physical Internetworking and Industry Standards for Networks, Physical Internetworking Overview*

*ISDN and Dial on Demand Routing, ISDN Architecture*

### B. **General Routing Concepts**

*IP Routing*

*Frame-Relay*

*Routing Information Protocol (RIP)*

*Enhanced Interior Gateway Routing Protocol (EIGRP)*

*ISIS Part I: Routing in Single Areas*

*ISIS Part II: Hierarchical Networks*

*OSPF in Single Areas: Learning the Protocol*

*OSPF Part 2: Using OSPF in Hierarchical Systems*

*Scalable Routing and Link State Review*

*Layer 2 Switching and Bridging*

*New Generation of Cisco Switching*

*Ethernet LAN Switching Part I*

*Multiprotocol Label Switching (MPLS)*

*ISDN and DDR, Dynamic or Static Routing?*

*ISDN and Dial on Demand Routing*

*Cisco High Availability Techniques*

*IPv4 and IPv6 Addressing and Services*  
*L3VPNs*  
*How to Study Virtual Private Networks*  
*Interior Redistribution, Routing Loops*  
*WAN Troubleshooting Guide, Loopback Testing*  
*Physical Internetworking and Industry Standards for Networks, Transparent Bridging*  
*Bridging, The IEEE / DEC Spanning Tree*  
*X.25: An Oldie but a Goodie, X.25 Switching and Tunneling*  
*The Other VPNs: It's Not All MPLS, Tunnels*  
*Troubleshooting Ethernet Networks, Tunneling and Frame Lengths*  
*The 3550 Switch, 802.10 (VLAN) Tunneling*

### **C. Standards**

*OSI Reference Model, 2<sup>nd</sup> Edition, Protocols and OSI Layers*  
*Physical Internetworking and Industry Standards for Networks*  
*Layer 1 and Layer 2 Ethernet*  
*Ethernet LAN Switching Part I*  
*Ethernet LAN Switching Part II*  
*Troubleshooting Ethernet Networks*  
*Layer 2 Switching and Bridging*  
*Layer 2 Switching – Virtual Local Area Networks*  
*New Generation of Cisco Switching*  
*The 3550 Switch*  
*Frame-Relay*  
*Scalable Routing and Link State Review*  
*IPv4 and IPv6 Addressing and Services*  
*Multiprotocol Label Switching (MPLS)*  
*Cisco High Availability Techniques*  
*ATM Part I: Basics*  
*Bridging, The IEEE / DEC Spanning Tree*  
*WAN Troubleshooting Guide, Cabling*  
*Routing Information Protocol (RIP), IP RIP Characteristics, Strengths, and Weaknesses*

### **D. Protocol Mechanics**

*OSI Reference Model, 2<sup>nd</sup> Edition, Protocols and OSI Layers*  
*X.25: An Oldie but a Goodie*  
*OSPF in Single Areas: Learning the Protocol*  
*Enhanced Interior Gateway Routing Protocol (EIGRP)*  
*Ethernet LAN Switching Part I*  
*Troubleshooting Ethernet Networks*  
*IPv4 and IPv6 Addressing and Services*  
*ISDN and Dial on Demand Routing*  
*Bridging*  
*WAN Troubleshooting Guide*  
*The Other VPNs: It's Not All MPLS*  
*Scalable Routing and Link State Review, Retransmission*

*New Generation of Cisco Switching, Database Manager*  
*ATM Part I: Basics, ATM Adaptation Layer (AAL)*  
*Routing Principles and IOS Implementation Considerations, IP Fragmentation*  
*QoS Part 2: Managing Performance and Other Means of IP QoS Control,*  
*Fragmentation*  
*IP Routing, EIGRP Metrics*  
*New Generation of Cisco Switching, Database Manager*

#### **E. Commands**

*Cisco Device Operations*  
*Basic Router Operation*  
*IP Multicast Fundamentals*  
*WAN Troubleshooting Guide*  
*The 3550 Switch, Housekeeping Commands*

## **II. Bridging and LAN Switching**

*Bridging*  
*Ethernet LAN Switching Part I*  
*Ethernet LAN Switching Part II*  
*New Generation of Cisco Switching*  
*Layer 2 Switching and Bridging*  
*Layer 2 Switching – Virtual Local Area Networks*  
*The 3550 Switch*

### **A. Transparent**

*Bridging*  
*Ethernet LAN Switching Part I*  
*New Generation of Cisco Switching*  
*Layer 2 Switching and Bridging*  
*Introduction to the Spanning Tree Protocol*  
*Cisco High Availability Techniques*  
*Physical Internetworking and Industry Standards for Networks, Transparent Bridging*  
*Layer 2 Switching – Virtual Local Area Networks, Spanning Tree Protocol and VLANs*  
*– Cisco's Solution*  
*Networking Without a Net, Roots*

### **B. LAN Switching**

*Ethernet LAN Switching Part I*  
*Ethernet LAN Switching Part II*  
*New Generation of Cisco Switching*  
*Layer 2 Switching – Virtual Local Area Networks*  
*The 3550 Switch*  
*Cisco High Availability Techniques*  
*Bridging*  
*Cisco Voice Systems*

*Topology and IP Addressing, Basic Mappings*  
*IPv4 and IPv6 Addressing and Services, Coming Together: VLANs, Secondaries, and Subinterfaces*

**C. [MLS \(Multilayer Switching\)](#)**

*Ethernet LAN Switching Part II, Multi-Layer What?*  
*Scalable Routing and Link State Review, Can You Say “Marketing-Speak”?*

**D. [Data Link Layer](#)**

*Physical Internetworking and Industry Standards for Networks, Overview of the Data Link Layer*  
*Ethernet LAN Switching Part I*  
*Layer 1 and Layer 2 Ethernet, The Mystery Two Bytes – Or Is It Four?*  
*Troubleshooting Ethernet Networks, Ethernet Media Access Control Layer*

**E. [Ethernet](#)**

*Ethernet LAN Switching Part I, Speeding Things Up*  
*Ethernet LAN Switching Part II*  
*Layer 1 and Layer 2 Ethernet*  
*Gigabit and Ten Gigabit Ethernet*  
*Troubleshooting Ethernet Networks*  
*Physical Internetworking and Industry Standards for Networks, LAN Specifications*  
*The 3550 Switch*  
*New Generation of Cisco Switching*  
*ATM Part 1: Basics, Gigabit Ethernet*

**F. [Catalyst IOS Configuration Commands](#)**

*New Generation of Cisco Switching*  
*Layer 2 Switching – Virtual Local Area Networks*  
*Layer 2 Switching and Bridging*  
*Ethernet LAN Switching Part II*  
*The 3550 Switch*  
*New Age Bridging & Switching*

**III. [IP](#)**

**A. [Addressing](#)**

*Topology and IP Addressing*  
*IPv4 and IPv6 Addressing and Services*  
*Routing Information Protocol (RIP)*  
*Address Resolution Protocol (ARP)*  
*Network Address Translation (NAT)*  
*Frame-Relay, Layer 2 to Layer 3 Mapping Solutions*  
*The 3550 Switch, Hot-Standby Router Protocol (HSRP)*  
*Cisco High Availability Techniques*

*ATM Part 1: Basics, Dynamic Address Resolution, Classical IP  
Building a Firewall: Three Cisco Offerings, IOS Security Features, IOS Security  
Feature – Network Address Translation  
Securing Communications, Part 2, Architecture*

## **B. Services**

*DNS and DHCP*

*Network Address Translation (NAT)*

*IPv4 and IPv6 Addressing and Services*

*New Generation of Cisco Switching, DHCP-related Security Features*

*Network Management, Use ICMP*

*OSPF Part2: Using OSPF in Hierarchical Systems, Special Considerations for Area  
0.0.0.0*

*Routing Principles and IOS Implementation Considerations, Destination Unreachable  
and Destination Administratively Prohibited*

*Access Lists: Tricks of the Trade, IP Extended Access Lists*

*Network Security, Extended IP Access Lists*

*Security on Cisco Routers*

*Building a Firewall: Three Cisco Offerings, Guidelines for Configuring a Firewall  
Authentication, Authorization, and Accounting Protocols (AAA), How AAA Improves  
the Scalability of Authentication*

*Networking Without a Net, Configuration*

## **C. Applications**

*Basic Router Operation*

*Layer 2 Switching and Bridging, Managing Configuration Information*

*IPv4 and IPv6 Addressing and Services, IP Helpers*

*Security on Cisco Routers*

*Network Security*

*Access Lists: Tricks of the Trade, IP Extended Access Lists*

*The 3550 Switch, Securing Telnet Access to the Switch*

*Building a Firewall: Three Cisco Offerings, IOS Security Features*

*Authentication, Authorization, and Accounting Protocols (AAA)*

*Network Management*

*QoS Part 2: Managing Performance and Other Means of IP QoS Control*

## **D. Transport**

*Basic Router Operation*

*Troubleshooting Ethernet Networks*

*Introduction to IT Security*

*The Other VPNs: It's Not All MPLS*

*Securing Communications, Part 2*

*Introduction to Telephony*

*Network Management*

*QoS Part 1: General Principles and Ingress Handling, Handling Incoming Traffic*

*QoS Part 2: Managing Performance and Other Means of IP QoS Control*

*Routing Principles and IOS Implementation Considerations, IP Fragmentation  
IPv4 and IPv6 Addressing and Services, Output Services  
ISDN and Dial on Demand Routing, PPP Multilink  
X.25: An Oldie but a Goodie, X.25 Addressing  
Routing Information Protocol (RIP), RIPv1  
ATM Part 1: Basics, ATM Adaptation Layer (AAL)  
Authentication, Authorization, and Accounting Protocols (AAA), Configuring Tacacs,  
Configuring Radius, Configuring Kerberos*

**E. IPv6**

*IPv4 and IPv6 Addressing and Services  
Troubleshooting Ethernet Networks, IPv6 and EtherTypes  
QoS Part 1: General Principles and Ingress Handling, Looking Forward to IPv6  
Cisco High Availability Techniques, IRDP  
Routing Information Protocol (RIP), RIP Next Generation  
The Other VPNs: It's Not All MPLS, IP-in-IP*

**F. Network Management**

*Network Management  
Switched WAN Technologies  
Ethernet LAN Switching Part II  
QoS Part 1: General Principles and Ingress Handling  
QoS Part 2: Managing Performance and Other Means of IP QoS Control  
Securing Communications, Part 2*

**IV. IP Routing**

**A. OSPF**

*OSPF in Single Areas: Learning the Protocol  
OSPF Part 2: Using OSPF in Hierarchical Systems  
Scalable Routing and Link State Review  
Interior Redistribution  
ISIS Part II: Hierarchical Networks  
Frame-Relay, Frame-relay and Link State Protocols  
ISDN and Dial on Demand Routing, OSPF and On-Demand Circuits  
Multiprotocol Label Switching(MPLS), Using OSPF as the IGP, Using OSPF as the  
IGP with Traffic Engineering*

**B. BGP**

*BGP Part 1 – The Problem, the Protocol, and Principles of Use  
BGP Part 2 – Basic Multihoming  
BGP Part 3 – Scalability in Larger ISPs  
How to Study Virtual Private Networks  
L3VPNs  
OSPF Part 2: Using OSPF in Hierarchical Systems, OSPF and Defaults*

**C. EIGRP**

*Enhanced Interior Gateway Routing Protocol (EIGRP)*

*Interior Redistribution*

*Frame-Relay, Frame-Relay and Distance Vector Protocols*

**D. IS-IS**

*ISIS Part I: Routing in Single Areas*

*ISIS Part II: Hierarchical Networks*

*Scalable Routing and Link State Review*

*Interior Redistribution*

*ISDN and Dial on Demand Routing*

*Frame-Relay, Frame-Relay and Link State Protocols*

*Multiprotocol Label Switching (MPLS), Configuring MPLS*

*L3VPNs, RFC 2547bis Basic Configuration, Cisco IOS L3VPN Configuration*

*Enhancements*

**E. Route filtering and Policy Management**

*Access Lists: Tricks of the Trade*

*Network Management*

*Network Security*

*Security on Cisco Routers*

*Bridging*

*Building a Firewall: Three Cisco Offerings*

*Interior Redistribution*

*L3VPNs*

*ISIS Part II: Hierarchical Networks*

*BGP Part 3 – Scalability in Larger ISPs, Actions in Route Maps*

*BGP Part 2 – Basic Multihoming*

*BGP Part 1 – The Problem, the Protocol, and Principles of Use, Routing Policies*

*QoS Part 1: General Principles and Ingress Handling, Handling Incoming Traffic*

*How to Study Virtual Private Networks, Policy Routing in L3VPNs*

**F. DDR**

*ISDN and Dial on Demand Routing*

*Cisco High Availability Techniques*

*ISDN and DDR, Dial-on-Demand Routing*

*WAN Troubleshooting Guide, The Show Interface Command, Troubleshooting ISDN*

*Scalable Routing and Link State Review, Demand Media*

*Frame-Relay, Frame-relay backup*

*New Generation of Cisco Switching, Switching Functions for High Availability*

**G. RIPv2**

*Routing Information Protocol (RIP)*

*Interior Redistribution*

*Scalable Routing and Link State Review*



**Enhanced Interior Gateway Routing Protocol (EIGRP)**  
**Routing Principles and IOS Implementation Considerations, The RIB installation task,**  
*Default Whatevers, Load Sharing*  
**IP Routing, RIPv2**  
**Frame-Relay, Frame-relay and Distance Vector Protocols**  
**OSPF Part 2: Using OSPF in Hierarchical Systems, Hierarchical versus Mutual**  
*Importing and Exporting, Aggregating Externals*  
**L3VPNs, CE-PE Routing Information Exchange**

## **H. The use of show and debug commands**

**Basic Router Operation**  
**IP Multicast Fundamentals**  
**WAN Troubleshooting Guide**  
**The 3550 Switch, Housekeeping Commands**

## **V. QoS**

### **A. Traffic classification**

**QoS Part 1: General Principles and Ingress Handling**  
**QoS Part 2: Managing Performance and Other Means of IP QoS Control**  
**Multiprotocol Label Switching (MPLS)**  
**ATM Part 1: Basics**  
**Switched WAN Technologies**  
**The 3550 Switch, Quality of Service (QoS)**  
**New Generation of Cisco Switching**  
**Cisco High Availability Techniques**

### **B. Congestion Management**

**QoS Part 1: General Principles and Ingress Handling**  
**QoS Part 2: Managing Performance and Other Means of IP QoS Control**  
**ATM Part 1: Basics**  
**Switched WAN Technologies**  
**The 3550 Switch, Quality of Service (QoS)**  
**New Generation of Cisco Switching**

### **C. Congestion Avoidance**

**QoS Part 1: General Principles and Ingress Handling**  
**QoS Part 2: Managing Performance and Other Means of IP QoS Control**  
**ATM Part 1: Basics**  
**Switched WAN Technologies**  
**The 3550 Switch, Quality of Service (QoS)**  
**New Generation of Cisco Switching**

## **VI. WAN**

### **A. ISDN**

*ISDN and Dial on Demand Routing*

*ISDN and DDR*

*WAN Protocols*

*Voice over X*

*WAN Troubleshooting Guide, Integrated Services Digital Network (ISDN)*

*Basic Router Operation, Overview of Cisco Router Hardware and Software*

### **B. Frame Relay**

*Frame-Relay*

*IPv4 and IPv6 Addressing and Services*

*WAN Protocols, Frame Relay on Cisco Routers*

*WAN Troubleshooting Guide, Frame Relay*

*Switched WAN Technologies, Current WAN Technologies*

*Address Resolution Protocol (ARP), InARP*

*Voice over X, Configuring Voice over Frame Relay*

*ISIS Part I: Routing in Single Areas, NBMA Networks*

*QoS Part 1: General Principles and Ingress Handling, Frame Relay Traffic Shaping (FRTS)*

*QoS Part 2: Managing Performance and Other Means of IP QoS Control, WFQ and Frame Relay*

*ISDN and Dial on Demand Routing, Dial Backup*

*L3VPNs, VPN Topology Support*

### **C. ATM**

*ATM Part 1: Basics*

*ATM Part II: Implementations*

*Multiprotocol Label Switching (MPLS)*

*L3VPNs*

*Introduction to Telephony*

*Voice over X, Configuring Voice over ATM*

*Switched WAN Technologies, ATM Implementation*

### **D. Physical Layer**

*Switched WAN Technologies*

*IPv4 and IPv6 Addressing and Services*

*Cisco High Availability Techniques*

*WAN Troubleshooting Guide*

*Introduction to Telephony*

*ISIS Part I: Routing in Single Areas*

*ISIS Part II: Hierarchical Networks, The Tutorial Network*

*ATM Part 1: Basics*

*Scalable Routing and Link State Review, Database Initialization and Synchronization*

*OSPF in Single Areas: Learning the Protocol, OSPF Protocol Mechanisms*

*Routing Information Protocol (RIP), RIP Routing Operation*

*BGP Part1 – The Problem, the Protocol, and Principles of Use, The BGP Stack*

*BGP Part3 – Scalability in Larger ISPs, Synchronization*

*Physical Internetworking and Industry Standards for Networks, WAN Specifications*

*Enhanced Interior Gateway Routing Protocol (EIGRP), EIGRP Metrics*

*New Generation of Cisco Switching, SONET and POS*

*Securing Communications, Part 2, Multiplexed Switched Circuits*

*Voice over X, Digital Ports*

**E. Leased Line Protocols**

*WAN Protocols*

*WAN Troubleshooting Guide*

*ISDN and Dial on Demand Routing*

*ISDN and DDR*

*Introduction to IT Security*

*Basic Router Operation, Auxiliary Line Password*

*Physical Internetworking and Industry Standards for Networks, HDLC*

*Cisco High Availability Techniques, Multilink PPP and Multichassis Multilink*

*Securing Communications, Part 2, Tunnels and VPN Implementation*

*Authentication, Authorization, and Accounting Protocols (AAA)*

*The Other VPNs: It's Not All MPLS, Technologies*

**VII. IP Multicast**

*IP Multicast Fundamentals*

*Ethernet LAN Switching Part 1*

*IPv4 and IPv6 Addressing and Services*

**A. IGMP/CGMP (Internet Group Management Protocol/ Cisco Group Management Protocol)**

*IP Multicast Fundamentals*

*IPv4 and IPv6 Addressing and Services, Multicast Services*

*Layer 1 and Layer 2 Ethernet, MAC Addressing*

**B. Addressing**

*IP Multicast Fundamentals, Multicast addressing*

*Ethernet LAN Switching Part 1, Addressing*

*IPv4 and IPv6 Addressing and Services, Multicast Services*

**C. Distribution Trees**

*IP Multicast Fundamentals, Multicast Distribution Trees*

- D. **PIM-SM Mechanics**  
*IP Multicast Fundamentals, PIM*
- E. **Rendezvous Points**  
*IP Multicast Fundamentals*
- F. **RPF**  
*IP Multicast Fundamentals*  
*Security on Cisco Routers*  
*Cisco High Availability Techniques*

## VIII. Security

- A. **Access Lists**  
*Security on Cisco Routers*  
*Access Lists: Tricks of the Trade, Access Control Lists and Access Lists*  
*Network Security, Access Lists*  
*Bridging, Access Lists for Non-routable Traffic*  
*Building a Firewall: Three Cisco Offerings, IOS Security Feature – Dynamic ACLs*  
*Network Management, Manage Traffic on a Single System*  
*QoS Part 1: General Principles and Ingress Handling, Handling Incoming Traffic*  
*L3VPNs*  
*How to Study Virtual Private Networks, Policy Routing in L3VPNs*  
*Interior Redistribution*  
*ISIS Part 2: Hierarchical Networks*  
*BGP Part 1 – The Problem, the Protocol, and Principles of Use, Routing Policies*  
*BGP Part 2 – Basic Multihoming*  
*BGP Part 3 – Scalability in Larger ISPs, Actions in Route Maps*
- B. **LAN security**  
*Security on Cisco Routers*  
*Building a Firewall: Three Cisco Offerings*  
*Authentication, Authorization, and Accounting Protocols (AAA)*  
*How to Study Virtual Private Networks, Private VLAN*  
*The 3550 Switch*  
*Network Security, Access Lists*  
*Networking Without a Net, Access Control Lists (ACLs) and Filtering*
- C. **Device Security/Access**  
*Security on Cisco Routers*  
*Building a Firewall: Three Cisco Offerings*  
*The 3550 Switch*
- D. **Spoofing**  
*Security on Cisco Routers*

## *Securing Communications, Part 2*

### **IX. Enterprise Wireless Mobility**

#### **A. Standards**

*How to Implement Wireless Networks  
Networking Without a Net*

#### **B. Hardware**

*How to Implement Wireless Networks  
Networking Without a Net*

#### **C. SWAN**

#### **D. RF Troubleshooting**

*How to Implement Wireless Networks  
Networking Without a Net*

#### **E. VoWLAN**

#### **F. Products**

*How to Implement Wireless Networks  
Networking Without a Net  
Cisco Voice Systems*