

## **BGP-642-661**

### **I. BGP Overview**

#### **Introduction to BGP**

- Given a network scenario, identify appropriate BGP usage and its limitations

#### **BGP Session Establishment**

- Given a typical BGP network scenario, describe the concept of BGP neighbors and the neighbor session establishment procedures

#### **BGP Route Processing**

- Given a diagram of an operational BGP network, describe interdomain route processing, route propagation and BGP path selection

#### **Basic BGP Configuration**

- Given a network consisting of multiple domains, successfully configure BGP

#### **Monitoring and Troubleshooting BGP**

- Given a configured BGP network, verify proper operation and perform the steps necessary to correct basic BGP configuration errors

### **II. Route Selection Using Policy Controls**

#### **Multi-Homed BGP Networks**

- Given a customer scenario where connections to multiple ISPs must be supported, describe the need for influencing BGP route selection

#### **AS-Path Filters**

- Given a customer scenario where connections to multiple ISPs must be supported, successfully configure BGP to influence route selection using AS path filters

#### **Prefix-List Filters**

- Given a customer scenario where connections to multiple ISPs must be supported, successfully configure BGP to influence route selection using prefix-list filters

#### **Outbound Route Filtering**

- Given an operational BGP network, use outbound route filtering to minimize the impact of BGP routing updates on router resources

#### **Route-Maps as BGP Filters**

- Given a typical BGP network, correctly configure BGP to influence route selection using route maps

#### **Implementing Changes in BGP Policy**

- Given a typical BGP network, configure the route-refresh feature to minimize the impact of expediting BGP policy updates

### **III. Route Selection Using Attributes**

#### **BGP Path Attributes**

- List BGP path attributes and functionality of each attribute Influencing BGP Route Selection with Weights
- Given a customer scenario where multiple connections must be supported, successfully configure BGP to influence route selection using the weight attribute

#### **BGP Local Preference**

- Given a customer scenario where multiple connections must be supported, successfully configure BGP to influence route selection using the local preference attribute

## **BGP Multi-Exit-Discriminator (MED)**

- Given a customer scenario where multiple connections must be supported, successfully configure BGP to influence route selection using the Multi-Exit-Discriminator (MED) attribute

## **BGP Communities**

- Given a customer scenario where multiple connections must be supported, successfully configure BGP to influence route selection using BGP community attributes

## **IV. Customer-to-Provider Connectivity with BGP Customer Connectivity Requirements**

- Describe the requirements to connect customer networks to the Internet in a service provider environment

## **Static Routing Toward the Customer**

- Given a service provider network, implement customer connectivity using static routing

## **BGP Customer Multi-Homed to a Single Service Provider**

- Given a customer scenario where multiple connections to a single ISP must be supported, implement customer connectivity with BGP

## **BGP Customer Multi-Homed to Multiple Service Providers**

- Given a customer scenario where connections to multiple ISPs must be supported, implement customer connectivity with BGP

## **V. BGP Transit Autonomous System Transit Autonomous System Functions**

- Describe the function of a transit autonomous system and the need for IBGP, EBGP and EBGP Interaction in a Transit AS
- Given a transit autonomous system, describe the interaction between EBGP and IBGP in relation to relevant BGP attributes

## **Packet Forwarding in Transit Autonomous Systems**

- Describe the function of an IGP in forwarding packets through an autonomous system

## **Configuring a Transit Autonomous System**

- Given a BGP network scenario, successfully configure an autonomous system to act as a transit backbone

## **Monitoring and Troubleshooting IBGP in Transit AS**

- Given a configured BGP transit network, verify proper operation and perform the steps necessary to correct basic IBGP configuration errors

## **VI. BGP Route Reflectors Introduction to Route Reflectors**

- Describe the function and operation of route reflectors in a BGP environment

## **Network Design with Route Reflectors**

- Based upon established route reflector design rules, describe the concept of hierarchical route reflectors and their requirements

## **Configuring and Monitoring Route Reflectors**

- Given an existing IBGP network, configure and verify proper operation of route reflectors to modify IBGP split-horizon rules

## **VII. Advanced BGP Configuration Limiting the Number of Prefixes Received from a BGP Neighbor**

- Given a typical BGP network, successfully configure BGP to limit the number of prefixes received from a neighbor

### **AS-Path Prepending**

- Given a typical service provider network with connections to multiple autonomous systems, use AS-Path prepending to influence the return path selected by the neighboring autonomous systems

### **BGP Peer Group**

- Given a typical BGP network, use BGP peer groups to share common configuration parameters between multiple BGP peers

### **BGP Route Flap Dampening**

- Given a properly configured BGP network, use route flap dampening to minimize the impact of unstable routes

## **VIII. Scaling IGP and BGP in Service Provider Networks**

### **Common Routing Issues in Service Provider Networks**

- Describe common routing concerns of service provider networks

### **Optical Networking Designs**

- Describe the scalability issues of using OSPF and IS-IS as interior gateway protocols in a service provider network and list solutions for each

### **Scaling BGP in Service Provider Networks**

- Describe common scalability issues when using BGP in a service provider network and list solutions for each

## **MPLS-642-611**

### **MPLS Fundamentals**

- Explain basic core MPLS technology and concepts
- Explain the function of MPLS Labels and Label Stack
- Identify MPLS Applications

### **MPLS Operation**

- Describe the characteristics and behaviors of Label Distribution in Frame-mode MPLS
- Explain Convergence in Frame-mode MPLS
- Describe the characteristics and behaviors of Label Distribution over LC-ATM Interfaces and VC Merge
- Describe the features of MPLS Label Allocation, Distribution, and Retention Modes
- Explain the process of LDP Neighbor Discovery

### **Frame-Mode/Cell-Mode MPLS Implementation, Configuration and Troubleshooting**

- Identify the functions of CEF Switching
- Explain and configure Frame-mode MPLS on Cisco IOS platforms
- Monitor MPLS on Cisco IOS platforms - Frame-mode interfaces
- Troubleshoot Frame-Mode MPLS configurations on Cisco IOS Platforms
- Explain and configure Label-Controlled ATM MPLS
- Explain and configure LC-ATM MPLS over ATM Virtual Path
- Monitor LC-ATM MPLS on Cisco IOS platforms

### **MPLS Virtual Private Networks Technology**

- Describe the characteristics and functions of Virtual Private Networks
- Describe Overlay and Peer-to-Peer VPNs
- Explain Major VPN Categorization

- Describe MPLS VPN Architecture
- Describe the MPLS VPN Routing Model
- Explain the process of MPLS VPN Packet Forwarding

## **MPLS VPN Implementation, Configuration and Troubleshooting**

- Explain MPLS VPN Mechanisms supported on Cisco Platforms
- Configure VRF tables
- Configure MP-BGP Session between PE routers
- Configure Small Scale Routing Protocols
- Monitor MPLS VPN Operation
- Configure OSPF as the Routing Protocol
- Configure BGP as the Routing Protocol
- Troubleshoot basic MPLS VPN configuration errors

## **Complex MPLS VPNs**

- Describe the advanced VRF Import/Export Features
- Explain the characteristics of Overlapping VPNs
- Explain the features of Central Services VPNs
- Describe Managed CE Router Service

## **Internet Access from a MPLS VPN**

- Explain VPN Internet Access Topologies
- Describe VPN Internet Access Implementation Methods
- Describe the methods to Separate Internet Access from VPN Service
- Internet Access Backbone as a Separate VPN

## **QOS-642-642**

### **IP QoS Fundamentals**

- Given a description of a converged network, identify problems that could lead to poor quality of service and explain how the problems might be resolved
- Define the term Quality of Service (QoS) and identify and explain the key steps to implementing QoS on a converged network

### **IP QoS Components**

- List and explain the models for providing Quality of Service on a network
- Explain the purpose and function of the DiffServ model
- Describe the basic format of and explain the purpose of the DSCP field in the IP header
- Define and explain the different per hop behaviors used in DSCP
- Explain the interoperability between DSCP-based and IP-precedence-based devices in a network
- Given a list of QoS actions, correctly match the QoS actions to mechanisms for implementing QoS and identify where in a network the different QoS mechanisms are commonly used

### **Modular QoS CLI and Auto-QoS**

- Given a network requiring QoS, explain how to implement a QoS policy using MQC
- Explain how AutoQoS is used to implement QoS policy

### **Classification and Marking**

- Explain how link layer and network layer markings are used to define service classes and the different applications represented by each of these service classes
- Given a network and a description of QoS issues, use MQC CLI commands to classify packets
- Given a network and a description of QoS issues, use class-based marking to assign packets to a specific service class
- Describe the function of Network Based Application Recognition
- Describe the purpose of pre-classification to support QoS in various VPN (IPSEC, GRE, L2TP) configurations

- Describe QoS trust boundaries and their significance in LAN based classification and marking
- Identify the different classification and marking options available on Cisco L2 and L3 switching platforms

## Congestion Management Methods

- List and explain the different queuing algorithms
- Explain the components of hardware and software queuing systems on Cisco routers and how they are effected by tuning and congestion
- Describe the benefits and drawbacks of using WFQ to implement QoS
- Explain the purpose and features of Class-Based WFQ (CBWFQ)
- Explain the purpose and features of Low Latency Queuing (LLQ)
- Identify the Cisco IOS commands required to configure and monitor LLQ on a Cisco router
- Describe and explain the different queuing capabilities available on the Cisco Catalyst 2950 Switch

## Congestion Avoidance Methods

- Describe the drawbacks tail drop as a congestion control mechanism
- Describe the elements of a RED traffic profile
- Describe Weighted Random Early Detection and how it can be used to prevent congestion
- Identify the Cisco IOS commands required to configure and monitor DSCP-based CB-WRED
- Explain how ECN interacts with WRED in Cisco IOS

## Traffic Policing and Shaping

- Describe the purpose of traffic conditioning using traffic policing and traffic shaping and differentiate between the features of each
- Explain how network devices measure traffic rates using single rate or dual rate, single or dual token bucket mathematical models
- Identify the Cisco IOS commands required to configure and monitor single rate and dual rate CB-Policing
- Identify the Cisco IOS commands required to configure and monitor percentage based CB-Policing
- Explain how the two rate limits, average rate and peak rate, can be used to rate limit traffic
- Identify the Cisco IOS commands required to configure and monitor CB-Shaping
- Identify the Cisco IOS commands required to configure and monitor Frame Relay adaptive CB-Shaping on Frame Relay interfaces

## Link Efficiency Mechanisms

- Explain the various link efficiency mechanisms and their function
- Identify the Cisco IOS commands required to configure and monitor CB header compression
- Given a list of link speeds and a specific delay requirement, determine the proper fragment size to use at each link speed and identify the typical delay requirement for VoIP packets
- Identify the Cisco IOS commands required to configure and monitor Multilink PPP with Interleaving
- Identify the Cisco IOS commands required to configure and monitor FRF.12

## QoS Best Practices

- Explain the QoS requirements of the different application types
- List typical enterprise traffic classes then identify the delay, jitter, packet loss and bandwidth requirements of each traffic class
- Explain the best practice QoS implementations and configurations within the campus LAN
- Explain the best practice QoS implementations and configurations on the WAN customer edge (CE) and provider edge (PE) routers

## Route - 642-902

### Implement an EIGRP based solution, given a network design and a set of requirements

- Determine network resources needed for implementing EIGRP on a network
- Create an EIGRP implementation plan

- Create an EIGRP verification plan
- Configure EIGRP routing
- Verify EIGRP solution was implemented properly using show and debug commands
- Document results of EIGRP implementation and verification

### **Implement a multi-area OSPF Network, given a network design and a set of requirements**

- Determine network resources needed for implementing OSPF on a network
- Create an OSPF implementation plan
- Create an OSPF verification plan
- Configure OSPF routing
- Verify OSPF solution was implemented properly using show and debug commands
- Document results of OSPF implementation and verification plan

### **Implement an eBGP based solution, given a network design and a set of requirements**

- Determine network resources needed for implementing eBGP on a network
- Create an eBGP implementation plan
- Create an eBGP verification plan
- Configure eBGP routing
- Verify eBGP solution was implemented properly using show and debug commands
- Document results of eBGP implementation and verification plan

### **Implement an IPv6 based solution, given a network design and a set of requirements**

- Determine network resources needed for implementing IPv6 on a network
- Create an IPv6 implementation plan
- Create an IPv6 verification plan
- Configure IPv6 routing
- Configure IPv6 interoperation with IPv4
- Verify IPv6 solution was implemented properly using show and debug commands
- Document results of IPv6 implementation and verification plan

### **Implement an IPv4 or IPv6 based redistribution solution, given a network design and a set of requirements**

- Create a redistribution implementation plan based upon the results of the redistribution analysis
- Create a redistribution verification plan
- Configure a redistribution solution
- Verify that a redistribution was implemented
- Document results of a redistribution implementation and verification plan
- Identify the differences between implementing an IPv4 and IPv6 redistribution solution

### **Implement Layer 3 Path Control Solution**

- Create a Layer 3 path control implementation plan based upon the results of the redistribution analysis
- Create a Layer 3 path control verification plan
- Configure Layer 3 path control
- Verify that a Layer 3 path control was implemented
- Document results of a Layer 3 path control implementation and verification plan
- Implement basic teleworker and branch services
- Describe broadband technologies
- Configure basic broadband connections
- Describe basic VPN technologies
- Configure GRE
- Describe branch access technologies