Configuring BGP of Cisco Routers v4.0 (BGP)

Course Summary

Description

This course provides students with in-depth knowledge of Border Gateway Protocol (BGP), the routing protocol that is one of the foundations of the Internet and New World technologies such as Multiprotocol Label Switching (MPLS). This curriculum covers the theory of BGP, configuration of BGP on Cisco IOS routers, detailed troubleshooting information and hands-on exercises that provide learners with the skills that they need to configure and troubleshoot BGP networks in customer environments. Different service solutions in the curriculum cover BGP network design issues and usage rules for various BGP features, preparing learners to design and implement efficient, optimal and trouble free BGP networks.

Objectives
By the end of this course, participants will be able to:

- Describe how to configure, monitor, and troubleshoot basic BGP to enable interdomain routing in a network scenario with multiple domains
- Describe how to use BGP policy controls to influence the BGP route selection process in a network scenario in which you must support connections to multiple ISPs
- Describe how to use BGP attributes to influence the route selection process in a network scenario where you must support multiple connections
- Describe how to successfully connect the customer network to the Internet in a network scenario in which multiple connections must be implemented

- Describe how to configure the service provider network to behave as a transit AS in a typical implementation with multiple BGP connections to other autonomous systems
- Enable route reflection as possible solution to BGP scaling issues in a typical service provider network with multiple BGP connections to other autonomous systems
- Describe the available BGP tools and features to optimize the scalability of the BGP routing protocol in a typical BGP network

Topics

- BGP Overview
- BGP Transit Autonomous Systems
- Route Selection Using Policy Controls
- Route Selection Using Attributes

- Customer-to-Provider Connectivity with BGP
- Scaling Service Provider Networks
- Optimizing BGP Scalability

Audience

- This course is intended primarily for network administrators, network engineers, network managers and systems engineers who would like to implement BGP

- This course is intended for network designers and project managers. The course is also recommended to all individuals preparing for BGP exam

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Course Summary (con't)

Prerequisites

To fully benefit from this course, students should have the following prerequisite skills and knowledge:
- Intermediate to advanced knowledge of Cisco IOS Software configuration
- Configuring and troubleshooting RIP, EIGRP, OSPF and IS-IS
- Skills and knowledge equivalent to those learned in:
  - Interconnecting Cisco Networking Devices v2.0, Part 1 (ICND1 v2.0) and Part 2 (ICND2 v2.0) or
  - Interconnecting Cisco Networking Devices: Accelerated Version 2.0 (CCNAX v2.0)
  - Implementing Cisco IP Routing (ROUTE v2.0)
  - Building Cisco Service Provider Next-Generation Networks Part 1 (SPNGN1) v1.2
  - Building Cisco Service Provider Next-Generation Networks Part 2 (SPNGN2) v1.2

Duration

Five days

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Course Outline

I. BGP Overview
   A. Introducing BGP
      1. Inter-domain Routing
      2. Why External Routing Protocols?
      3. BGP Characteristics
      4. BGP Development Considerations
      5. Single-Homed Customers
      6. Multihomed Customers
      7. Transit Autonomous Systems
      8. BGP Limitations
      9. Summary
   B. Understanding BGP Path Attributes
      1. BGP Path Attributes
      2. Well-Known BGP Attributes
      3. Optional BGP Attributes
      4. AS-Path Attribute
      5. Next-Hop Attribute
      6. Summary
   C. Establishing BGP Sessions
      1. BGP Neighbor Discovery
      2. Establishing a BGP Session
      3. BGP Keepalives
      4. MD5 Authentication
      5. Summary
   D. Processing BGP Routes
      1. Receiving Routing Updates
      2. Building BGP Table
      3. BGP Route Selection Criteria
      4. BGP Route Propagation
      5. Building IP Routing Table
      6. Advertising Local Networks
      7. Automatic Summarization
      8. Summary
   E. Configuring Basic BGP
      1. BGP Routing Process
      2. Configuring External Neighbors
      3. Announcing Networks in BGP
      4. Redistributing Routes into BGP
      5. BGP Conditional Route Injection
      6. BGP Support for TTL Security Check
      7. Multihomed Customer Problem
      8. Summary
   F. Monitoring and Troubleshooting BGP
      1. Monitoring Overall BGP Routing
      2. Monitoring BGP Neighbors
      3. Monitoring BGP Table
      4. Debugging BGP
      5. BGP Session Startup Problems
      6. BGP Neighbor Not Reachable
      7. BGP Neighbor Not Configured
      8. BGP AS Number Mismatch
      9. Summary
   G. Lesson 7: Module Summary
   H. Lesson 8: Module Self-Check

II. BGP Transit Autonomous Systems
   A. Working with Transit AS
      1. Transit AS Tasks
      2. External Route Propagation
      3. Internal Route Propagation
      4. Packet Forwarding in AS
      5. Core Router IBGP Requirements in Transit AS
      6. Summary
   B. Interacting with IBGP and EBGP in Transit AS
      1. AS-Path Processing in IBGP
      2. Multipath Load Sharing in BGP
      3. BGP Split Horizon
      4. IBGP Full Mesh
      5. IBGP Neighbors
      6. IBGP Next-Hop Processing
      7. Transit Network Using Edge Routers as Next Hops Example
      8. Differences Between EBGP and IBGP Sessions
      9. Scalability Limitations of IBGP-Based Transit Backbones
     10. Summary
   C. Forwarding Packets in Transit AS
      1. Packet Forwarding in Transit AS
      2. Recursive Lookup in Cisco IOS Software
      3. Routing Protocols in Transit AS
      4. BGP and IGP Interaction
      5. Problems with BGP and IGP Interaction
      6. Summary
   D. Monitoring and Troubleshooting IBGP in Transit AS
      1. Monitoring IBGP
      2. Common IBGP Problems
      3. Troubleshooting IBGP Session Startup Issues
      4. Troubleshooting IBGP Route Selection Issues
      5. Troubleshooting IBGP Synchronization Issues
      6. Summary
   E. Module Summary
   F. Module Self-Check

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Course Outline (con't)

III. Route Selection Using Policy Controls
- A. Using Multihomed BGP Networks
  1. Business Requirements for Multihomed BGP Networks
  2. Technical Requirements for Multihomed BGP Networks
  3. BGP Route Selection without BGP Policies
  4. Multihomed Customer Routing Policies
  5. Influencing BGP Route Selection
  6. Transit Traffic Issue
  7. Routing Update Reliability Issue
  8. Return Traffic Issue
  9. Summary
- B. Employing AS Path Filters
  1. AS Path Filtering Scenarios
  2. AS Path Regular Expressions
  3. String Matching
  4. Applying AS Path Filters
  5. Configuring BGP AS Path Filters
  6. Monitoring AS Path Filters
  7. Summary
- C. Filtering with Prefix Lists
  1. Requirements for Prefix-Based Filters
  2. Prefix Lists vs. IP Access Lists
  3. Configuring Prefix Lists
  4. BGP Filters Implementation
  5. Implementing Prefix Lists in the BGP Process
  6. Modifying Prefix Lists
  7. Monitoring Prefix Lists
  8. Summary
- D. Using Outbound Route Filtering
  1. Outbound Route Filtering
  2. Inbound vs. Outbound Filtering Example
  3. BGP Prefix-Based Outbound Route Filtering
  4. Outbound Route Filter Message
  5. Configuring Outbound Route Filtering
  6. Using Outbound Route Filtering
  7. Summary
- E. Applying Route Maps as BGP Filters
  1. Route Map Overview
  2. BGP Route-Map Policy List Support
  3. BGP Route Map Continue
  4. Prefix List Use in Route Maps
  5. BGP Filters
  6. Using Route Maps as BGP Filters
  7. Summary

- F. Implementing Changes in BGP Policy
  1. Traditional Filtering Limitations
  2. BGP Soft Reset Enhancement
  3. Route Refresh
  4. Configuring Route Refresh
  5. Monitoring Route Refresh
  6. Summary
- G. Lesson 7: Module Summary
- H. Lesson 8: Module Self-Check

IV. Route Selection Using Attributes
- A. Influencing BGP Route Selection with Weights
  1. BGP Route Selection Criteria
  2. Influencing BGP Route Selection
  3. Configuring Per-Neighbor Weights
  4. Changing Weights with Route Maps
  5. BGP Route Selection and Filtering Tools Summary
  6. Summary
- B. Setting BGP Local Preference
  1. Consistent Route Selection Within the AS
  2. BGP Local Preference
  3. Configuring Default Local Preference
  4. Monitoring Local Preference
  5. Configuring Local Preference with Route Maps
  6. Summary
- C. Using AS Path Prepending
  1. Return Path Selection in a Multihomed AS
  2. AS Path Prepending
  3. AS Path Prepending Design Considerations
  4. BGP Hide Local-Autonomous System
  5. Summary
- D. Understanding BGP Multi-Exit Discriminators
  1. Selecting the Proper Return Path
  2. MED Propagation in a BGP Network
  3. Changing MED
  4. Troubleshooting the MED
  5. Advanced MED Configuration
  6. Summary
- E. Addressing BGP Communities
  1. Selecting the Proper Return Path
  2. BGP Communities Overview
  3. Using Communities
  4. Configuring BGP Communities
  5. BGP Named Community Lists
  6. BGP Cost Community

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VII. Optimizing BGP Scalability
- A. Improving BGP Convergence
  1. BGP Convergence
  2. BGP Processes
  3. CPU Effects of BGP Processes
  4. Improving BGP Convergence
  5. PMTU Discovery
  6. Increasing Input Queue Depth
  7. BGP Prefix Independent Convergence
  8. Bidirectional Forwarding Detection for BGP
  9. BGP Nonstop Forwarding Awareness
  10. BGP Scan Time
  11. BGP Advertisement Interval
  12. BGP Keepalive and Hold-Down Timers
  13. Summary
- B. Limiting the Number of Prefixes Received from a BGP Neighbor
  1. Objective: Configure BGP to limit the number of prefixes that are received from a neighbor
  2. BGP Route Limiting
  3. Configuring the BGP Route Limiting
  4. Summary
- C. Implementing BGP Peer Groups
  1. BGP Peer Groups Overview
  2. BGP Peer Groups as a Performance Tool
  3. BGP Peer Group Limitations
  4. Configuring BGP Peer Groups
  5. BGP Peer Group Configuration Examples
  6. BGP Dynamic Update Peer Groups Feature
  7. BGP Peer Templates Overview
  8. BGP Peer Templates Inheritance
  9. BGP Peer Templates Configuration
  10. Summary
- D. Using BGP Route Dampening
  1. BGP Route Dampening
  2. BGP Route Dampening Operation
  3. Configuring BGP Route Dampening
  4. Summary
- E. Module Summary
- F. Module Self-Check

LABS:
- Discovery 1: Configure Basic BGP
- Discovery 2: Announcing Networks in BGP
- Discovery 3: Implement BGP TTL Security Check
- Discovery 4: BGP Route Propagation
- Discovery 5: IBGP Full Mesh
- Discovery 6: BGP Administrative Distance
- Discovery 7: Configure Non-Transit Autonomous System
- Discovery 8: Filtering Customer Prefixes
- Discovery 9: Prefix-Based Outbound Route Filtering
- Discovery 10: Configure Route Maps as BGP Filters
- Discovery 11: Configure Per-Neighbor Weights
- Discovery 12: Configure and Monitor Local Preference
- Discovery 13: Configure Local Preference Using Route Maps
- Discovery 14: Configure AS Path Prepending
- Discovery 15: Configure MED
- Discovery 16: Configure Local Preference Using the Communities
- Discovery 17: Configure Route Reflector
- Discovery 18: Configure BGP Route Limiting
- Discovery 19: Configure BGP Peer Groups
- Discovery 20: Configure BGP Route Dampening
- Challenge 1: Configure a Basic BGP Network
- Challenge 2: Configure a BGP Transit AS
- Challenge 3: Configure BGP Using BGP Filtering
- Challenge 4: Configure BGP Route Selection Using BGP Attributes
- Challenge 5: Configure BGP Route Reflectors