Hewlett Packard Enterprise

Accelerated Interoperability and Troubleshooting HPE Networks HL039S

The Accelerated Interoperability and Troubleshooting HPE Networks course is a 5-day course combining the Troubleshooting HPE Networks and HPE Networking Interoperability courses.

HPE course number	HL039S
Course length	5 days
Delivery mode	ILT
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Why HPE Education Services?

- IDC MarketScape leader 4 years running for IT education and training*
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- Simplified purchase option with HPE Training Credits

Course description

This accelerated training helps network engineers to design and implement multivendor networks that include Comware, ProVision, and Cisco switches. The course focuses on the key differences between platforms, such as VLAN configuration, Spanning Tree Protocol (STP), Open Shortest Path First (OSPF), link aggregation, and Network Address Translation (NAT).

This accelerated course also helps networking engineers to improve their troubleshooting skills on both Comware and ProVision switches. The course focuses on troubleshooting methodologies and practices in medium to enterprise networks. The course is built around the IETF 5 Layer Model and includes a number of labs covering topics like troubleshooting VLANs, OSPF routing and spanning tree issues.

Audience

Professionals who design, implement, and support network solutions based on Comware, ProVision and Cisco switches and technologies, including systems engineers, systems designers, customer IT staff, HPE services field and call center support engineers.

Prerequisites

To attend the Accelerated Interoperability and Troubleshooting HPE Networks course it is recommended that the candidate has one of the following active certifications:

- ASE
- CCNP
- Industry equivalent experience

Course objectives

After completing this course, you should be able to:

- Design and implement multivendor networks containing Comware, ProVision and Cisco switches and routers
- Identify and solve issues that can arise when combining vendor specific proprietary protocols and industry standard IEEE based protocols

Support and correct issues in LAN-switching and in routed, multiple subnet network deployments.

- Develop a troubleshooting methodology to isolate and correct problems in complex networks

*Realize Technology Value with Training, IDC Infographic 2037, Sponsored by HPE, January 2016

Detailed course outline

Module 1: Introduction to HPE Networking Interoperability

- Course objectives
- Course agenda
- Multi-vendor networks—Challenges and opportunities.
- Interoperability goals
- Initial information for labs
- Module 1 summary

Module 2: Switch Management

- Module 2 objectives
  - Notes
- Enabling basic remote management
  - Notes
- Management scenario 1
- Management scenario 1a—Cisco
- Management scenario 1b—HPE A-Series
- Management scenario 1c—HPE E-Series
- Setting up a DHCP server on an HPE A-Series switch
- IMC discovery—1
- IMC discovery—2
- IMC discovery—3
- IMC discovery—4
- IMC discovery—5
- Advanced and secured management
  - Notes
- Management scenario 2
- Management scenario 2a—Cisco
- Management scenario 2b—HPE A-Series
- Information center on HPE A-Series switches
  - Introduction to information center
  - Classification of system information
  - Eight levels of system information
  - Seven output destinations and ten channels of system information
  - Ten channels of system information
  - Default output rules of system information
  - info-center source
  - Configuring SNMP NMS
- Management scenario 2c—HPE E-Series
- LLDP and CDP
  - Notes
- IEEE 802.1AB LLDP and CDP
  - HPE E-Series
  - HPE A-Series
  - Cisco
- Useful show and display commands
  - Notes
- Lab 2.1: Management
- Lab debrief
- Module 2 summary

Module 3: VLANs

- Module 3 objectives
- Notes
- Configuring and managing VLANs
- Notes
- Terminology
- Access, trunk, and hybrid ports on HPE A-Series switches
- VLAN configuration scenario
- VLAN configuration on Cisco: VLAN creation and trunk ports
- VLAN configuration on Cisco: Access and voice ports
- VLAN routing on Cisco
- DHCP relay on Cisco
- VLAN configuration on HPE A-Series: VLAN creation and trunk ports
- VLAN configuration on HPE A-Series: Access and voice ports
- VLAN routing on HPE A-Series
- DHCP relay on HPE A-Series
- VLAN configuration on HPE E-Series
- VLAN routing on HPE E-Series
- DHCP relay on HPE E-Series
- Dynamic VLAN creation: VTP and GVRP
- VTP versus GVRP
- GVRP and VTP on the same network
- GVRP operations
- GVRP general operation
- GVRP
- GVRP and VTP: Pros and cons
- Trunk and static VLANs: A best practice?
- Lab debrief
- Module 3 summary
- Learning check

Module 4: Link Aggregation	• Module 4 objectives • MSTP review • MSTP regions—Review 1 • MSTP regions—Review 2 • Which BPDUs are used?—Review 3 • MSTP BPDUs—Review 4 – Additional Information about MSTP • Common spanning tree—Review 5 • What setup is required to enable load balancing?—Review 6 • Mapping VLANs to MST instances—Review 7 • Is MSTP "aware" of the VLAN setup?—Review 8 • MSTP design options • How do you set up VLANs on uplinks? • Instances and VLAN settings—Activity • MSTP setting—Activity	• Adding a new VLAN on a switch implementing MSTP • Assigning a VLAN to an MSTP instance • Strategies to place VLANs in MSTP instances • MSTP—Path costs • Configuring MSTP • IOS requirements for MSTP on Cisco • Cisco and HPE MSTP scenario: HPE A-Series switch configurations • Cisco and HPE MSTP scenario: HPE E-Series switch configurations • Troubleshooting MSTP • Conclusion: MSTP on Cisco and HPE switches • Lab 4.1: Configuring MSTP • Lab debrief • Module 4 summary • Learning check
Module 5: Implementing MSTP on Cisco and HPE Switches	• Module 5 objectives • PVST+ and STP interoperability • How do STP/RSTP and Cisco PVST+/Rapid PVST+ differ? • PVST+ versus MSTP • Spanning tree BPDUs • Cisco PVST+: Which BPDUs are sent on trunk ports? • Cisco PVST+: Which BPDUs are sent on access ports? • Spanning tree BPDUs—Quiz 1 • Spanning tree BPDUs—Quiz 2 • Which BPDUs are sent and interpreted? • Resulting topology • STP—Port cost differences • PVST+ quiz • Cisco and HPE scenario 1 • PVST+/STP interoperability—Scenario 1 • Scenario 1—VLAN topologies • Considering STP port cost differences • Cisco and HPE scenario 1: Cisco switch configurations • Cisco and HPE scenario 1: HPE A-Series switch configuration	• Cisco and HPE scenario 1: HPE E-Series switch configuration • Cisco and HPE scenario 2 • PVST+/STP interoperability—Scenario 2 • Scenario 2—VLAN topologies • What setup is required in VLAN 1? • Cisco view in other VLANs • Cisco and HPE scenario 2: Cisco switch configurations • What about other Cisco switches in the access layer? • What is the purpose of load balancing? • Lab 5.1: PVST+/MSTP interoperability • Lab debrief • Cisco and HPE scenario 3 • HPE in aggregation—Scenario 3 • HPE in aggregation—Scenario 3: With MSTP and PVST+ • HPE in aggregation—Scenario 3: Configuration • Lab 5.2: PVST+/MSTP interoperability: HPE at the aggregation layer (Optional) • Lab debrief • Module 5 summary • Learning check

Module 6: Interoperability among PVST+, Rapid PVST+, and MSTP	• Module 6 objectives • Reminder: With IRF, STP is unnecessary • Disabling STP on HPE edge switches/ • What happens when STP is disabled on the HPE edge switch? • Configuring the HPE switch to disable STP • Configuring smart link • Smart link on HPE A-Series switches • Simple smart link configuration	• Smart link and load balancing – Topology change mechanisms • Smart link status • Configuring monitor link • Monitor link on HPE A-Series switches • Monitor link configuration • Lab 6.1: Redundancy without STP • Lab debrief • Module 6 summary • Learning check
Module 7: Redundancy Without STP	• Module 7 objectives • Spanning tree problems • Hardening STP • Spanning tree hardening features • Setting edge ports and non-edge ports • UDLD and DLDP • Why unidirectional links cause problems • UDLD and DLDP interoperability • STP hardening on edge ports • BPDU guard—BPDU protection • HPE loop protect (HPE E-Series) • TCN guard	• BPDU filter—Disabling STP on individual ports • STP hardening on Cisco • STP hardening on HPE A-Series • STP hardening on HPE E-Series • STP hardening on uplinks • Root guard • Spanning tree root guard configuration • Loop guard • Spanning tree loop guard configuration • Lab 7.1: Hardening STP • Module 7 summary
Module 8: Link Aggregation	• Module 8 Objectives • Link aggregation and interoperability • Link aggregation modes • Interoperability between modes: What works? • Link aggregation load balancing options • IRF, link aggregation, and interoperability: IRF in the distribution layer • IRF, link aggregation, and interoperability: IRF in the distribution and access layers	• IRF, link aggregation, and interoperability: IRF in the core and distribution layers • Static link aggregation configuration • Static LACP link aggregation configuration • VLAN trunking and link aggregation • Troubleshooting link aggregation • Lab 8.1: Configuring link aggregation and IRF Lab debrief • Module 8 summary • Learning check

Module 9: Virtual IP Protocols

- Module 9 objectives
- Virtual IP concepts
  - Reference
- Virtual IP quiz
- HSRP, GLBP, and VRRP comparison
  - Interoperability
  - Authentication
  - Preempt delay
  - Load balancing
  - Tracking interface and remote IP
  - Stateful NAT
  - Virtual MAC
  - Multicast IP
- Comparing IRF to virtual IP protocols
- VRRP on Cisco
- Virtual IP design cases
- Default gateway redundancy with HSRP and VRRP
- Default gateway redundancy with IRF
  - Operational planes (control, management, and forwarding)
  - Operational planes in IRFv2
- Load balancing with GLBP and VRRP (HPE A-Series devices)
- Load balancing with IRF
- Next hop router in static routes—Case 1
- Next hop router in static routes—Case 2
- Next hop router in static routes with IRF
- Preemption and preempt delay
- No preempt delay needed with IRF
- Tracking interfaces with VRRP or HSRP
- Tracking remote IP addresses
- Tracking with IRF and NQA
- Configuring virtual IP protocols
- HSRP configuration example
- GLBP configuration example
- VRRP configuration example on HPE A-Series
- VRRP tracking remote IP on HPE A-Series
  - Example output for display and debugging commands
- VRRP configuration example on HPE E-Series
- Lab 9.1: Configuring VRRP (Optional)
- Lab debrief
- Module 9 summary
- Learning check

Module 10: Routing with OSPF

- Module 10 objectives
- Scenarios for configuring OSPF neighbors
- OSPF neighboring—Scenario 1-1
  - Best practices
- OSPF DR election—Scenario 1-2
- Other best practices
- OSPF authentication
- OSPF neighbors—Scenario 1-4
  - What is the purpose of the configurations displayed in this slide?
  - When would you need to initiate a graceful restart?
  - What are requirements for implementing graceful restart?
  - What happens on each router when you initiate a graceful restart on HPE 1?
  - Commands for enabling OSPF graceful restart
- OSPF neighbors—Scenario 1-5
  - Why is it relevant to use BFD between the three routers?
  - What BFD transmit timers will be negotiated between HPE 1 and Cisco 3?
  - What values would you recommend for the timers?
  - What will happen if INT VLAN10 fails on HPE 1?
- OSFP area scenarios
- OSPF area summarization—Scenario 2-1
- OSPF area summarization—Scenario 2-1-a
  - How can the ABR filter networks?
  - What is the default value for router ID?
  - How and why would you configure the ABR to send a default route to routers in an area?
- OSPF area summarization—Scenario 2-1-b
- OSPF area summarization—Scenario 2-1-c
- OSPF area summarization—Scenario 2-2
- OSPF passive interface—Scenario 2-3
  - Use cases
- OSPF passive interface—Scenario 2-3-a
- OSPF area and redistribution scenarios
- OSPF redistribution—Scenario 3-1
  - OSPF redistribution—Scenario 3-1-a
  - OSPF redistribution—Scenario 3-1-b
  - OSPF redistribution—Scenario 3-1-c
- OSPF redistribution—Scenario 3-2
  - OSPF redistribution—Scenario 3-2-a
  - OSPF redistribution—Scenario 3-2-b
  - OSPF redistribution—Scenario 3-2-c
- OSPF redistribution—Scenario 3-3
- OSPF redistribution—Scenario 4-1
  - Use cases
- OSPF redistribution—Scenario 4-1 implications
- OSPF redistribution—Scenario 4-1 configuration
- OSPF redistribution—Scenario 4-1-a
- OSPF redistribution—Scenario 4-1-b
- OSPF redistribution—Scenario 4-1-c
  - Configuration for Cisco
  - Limitations of the solution
- OSPF redistribution—Scenario 4-2
- OSPF redistribution and filtering: Scenario 4-2-a
- OSPF redistribution and filtering—Scenario 4-2-b
  - Alternate configuration with ip prefix-list
  - Alternate configuration with filter-policy export
- OSPF redistribution and filtering—Scenario 4-2-c
- OSPF redistribution and filtering—Scenario 4-2-d
- OSPF default route injection—Scenario 5
- OSPF default route injection—Scenario 5-1
  - Additional reference
- OSPF redistribution and filtering—Scenario 5-2
- Labs 10.1 and 10.2: Configuring OSPF
- Lab debrief
- Module 10 summary
- Learning check

Module 11: Network Address Translation

- Module 11 objectives
- Internet access with dynamic NAT
- NAT and Internet access—Scenario 1
- NAT and Internet access—Scenario 1a
- NAT and Internet access—Scenario 1b
  - NAPT configuration on the HPE A-Series switch
  - Introduction to connection limit
- Internal servers with static NAT
- Internal servers and NAT—Scenario 2
- Internal servers and NAT—Scenario 2a
- Internal servers and NAT—Scenario 2b
- Internal servers and NAT—Scenario 3
- Internal servers and NAT—Scenario 3a
- Internal servers and NAT—Scenario 3b
- Internal servers and NAT—Scenario 3c
- Using static NAT for overlapping networks
- Overlapping networks—Scenario 4
- Overlapping networks—Scenario 4a
- Overlapping networks—Scenario 4b
- Overlapping networks—Scenario 4c
- Overlapping networks—Scenario 4d
  - Alternative configuration with dynamic NAT
- Module 11 summary
- Learning check

Module 12: Troubleshooting Methodologies and Practices	• Troubleshooting Methodology • Problem Solving Methodology • Identification and Analysis	• Hypothesis and Validation • Implementation and Verification • Summary
Module 13: Layer 1 (Physical Layer) Troubleshooting and Problem Resolution	• "It's the cable"	• Physical Layer Symptoms
Module 14: Layer 2 (Data Link Layer) Troubleshooting and Problem Resolution	• Switching • VLANs • Switch VLAN port types • Link Aggregation • LACP – Link Aggregation Control Protocol • Configurable LACP States	• Static vs. Dynamic Link Aggregation • Spanning Tree • Basic IRF Concepts • How IRF simplifies networks • Lab 4: VLAN Switching
Module 15: Layer 3 (Network Layer) Troubleshooting and Problem Resolution	• Forwarding between VLANs • VRRP Basics • OSPF Basics • External and internal Border Gateway Protocol (BGP) • Network Address Translation (NAT)	• Static and Dynamic NAT • Lab 5: Layer 3 Practice and Tools • Lab 6: OSPF Routing Issues • Lab 7: Addressing Issues • Lab 8: Inter-VLAN and Routing
Module 16: Layer 4 (Transport Layer) Troubleshooting and Problem Resolution	• Troubleshooting TCP/UDP • Firewalls	• Firewall types • Network address translator (NAT)
Module 17: Layer 5 (Application Layer) Troubleshooting and Problem Resolution	• QoS process flow • 802.1p traffic prioritization • Traffic marking by an end station	• Retaining priority between VLANs • Normal priority data traffic • Lab 10: Quality of Service
Module 18: Troubleshooting an End-to-End Complex, Integrated Multi-Protocol Network	• Lab 11: Final lab	

Next steps

- Deploying HPE FlexNetwork Core Technologies—H8D06S

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