HPE Digital Learner FlexFabric Content Pack

The first part of this Content Pack introduces network professionals to the basic features of modern networks through a series of HPE Networking Fundamental concepts short videos. The second part covers HPE FlexFabric Comware advanced features (IRF, MDC and EVI) with self-paced hands-on labs. Participants will learn how these technologies are implemented in the HPE Comware 7 platform.

**Why HPE Education Services?**

- IDC MarketScape leader 5 years running for IT education and training*
- Recognized by IDC for leading with global coverage, unmatched technical expertise, and targeted education consulting services*
- Key partnerships with industry leaders OpenStack®, VMware®, Linux®, Microsoft®, ITIL, PMI, CSA, and SUSE
- Complete continuum of training delivery options—self-paced eLearning, custom education consulting, traditional classroom, video on-demand instruction, live virtual instructor-led with hands-on lab, dedicated onsite training
- Simplified purchase option with HPE Training Credits

**Audience**

This course is intended for network or systems administrators, network engineers and consultants.

**Content Pack components**

This Content Pack consists of the following 12 courses:

- HPE Networking Fundamentals
  - OSI Model
  - Binary
  - Data Flows
  - IP Subnetting
  - IP Addressing
  - TCP and UDP
  - VLANs
  - Routing
  - Spanning Tree

- HPE FlexFabric Comware Advanced Features
  - Intelligent Resilient Framework (IRF)
  - Multitenant Device Context (MDC)
  - Ethernet Virtual Interconnect (EVI)

**Content Pack objectives**

By the end of the course, you should be able to meet the following objectives:

- Understand some of the HPE Networking Fundamentals key concepts
- Understand and configure some of the HPE FlexFabric Comware Advanced Features
- Understand the significance of IRF, MDC and EVI

**Recommended learning**

Students should possess experience with networking and common LAN protocols.

---

*Realize Technology Value with Training. IDC infographic 2017. Sponsored by HPE. October 2017*
Detailed Content Pack outline

<table>
<thead>
<tr>
<th>HPE Networking Fundamentals - OSI Model</th>
<th>Outline</th>
</tr>
</thead>
</table>
| This OSI Model video explains the reasons for using the OSI model and then explains each of the seven layers of the OSI model. It also explains the encapsulation and de-encapsulation process used in the OSI model. The differences between the TCP/IP Model and OSI Model are explained. | • Why the OSI model?  
• Layers of the OSI model  
• How traffic flows between hosts  
• Sniff the wire using Wireshark |

<table>
<thead>
<tr>
<th>HPE Networking Fundamentals - Binary</th>
<th>Outline</th>
</tr>
</thead>
</table>
| This video explains the basics of binary. Converting a decimal value and IP address to binary and vice versa are explained and demonstrated. | • Why binary?  
• Overview  
• Converting an IP address to binary |

<table>
<thead>
<tr>
<th>HPE Networking Fundamentals - Data Flows</th>
<th>Outline</th>
</tr>
</thead>
</table>
| This video discusses the basics of Ethernet. The video starts with a discussion of unicast, broadcast and multicast. It then continues with explanations of Ethernet 10base2, CSMA/CD, MAC addresses, collision domains, broadcast domains, UTP cabling including categories (Cat 1 to 7a), T568A, T568B, straight through cables, cross over cables, auto crossover (auto MDI/MDIX) and DAC cables. Then the video discusses the flow of data in a network containing hubs, bridges and switches. Detailed examples of frame flow when using the various devices. Next the video discusses the flow of data in a network containing routers. Concepts such as ARP, routing tables are demonstrated and explained. | • Types of communication  
• CSMA/CD  
• Hubs  
• Bridges  
• Switches  
• Routers  
• Packet flows |

<table>
<thead>
<tr>
<th>HPE Networking Fundamentals - IP Subnetting</th>
<th>Outline</th>
</tr>
</thead>
</table>
| This video explains the reasons for subnetting and then demonstrates two methods to work out the subnet address, first host, last host and broadcast address when given an IP address and subnet mask. The two methods discussed are the binary method and quick method. The video demonstrates how to work out subnets for a given number of hosts or subnets. The formulas 2n and 2n -2 are discussed. | • Subnetting method 1 – Binary method  
• Subnetting method 2 – Quick method  
• How to subdivide a network or subnet when given:  
  • A specific number of hosts required  
  • A specific number of subnets required |

<table>
<thead>
<tr>
<th>HPE Networking Fundamentals - IP Addressing</th>
<th>Outline</th>
</tr>
</thead>
</table>
| This video explains the basics of IPv4 addressing. Topics such as network addresses, host addresses, IPv4 address format and address classes (A, B, C) are discussed. It also discusses special IPv6 addresses such as RFC1918 addresses, directed broadcasts, local broadcasts, loopback addresses, link local addresses and more. | • IP Address overview  
• Address classes  
• Special addresses  
• Network masks |
HPE Networking Fundamentals - TCP and UDP

This video explains the differences between UDP and TCP. Port numbers well known, Registered, Dynamic and Ephemeral are explained. Sockets are also explained. The UDP header is discussed. It also explains TCP options including the TCP 3-way handshake (SYN, ACK), other TCP flags such as RST and FIN, windowing, sequence numbers, acknowledgement numbers, MSS and flow control. Wireshark demonstration used to explain TCP using a real packet capture.

Outline
- Comparison
- Port numbers
- UDP
- TCP
- TCP 3 way handshake
- Windowing
- Sequence numbers

HPE Networking Fundamentals - VLANs

This video discusses the basics of VLANs. Concepts such as VLAN advantages, physical versus logical topology, access ports/untagged ports, trunk ports/tagged ports are discussed. Explanations of unicast and broadcast frame flows in a VLAN environment. Configuration of Provision and Comware access ports explained. It also discusses 802.1Q, voice VLANs, inter-VLAN routing and frame flows. Configuration of tagged Provision and trunk Comware ports are explained.

Outline
- VLAN overview
- 802.1Q
- VLAN Comware - Provision terminology

HPE Networking Fundamentals - Routing

This video discusses the basics of IPv4 routing, including routed and routing protocols, the advantages and disadvantages of static and dynamic routing protocols, route selection criteria, autonomous systems, EGP, IGP, distance vector and link state routing protocols, administrative distance or preference, classful and classless routing protocols. It also discusses Distance Vector routing protocols in more detail. Concepts such as clock synchronization, counting to infinity, split horizon, route poisoning, poison reverse, hold down timers and triggered updates are explained. Next it discusses Link State routing protocols. Concepts such as router types (ABR, ASBR, internal, backbone), areas, SPF and topological database are explained.

Outline
- Routed vs. routing protocols
- Static vs. dynamic routing protocols
- Distance vector routing protocols
- Link state routing protocols

HPE Networking Fundamentals - Spanning Tree

This video explains the reasons for subnetting and then demonstrates two methods to work out the subnet address, first host, last host and broadcast address when given an IP address and subnet mask. The two methods discussed are the binary method and quick method. The video demonstrates how to work out subnets for a given number of hosts or subnets. The formulas 2^n and 2^n -2 are discussed.

Outline
- 802.1D
- PVST / PVST+
- PVRST+ / RPVST+
- 802.1s / Multiple Spanning Tree (MSTP)
- 802.1w / Rapid Spanning Tree (RSTP)
This self-paced seminar is an introduction to HPE Intelligent Resilient Framework (IRF). HPE IRF creates a large IRF virtual device from multiple devices to provide fast failover, scalability, manageability and high availability. It includes a WBT and hands-on lab where you will configure IRF.

<table>
<thead>
<tr>
<th>Outline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module 1: HPE IRF virtualization</td>
</tr>
<tr>
<td>Module 2: Traditional network issues</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Module 3: IRF advantages</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Module 4: IRF versus STP

Module 5: Supported Comware products

Module 6: IRF analogy | • Chassis based switches | • Chassis based switches with IRF |
| Module 7: IRF topologies | • Daisy chain | • Ring |
| Module 8: IRF components | • Topology collection | • IRF domain |
| | • Logical IRF ports | • Member IDs |
| Module 9: IRF resiliency | • N1 | • Link |
| | • Protocol information | • IRF port |

Module 10: Electing a master

Module 11: Switch configuration files

Module 12: IRF topology and forwarding traffic | • Switching at layer 2 | • Routing at layer 3 |

Module 13: IRF split stack condition

Module 14: Multiple Active Devices (MAD) | • Functions of MAD | • MAD implementations |

Module 15: Detecting a split stack | • Comware LACPUs | • BFD |

Module 16: Preventing addressing conflicts and

Module 17: IRF configuration steps
**HPE FlexFabric Comware Advanced Features Multitenant Device Context (MDC)**

This self-paced seminar is an introduction to the HPE Multitenant Device Context (MDC). HPE MDC helps organizations consolidate switch hardware and reduce TCO. It includes a WBT and hands-on lab where you will configure MDC.

**Outline**

<table>
<thead>
<tr>
<th>Module 1: Feature overview</th>
<th>MDC overview</th>
<th>IRF versus MDC</th>
<th>MDC features</th>
<th>MDC applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module 2: MDC benefits overview</td>
<td>MDC benefits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module 3: Supported platforms</td>
<td>Supported products</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module 4: Use case 1, datacenter change management</td>
<td>Overview</td>
<td>Development network</td>
<td>Quality Assurance (QA) network</td>
<td></td>
</tr>
<tr>
<td>Module 5: Use case 2, customer isolation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module 6: Use case 3, infrastructure and customer isolation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module 7: Use case 4, hardware limitation workaround</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module 8: MDC numbering and naming</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module 9: Architecture</td>
<td>Control plane</td>
<td>Hardware limits</td>
<td>Console ports</td>
<td></td>
</tr>
<tr>
<td>ASICS</td>
<td>ASIC restrictions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASIC control</td>
<td>Platforms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module 10: Design considerations</td>
<td>ASIC restrictions</td>
<td>Platforms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module 11: Configuration Steps</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module 12: Network virtualization types</td>
<td>RF</td>
<td>MDC and IRF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MDC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module 13: IRF based MDC</td>
<td>IRF based MDC use bases</td>
<td>IRF based MDC use bases</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Virtualization hierarchy</td>
<td>Virtualization hierarchy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MDC and IRF on 12500/12500E</td>
<td>MDC and IRF on 12500/12500E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module 14: MDC and ISSU</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module 15: MDC deployment best practices</td>
<td>Avoid using MDC 1 for production networks</td>
<td>Connect MDC IRF links correctly on 12500/12500E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MDC Role Based Access Control (RBAC)</td>
<td>Minimize traffic on MDC IRF-port by deploying MLAG links to ToRs/Servers or other devices</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use multiple links on different LPUs to prevent IRF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module 16: Sample MDC configurations</td>
<td>Admin MDC</td>
<td>Non-default MDC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
HPE FlexFabric Comware Advanced Features Ethernet Virtual Interconnect (EVI)

This self-paced seminar is an introduction to the HPE Ethernet Virtual Interconnect (EVI). HPE EVI extends layer 2 networks across data centers and enables VMs to be easily moved to any data center. It includes a WBT and hands-on lab where you will configure EVI.

Outline

<table>
<thead>
<tr>
<th>Module 1: EVI Overview</th>
<th>• Introduction to EVI</th>
<th>• EVI Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• EVI Operation</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module 2: Supported Products</th>
<th>• Chassis Models</th>
<th>• Router Models</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Module 3: EVI Operation</th>
<th>• EVI Terminology</th>
<th>• EVI Neighbor Discovery</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• EVI Concepts</td>
<td>• EVI Traffic Forwarding process</td>
</tr>
<tr>
<td></td>
<td>• EVI Network</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module 4: EVI Traffic Optimization</th>
<th>• ARP Suppression</th>
<th>• Selective Flooding</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Module 5: EVI IS-IS Maximum MAC Address Announcement</th>
<th></th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Module 6: Design Considerations</th>
<th>• Automatic Loop Avoidance</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Module 7: Distributed L3 Gateway</th>
<th>• Active/Active DC Design</th>
<th>• Active/Stand-by DC Design</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Module 8: WAN Link Load Balancing</th>
<th></th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Module 9: Location Awareness</th>
<th></th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Module 10: Encryption Support</th>
<th>• Layer 2 Based Encryption - MacSec</th>
<th>• Layer 3 Based Encryption - IPsec</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Module 11: Hybrid Cloud Solution with EVI /VSR</th>
<th></th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Module 12: HSR/MSR for End to End DC Cloud Solution</th>
<th></th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Module 13: Configuration Steps for EVI</th>
<th>• Basic Configuration Steps for EVI</th>
<th>• Step 7: Configure ENDC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>‒ Step 1: Configure the EVI Site-ID (Optional)</td>
<td>‒ Step 8: Verify</td>
</tr>
<tr>
<td></td>
<td>‒ Step 2: Configure the Transport Interface</td>
<td>‒ Advanced Configuration Options</td>
</tr>
<tr>
<td></td>
<td>‒ Step 3: Configure the EVI Tunnel Interface</td>
<td>‒ Advanced Step 9: ARP Suppression</td>
</tr>
<tr>
<td></td>
<td>‒ Step 4: Configure the EVI Network ID</td>
<td>‒ Advanced Step 10: Selective Flooding</td>
</tr>
<tr>
<td></td>
<td>‒ Step 5: Configure the Extended VLANs</td>
<td>‒ Advanced Step 11: Virtual-system IDs</td>
</tr>
<tr>
<td></td>
<td>‒ Step 6: Configure ENDS</td>
<td></td>
</tr>
</tbody>
</table>