



Architecting HPE FlexNetwork Solutions H8D04S (00887054)

The Architecting HPE FlexNetwork Solutions course provides you with the knowledge and skills to successfully architect and design complex enterprise level networks based on open networking industry standards.

HPE course number	H8D04S
Course length	4 days
Delivery mode	ILT
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Why HPE Education Services?

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- Simplified purchase option with HPE Training Credits

Course description

Cloud and Converged Infrastructure architectures have redefined the way IT assets are deployed and consumed which dramatically affects the way networks are architected and managed. This course covers both traditional network designs, as well as network designs that support cloud or converged environments which require flatter, simpler networks to support the bandwidth-intensive, delay-sensitive, server-to-server traffic flows.

You will learn how to validate customer requirements and how to translate those requirements into a highly scalable, customized and secure network solution design, including switches, routers and wireless products, as well as server and storage network related components. The network will be future-ready, capable of IT innovations, including cloud services, security, OpenFlow and Bring Your Own Device (BYOD) with integrated wired and wireless solutions for seamless access.

This course is approximately 60 percent case studies and 40 percent lecture and learning activities.

The Architecting HPE FlexNetwork Solutions course prepares candidates for the HPE ASE FlexNetwork Architect V2 certification within the HPE ExpertOne program.

Audience

IT professionals with three or more years of experience in designing and architecting complex enterprise level networks. Recommended, but not required, is experience with server and storage network related technologies.

What is new?

The Architecting HPE FlexNetwork Solutions course is part of the HPE ASE FlexNetwork Architect V2 certification track. It includes designs based on HPE Networking's FlexNetwork architecture, which is the industry's only unified architecture for the data center, campus and branch enabling enterprises to fully harness the power of media-rich content, virtualization, mobility, and cloud computing.

Prerequisites

HPE AIS—Network Infrastructure (2011) (inactive) or HPE ATP—FlexNetwork Solutions V2.

Exam(s)

HPE0-Y50—Architecting HPE Network Solutions

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

Course objectives

After completing this course, you will be able to:

- Explain how open standards and the HPE FlexNetwork architecture addresses modern networking's bandwidth-intensive, delay-sensitive, mobility and BYOD demands
- Design a more simplified, flatter physical topology that can handle an enterprise's traffic volume and traffic patterns, including intensive server-to-server patterns anticipated for Cloud and Converged Infrastructures
- Design efficient routing and multicast routing solutions for various enterprise needs

- Describe best practices for designing solutions from the Physical Layer to the Network Layer, by providing basic connectivity with some resiliency and good performance ensured by the proper bandwidth provisioning and topology design
- Explain how HPE Virtual Connect (VC) modules help to simplify and optimize connections between servers and the data center LAN and SAN
- Design secure, integrated wired and wireless network solutions for seamless mobile access
- Develop a plan for implementing an HPE networking solution into either a greenfield or an existing network

- Obtain the data and documentation required to understand a company's general connectivity, availability, security, and application requirements based on information provided by the company's key decision makers
- Design data center solutions including network, server, and storage virtualization and explain how virtualization and cloud computing are changing the data center environment

Certification(s)

HPE ASE—FlexNetwork Architect V2.

Detailed course outline

Course Introduction

- Course overview
- Course objectives
- Day 1 agenda
- Day 2 agenda
- Day 3 agenda
- Day 4 agenda
- HPE ASE—FlexNetwork Architect V2 certification

Module 1: Networking Trends and the HPE FlexNetwork Architecture

- Objectives
 - HPE Networking Architect
 - Discussion topics
 - New technologies in the consolidated data center
 - Trends affecting data centers
 - New application and delivery models
 - Server virtualization
 - Need for “virtualization-aware” security
 - Need to adapt to accelerating changes
 - Network virtualization—SDN
 - Infrastructure convergence of data and storage
 - Discussion topics
 - Campus LAN trends
 - Proliferation of cloud services, multi-media applications, and SaaS
 - Wired to wireless migration
 - BYOD
 - Discussion topics
 - New applications and devices
 - Need to modernize the branch
 - Slow, unstable access to corporate resources
 - Limited local IT resources
 - BYOD access
 - Wireless access
 - Need for simpler, more cost-effective, and secure connections
 - Discussion topics
 - HPE FlexNetwork
 - HPE FlexFabric
 - HPE FlexCampus
 - HPE FlexBranch
 - HPE FlexManagement
 - Summary
 - Learning check
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Module 2: Gathering Customer Requirements

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- Objectives
 - Discussion topics
 - Identify key stakeholders
 - Maintain awareness of political climates
 - Understand the scope and constraints of the design
 - Focus on business needs
 - Create effective requirements statements
 - Ask the right level of questions to assess requirements
 - Translate information into requirement statements
 - Discussion topics
 - Understand the existing network
 - Sample questions
 - Activity—Gathering customer requirements
 - Determine basic connectivity requirements
 - Datacenter versus Campus LAN
 - Discussion topics
 - Assess the costs of downtime
 - Quantify availability
 - Determine availability requirements
 - Identify critical applications and services and assess the level of criticality
 - Identify components related to critical applications
 - Understand how redundancy and resiliency promote availability
 - Redundancy beyond layers 1, 2, and 3
 - Sample availability worksheets
 - Activity—Assess a customer’s availability requirements
 - Scenario
 - Activity: Assess the cost of a failure
 - Activity: Discuss availability requirements
 - Discussion topics
 - Assess the costs of network insecurity
 - Assess vulnerability to threats
 - Assess the need for various security mechanisms
 - Assess the need for access control
 - Benefits of network access control
 - Costs of network access control
 - Sample access control worksheets
 - Assess the need for endpoint integrity
 - Benefits of endpoint integrity
 - Costs of endpoint integrity
 - BYOD challenges
 - Assess the need for data security
 - Sample ACL worksheets
 - Assess firewall and IDS/IPS requirements
 - Supplemental information on HPE TippingPoint solutions
 - Discussion topics
 - QoS overview
 - Background information on QoS protocols
 - Classify network traffic
 - Reasons applications require different handling
 - Common traffic classes
 - Sample application requirements worksheets
 - Activity—Consider QoS needs
 - Scenario
 - Activity: Discuss application requirements
 - Discussion topics
 - Identify operational requirements
 - Identify relevant regulations
 - Activity
 - ITSM
 - Assess existing network management tools
 - Document network management policies
 - Consider traffic analysis tools
 - Ensure your proposal works with the customers’ tools
 - Obtain information about traffic patterns and traffic flow
 - Sample operational requirements worksheets
 - Discussion topics
 - Final analysis of customer requirements
 - Consolidate data and verify the integrity of requirements statements
 - Review statements with key company representatives
 - Document the approval of requirements
 - Summary
 - Learning check
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Module 3: Designing HPE FlexCampus Solutions

- Objectives
- Discussion topics
- HPE FlexCampus reference architectures
 - Supplemental information on IRF and backplane stacking
- Choose the architecture
- Activity—Examine the scalability of a two-tier design
- Discussion topics
- Choose between modular and fixed-port switches
- Activity—Choose between modular and fixed-port switches
 - Scenario
 - Discussion questions
- Determine the type of edge ports
- Plan oversubscription for access layer uplinks
- Approach 1—Assess the success of current oversubscription
- Approach 1—Predict success in the future
- Approach 1—Address detected issues directly
 - Good idea of peak requirements
 - More information about traffic patterns required
 - Supplement: Moving from 10/100 edge ports to Gigabit edge ports
- Approach 2
- Use rules of thumb
- Plan for heavy users
- Activity—Plan appropriate oversubscription
- Plan non-stacked access layer uplinks
- Plan IRF or backplane stacking uplinks
- Plan distribution of IRF or backplane stacking uplinks
- Best practices for access layer IRF or backplane stacking
 - Supplemental information on MAD
- Select modules and transceivers
 - Gigabit fiber connections
 - 10G fiber connections
- Activity
 - Plan uplinks
- Use basic requirements to select access layer switches
 - Choose a switch series and model
- Determine additional access layer requirements
 - Determine Layer 3 requirements
 - Determine security requirements
 - Determine QoS requirements
- Activity—Select access layer switches and transceivers
 - Add modules and transceivers for a fixed-port switch
- Plan the PoE power budget
- Facilitator demonstration—Plan the PoE budget
 - Scenario
 - Demonstration steps
- Activity—Plan the PoE power budget
 - Scenario
 - Activity
- Discussion topics
- Design the distribution layer
 - Select models and modules based on port count
 - Determine performance requirements
- Design the core layer
 - Determine the number and type of physical ports
 - Determine performance requirements
 - Supplement on CLOS versus cross-bar architecture
- Determine other requirements for campus LAN core and distribution switches
 - Determine Layer 3 requirements
 - Determine security requirements
 - Determine QoS requirements
 - Determine redundancy requirements
 - Summary of recommendations
- Guidelines for core and distribution layer IRF
- Activity—Design the core/distribution layer
 - Facilitator demonstrator: Select a fabric
- Discussion topics
- Assess connection needs at the core
- Determine core router requirements
 - Choose between core routers and 10G routing switches
 - Choose a core router
- Discussion topics
- Select management solutions
 - Simple management
 - Centralized enterprise management
 - Business optimization
- Select the correct IMC platform
- Add appropriate modules
- Summary
- Learning check

Module 4: Designing VLANs and Basic Routing for HPE FlexCampus Solutions

- Objectives
- Discussion topics
- Design VLANs
- Create access categories for security purposes
- Create access categories for devices that need special treatment
- Limit the broadcast domain
- Example design for core routing
- Assign logical VLAN IDs
- Choose appropriate network sizes
- Choose logical network addresses
- Assign contiguous network addresses
 - Preparing for route summarization
 - Preparing for ACLs
 - Using contiguous blocks
 - Optional activity
- Activity—Plan VLANs for a case study
 - Scenario
 - Activity
- Example design with access layer routing
- Discussion topics
- Core routing with traditional technologies
- Access layer routing in a two-tier design
- Core routing with distributed trunking
- Core routing with IRF
- Options for other topologies
- Activity—Compare routing options
- Discussion topics
- Assigning users to different VLANs
- VLAN assignment strategies
 - Static
 - Dynamic
- Dynamic VLANs with core routing
- Activity—Plan a large dynamic VLAN
 - Activity
- Discussion topics
- Design IPv6 addressing
- Activity: Review strategies for migrating to IPv6
- Summary
- Learning check

Module 5: Designing FlexBranch Solutions

- Objectives
 - HPE FlexBranch reference architectures
 - Determine branch router requirements
 - Select type
 - Physical connections and performance
 - Layer 3 services
 - High availability features
 - Security features
 - Management features
 - Branch-in-a-box solutions
 - Background on WAN connections
 - Leased lines
 - Traditional shared lines
 - Virtual dedicated lines
 - Activity—Plan FlexBranch solutions
 - Scenario
 - Assess branch solutions
 - Assess main office WAN router options
 - Alter the solution for a new scenario
 - Plan VLANs and IP addressing across multiple sites
 - Optional activity—Plan VLANs for more complicated routed topologies
 - Scenario
 - Make a general plan
 - Add appropriate modules
 - Summary
 - Learning check
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Module 6: Designing Routing for HPE FlexNetwork Solutions

- Objectives
- Discussion topics
- Design the OSPF areas
- Design router IDs
- Enabling OSPF on networks
 - Interfaces that connect to other OSPF routers
 - VLAN interfaces that support endpoints
- Ensure logical intra-area OSPF costs
- Design area summaries
 - ASBR summaries
- Activity—Design OSPF
 - Scenario
 - Activity
- Discussion topics
- Evaluate multicast traffic flow
 - Supplement on IGMP
- Design multicast routing
- Design PIM-SM
- Limit multicast scope
- Optional activity—Consider multicast design
 - Scenario 1
 - Activity
 - Scenario 2
 - Activity
- Summary
- Learning check

Module 7: Designing HPE Unified Wired-WLAN Solutions

- Objectives
- Discussion topics
- Design the RF coverage
 - Identify devices and their requirements
- Bring Your Own Devices (BYOD)
- 802.11 standards.
 - Identify users and their requirements
- Where and when users will access the network
- User and device density
- Users' applications and usage patterns
- Information about existing wireless networks
- Future plans
- Documentation
 - Site survey basics
- Site survey kit
- Site survey practices
 - Select wireless products
- Controlled AP or autonomous AP solution
- Selecting controllers
- Selecting management solutions
- General characteristics
- Radio type
- Wireless security role
- Summary of recommendations
- Supplement on 802.11ac
 - Bill of materials and finalizing the product plan
- Example
 - HPE Unified Wired-WLAN Wi-Fi Clear Connect
 - HPE Unified Wired-WLAN RMM DFS
 - HPE Unified Wired-WLAN RMM TPC
- Supplement: The effects of APs operating on the same channel
 - HPE Unified Wired-WLAN load balancing
 - Enhancing wireless performance with HPE Unified Wired-WLAN solutions
 - Activity—Select HPE wireless products
 - Scenario
- Select APs
- Identify relevant benefits of HPE Unified Wired-WLAN controllers
 - Discussion topics
 - Plan wireless meshing
- Overview of WLAN setup on HPE Unified Wired-WLAN solutions
- Plan WLANs
- Examples
 - Plan WLAN security for employees and controlled devices
 - Discussion topics
 - Plan how wireless traffic enters the LAN
 - VLAN assignment plan
- Static VLANs (One-per-WLAN)
- Static VLANs (One-per-WLAN and AP group)
- Dynamic (RADIUS-based) VLANs
 - Traffic distribution plan
- Centralized
- Distributed
- Hybrid
- Choosing a model
 - Introduction to scenarios
 - Wireless distribution: Scenario 1
 - Wireless distribution: Scenario 2
 - Wireless distribution: Scenario 3
 - Wireless distribution: Scenario 3 alternative solution 1
 - Wireless distribution: Scenario 3 alternative solution 2
 - Wireless distribution with access or distribution layer routing
 - Branch office mobility solutions
- Centralized solutions
- Distributed solutions
- Resilient distributed solutions
 - Activity—Plan WLANs
- Scenario
- Plan WLANs
 - Summary
 - Learning check

Module 8: Designing Security for HPE FlexCampus and FlexBranch Solutions

- Objectives
 - Discussion topics
 - Port-based access control
 - Plan for no or minimal security
 - Plan 802.1X authentication—Authentication server
 - A company with a Windows domain
 - Other companies
 - Plan 802.1X authentication—Entities and credentials
 - Windows computer authentication
 - Password versus certificate authentication
 - Plan 802.1X authentication—Policies
 - Discussion topics
 - Need for BYOD and BYOD approaches
 - Challenges in containing and controlling BYOD
 - HPE BYOD solutions
 - HPE BYOD solution features
 - Guest solutions
 - Guest solution 1
 - Guest solution 2
 - Alternatives
 - Plan support for endpoint integrity
 - Reference materials
 - Activity—Plan 802.1X and port-based security
 - Scenario 1
 - Plan 802.1X for a wireless solution
 - Consider credential options
 - Scenario 2
 - Discuss 802.1X for edge ports
 - Discuss port security
 - Scenario 3
 - Make a list of additional security measures
 - Discussion topics
 - Plan for data security
 - Options for protecting data
 - Guidelines for server-and application-based data security
 - Discussion topics
 - Secure management access and communications
 - Guidelines for SSH
 - Guidelines for HTTPS
 - Ensure physical security
 - Recommendations for physical security
 - Recommendations for physically insecure devices
 - Options for manager authentication
 - Optional activity—Compare options for manager authentication
 - Local advantages
 - Local disadvantages
 - RADIUS advantages
 - RADIUS disadvantages
 - TACACS+ advantages
 - TACACS+ disadvantages
 - Summary
 - Learning check
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Module 9: Designing QoS and High Availability for HPE FlexNetwork Solutions

- Objectives
 - Discussion topics
 - Review traffic classification
 - Example QoS solution
 - Place traffic in the proper queue—Example solution
 - Configure appropriate scheduling
 - Strict priority (SP)
 - SP with guaranteed minimum bandwidth (GMB)
 - Weighted Round Robin (WRR)
 - Weighted Fair Queuing (WFQ)
 - Configure appropriate scheduling—Example QoS solution
 - More on planning minimum guaranteed bandwidths
 - Classify traffic—Alternative solution
 - Example QoS policy
 - Example QoS results
 - Example QoS solution for VoIP phones
 - Supplemental information: Using the Comware voice
 - VLAN command
 - Implement other QoS features
 - HPE Unified Wired-WLAN QoS
 - Implement fast roaming
 - Implement wireless multicast optimization
 - Activity—Plan QoS
 - Scenario 1
 - Ensure support for VoIP phones
 - Scenario 2
 - Plan QoS settings for a soft UC&C client
 - Scenario 3
 - Integrate with an existing solution
 - Discussion topics
 - Review device and link redundancy
 - Device redundancy
 - Redundant components
 - Plan link redundancy
 - Design spanning tree
 - Design VRRP
 - Compare IRF and VRRP as default router redundancy options
 - IRF
 - VRRP
 - Plan for routing resiliency
 - Supplemental information on OSPF graceful restart
 - Activity—Meet the customer's high availability needs
 - Scenario
 - Assess redundancy
 - More details on planning for routing resiliency
 - Activity—Plan for routing resiliency
 - Scenario
 - Assess the redundancy plan
 - Improve the redundancy plan
 - Plan for service resiliency at branches
 - Plan for ISP resiliency
 - Resilient HPE Unified Wired-WLAN solutions—1+1 hot AC-backup (active-standby)
 - Resilient HPE Unified Wired-WLAN solutions—1+1 hot AC-backup (active-active)
 - Resilient HPE Unified Wired-WLAN solutions—N+1 and N+N AC-backup
 - Resilient HPE Unified Wired-WLAN solution—Backup authentication or remote-AP
 - Optional activity—Plan for routing resiliency
 - Summary
 - Learning check
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Module 10: Evolving Data Centers

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- Objectives
 - Discussion topics
 - Virtualization
 - Hypervisor
 - Connect a VM to the data center LAN
 - Support multiple virtual NICs on a virtual switch
 - Supplemental information about port groups
 - Create virtual switch NIC teams
 - Load balance with NIC teaming
 - Virtual switch NIC teaming—Physical switch Perspective
 - Implement VLANs with a virtual switch
 - External Switch Tagging (EST)
 - Virtual Switch Tagging (VST)
 - Virtual Guest Tagging (VGT)
 - Virtual server VLANs—Physical switch perspective
 - Multiple vNICs on the same VM
 - Summary of rules for VMware standard virtual switches
 - VMkernel adapter
 - vMotion
 - vMotion recommendations
 - Distributed virtual switch
 - Additional capabilities of distributed switches
 - Microsoft Hyper-V virtual switch
 - EVB/VEPA or 802.1Qbg
 - Activity—Review virtual network connections
 - Scenario
 - Activity
 - Activity: Discuss virtual switches
 - Discussion topics
 - SDN and innovation
 - OpenFlow
 - SDN structure
 - Example SDN scenario
 - Example SDN implementation
 - How to set up OpenFlow instances on ProVision switches
 - How to set up OpenFlow instances on Comware switches
 - How switches process traffic in OpenFlow VLANs
 - How the SDN controller programs flows
 - Results in the example
 - SDN adoption and implementation
 - Discussion topics
 - Data center use models
 - What is a cloud?
 - Summary
 - Learning check
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Module 11: Designing HPE FlexFabric Solutions

- Objectives
- High-level data center architecture
- Business drivers in the data center
- Discussion topics
- Power
- HPE innovations
 - Cooling and airflow
 - Physical space and cabling
 - Discussion topics
 - Plan server connections
 - Plan redundancy for server connections
 - Plan iLO connections
 - Place access layer switches for rack-mounted servers: ToR
 - Place access layer switches for rack-mounted servers: EoR or MoR
 - ToR versus EoR
 - Discussion topics
 - Design VLANs for data centers
 - Plan how VLANs extend to server ports
 - Plan VLANs in a traditional 3-tier network
 - Challenges when using the traditional design in virtualized environments
 - HPE FlexFabric solution for a virtualized data center
 - Identify environments that need a large Layer 2 solution
 - Extending Layer 2 further
 - HPE solutions for extending Layer 2
- Supplemental information: MPLS Layer 2 VPNs/ VPLS
- Supplemental information: TRILL
- Supplemental information: SPBM
 - How IRF enhances the solutions
 - Discussion topics
 - Need to connect multiple data centers at Layer 2
 - HPE solution—EVI
 - Need to isolate segments
 - HPE solution—MDC
- HPE MDC and EVI
 - Need to enhance visibility and control for VM-to-VM traffic
 - Solution—HPE 5900v, 59X0 Series, and IMC VAN CM
 - Discussion topics
 - Select data center access layer switches
 - Select data center core switches and modules
 - Select IMC modules
 - Solutions for customers evolving toward the private cloud
- Supplemental information on HPE CloudSystem
 - Activity—Consider HPE FlexFabric design
- Scenario
- Select appropriate switches
- Plan edge connectivity
- Consider the topology
- Consider reasons for adding switches to the rack
- Consider QoS
- Consider management solutions
- Brainstorm facility requirements
 - Summary
 - Learning check

Module 12: Integrating and Finalizing the HPE Network Solution

- Objectives
- Discussion topics
- Consider integration when expanding the edge
- Consider integration when adding sites
- Activity—Plan an expansion
- Scenario
- Plan the expansion
- Discussion topics
- Ensure interoperability with network infrastructure devices
- Assess the impact
- Plan how to deal with proprietary protocols
- Example Layer 2 interoperability
- Case 1
- Case 2
 - Example Layer 3 interoperability
 - Support non-IP devices
 - Activity—Consider interoperability with other vendor products
- Scenario
 - Make a plan for interoperability
 - Discuss interoperability concerns
 - Discussion topics
 - Fill gaps with HPE alliance partner solutions
 - Enhance the FlexFabric solution with F5 Networks—HPE Alliance
 - example 1
 - Deliver an end-to-end UC&C solution—HPE Alliance example 2
 - Evaluate the plan
 - Assess the customer operational capabilities
 - Activity—Evaluate plans
 - Proposal
 - Activity
 - Optional activity—Add care packs and services
 - Scenario
 - Explore care packs
 - Summary
 - Learning check

Course data sheet

Module 13: Implementing HPE Network Solutions

- Objectives
 - Discussion topics
 - Work within the customer's operational and governance frameworks
 - Consider scenarios
 - Evaluate the impact of the implementation
 - Divide the project into phases
 - Example of a phased migration
 - Discussion topics
 - Assign roles and tasks
 - Conduct proof of concept and other pre-tests
 - Demonstrations
 - Pre-tests of the design
 - Create a rollback plan
 - Consider the implementation strategy
 - Plan tests for the implementation
 - Schedule an outage
 - Prepare for the installation
 - Complete physical work
 - Create and load router and switch configurations
 - Ready VMs and physical servers
 - Manage physical constraints
 - Discussion topics
 - Documentation checklists
 - Conduct UATs
 - Identify ongoing opportunities
 - Activity—Discuss implementation strategies
 - Activity debrief
 - Summary
 - Learning check
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