Purpose of the exam prep guide

The intent of this guide is to set expectations about the content and the context of the exam and to help candidates prepare for the exam. In this guide, you will find recommended HP training courses, reference and study material help you achieve a successful passing score.

Studies conducted by HP and Prometric show that a combination of course attendance and self-study maximizes the likelihood of passing the exam on the first attempt.

Audience

This exam is for personnel supporting HSG80-based products with minimum 6 months experience in an HSG80 support role.

Examples of job roles:
- HP AIS support engineer
- HP Channel Partners supporting HP storage products (e.g., engineers who perform warranty and installation services)

General areas of content include:
- StorageWorks products and solutions fundamentals
- HP product and solutions portfolio
- Planning and design approaches for successful deployment of HP StorageWorks solutions
- Installation, configuration, and startup and upgrade procedures
- Performance tuning and solution optimizing
- Troubleshooting and repair practices and procedures
- Administration and operation of solutions
Certification requirements

The Supporting the Modular Array (MA) Storage Family (HP0-239) exam is a core requirement for the Accredited Integration Specialist + MA credential.

This level of certification is targeted for individuals who provide configuration, installation, warranty support and/or operational support for the Modular Array (MA) product family.

Prerequisites

- HP Accredited Integration Specialist - Storageworks

Exam details

At the beginning of the exam, you will be asked to answer some survey questions. The survey questions are designed to assist the exam development team in accurately profiling test results and to improve future exams.

The following are details about the exam

- **Number of items**: 69
- **Item types**: Multiple choice and drag-and-drop
- **Time commitment**: 90 minutes
- **Passing Score**: 71% (raw score of 49)
- **Reference Material**: No on-line or hard copy reference material will be allowed at the testing site.

Comments on the exam

After the exam has been completed, there is an additional 15 minutes allotted for participants to make specific comments about the test or survey items, (i.e., accuracy, appropriateness to audience, etc.). HP welcomes these comments as part of our continuous improvement process.

Exam Registration

This exam is available at [Prometric](https://www.prometric.com).

Exam content

The following testing objectives represent the specific areas of content covered in the exam. Use this outline to guide your study and to check your readiness for the exam. The exam measures your understanding of these areas.

**Supporting the Modular Array (MA) Storage Family (HP0-239)**

1.0 Define StorageWorks products and solutions fundamentals.
Describe and give examples of terms and functionalities within a SAN environment

- Topologies

Identify the storage virtualization techniques on the various levels within a storage solution

- Physical Disk (LBNs)
- RAID (Logical drives)
- Snapshot and clones (Point-in-time copies of logical drives)

Describe availability concepts for the listed components:

- Disk (RAID)
- Controller (Redundant hardware components, active/passive, or active/active)
- Paths (Multipathing with failover capability)
- Sites (Data replication, controller or host-based)
- Data (Backup)

Identify the different RAID levels and describe the differences in aspect of availability, cost and performance

- 1.5.1 RAID 0
- 1.5.2 RAID 1
- 1.5.3 RAID adaptive 3/5
- 1.5.4 RAID 0+1

Define the criteria for selecting a particular RAID level in aspect to the I/O characteristic

- Random I/O
- Sequential I/O

List and describe Fibre Channel (FC) interconnect technologies used in association with the HP StorageWorks products

- Identify FC as one of the serial interconnects within SCSI-3
- List the key attributes of FC:
  - Standards
  - Best of network and channel architecture features
  - Serial transport
  - Layered design
  - The ability to be used with other layered protocols:
    - SCSI
    - TCP/IP
• High reliability and availability

Give examples of the different physical implementations of FC links and describe the different characteristics:

• Multimode fibre
• Single mode fibre
• Copper

Describe the optical characteristics of a fibre optic link:

• Attenuation
• Dispersion
• Step index compared to grade index fibre
• Latency on fibre links
• Microbending, minimum radius

Describe the function and characteristics of the interconnect components:

• 1.9.5.1 GBIC, GLM
• 1.9.5.2 Transceiver SFF, SFP
• 1.9.5.3 SC, LC connector

Describe the different topologies. Include associated interconnect hardware, characteristics, and the resulting port types.

• Point-to-point
• Loop
• Fabric

Describe the loop initialization process and the resulting configuration constraints

Describe the layered protocol structure of FC

Describe the different classes of service and the impact for the data transmission

Describe the Fabric- and Port-logon process

Describe the WWID concept and the mapping to Port-Target-LUN

2.0 Describe the HP product and solutions portfolio and where it is used

Describe the differences between the various HP StorageWorks products and solutions and how they combine to fulfill ENSA Extended.

Describe the features and benefits of HP OpenView software solutions and components including methodologies for implementation, restrictions or limitations

• Storage Area Management
• OpenView Storage Area Manager
  ▪ Node Manager
  ▪ Accountant
  ▪ Allocator
  ▪ Optimizer
  ▪ Builder

• Provisioner
• Command View/HSG Element Manager

■ Data Management
  • Data Protector
  • Media Operations
  • EBS

■ Availability Management
  • Multipathing
  • Array-based local replication
  • Array-based remote replication
  • Host-based replication
  • Network-based replication

■ Storage Virtualization
  • Virtual Replicator
  • CASA
  • Modular Array

■ CASA Continuous Access Storage Appliance
  • Replication
  • Virtualization

Describe the features and benefits of HP Network Storage Solutions and components including methodologies for implementation, restrictions or limitations

■ NAS
■ MSA1000
■ Virtual Array VA7x10
■ Modular Array 8000, 12000, 16000
■ Enterprise Virtual Array EVA5000, EVA3000
■ HP-XP
Describe the features and benefits of HP Infrastructure Solutions and components including methodologies for implementation, restrictions or limitations

- iSCSI router
- B Series switches
- C Series switches
- M Series switches

Describe the features and benefits of HP Storage Services and methodologies for implementation, restrictions or limitations

- Design
- Build
- Integrate
- Manage
- Evolve

3.0 Plan and design to successfully deploy StorageWorks solutions

Describe the steps and approaches to proper planning and designing of the storage subsystem to meet customer capacity requirements.

- Describe how RAID levels on the Modular Array affect your usable capacity.
  - Stripe set
  - Mirror set
  - RAID set

Describe the steps and approaches to proper planning and designing of the Modular Array subsystem to meet customer performance requirements.

- Describe the key factors that impact performance and availability of the disk subsystem
  - Mixing of disk speeds and capacities
  - Implication of the number of physical disks within a LUN
  - Implication of the number of physical disks on a bus.

- Describe how RAID levels on the Modular Array affect your system performance.
  - Stripe set
  - Mirror set
  - RAID set

- Describe how different Modular Array configurations impact performance of the disk system.
  - Demonstrate the impact of using LUN offsets.
- Describe the effect of distributing the disks of a LUN over different busses.

- Describe how the background disk activities affect performance of the Modular Array subsystem
  - Snapshots
  - Clones
  - Failed drive rebuild

- Describe how the host configuration and architecture affect performance of the disk subsystem.

- Describe the effect of disk subsystem design on performance related to the different application types

Describe the steps and approaches to proper planning and designing of the Modular Array subsystem to meet customer high-availability requirements.

- Describe how RAID levels on the Modular Array affect your availability
  - Stripe set
  - Mirror set
  - RAID set

- Describe how different Modular Array configurations affect availability of the disk system.
  - Describe the affect of distributing the disks of a LUN across busses.
  - Concatenation

- Describe the parameters required to identify mission-critical data and the level of hardware and software redundancy to support minimal operational interruptions.
  - How to apply configuration restrictions (example: cable lengths)
  - Identify the different Drive Rebuild/Priority options.
  - Describe the purpose of online spares:
    - Online spare
    - Automatic spare

- Describe the Modular Array technologies and methodologies that enable redundant controller configurations.
  - Describe the functionality of Transparent Failover.
  - Describe the purpose of Multibus Failover.

- Describe the Modular Array technologies and methodologies that enable redundant data path configurations.
- Describe the software necessary for LUN presentation of the Modular Array under multipath conditions:
  - Windows
  - UNIX
  - OpenVMS
- Describe the different objectives of multipath configurations
- Describe the various Modular Array data replication methods and provide a brief explanation of each.
  - Snapshots
  - Clones
  - Data Replication Manager
- Describe how the disk cache architectures, implementations, and configurations impact the I/O performance
  - OS dependent
  - Hardware dependent
- Describe the enhanced support for backup and restore provided by the Modular Array
  - Snapshot
  - Clones
- Describe the need for zoning technologies
- Identify the appropriate ACS firmware version regarding the customer requirements (P-L-S-F-G)
4.0 Perform installation, configuration, startup, and upgrade procedures
- Recognize the configurations and hardware components associated with the MA/EMA
  - Identify the different Modular Array models
    - RA8000, ESA12000
    - MA6000, MA8000, EMA12000, EMA16000
  - Identify the various Modular Array configuration and capacities
    - MA6000
    - MA8000
    - EMA12000
    - EMA16000
  - Identify the Modular Array controller items and components
- HSG60, Cache, Battery Backup, Fans, EMU, PDU, OCP, Power Supplies
- HSG80, Cache, Battery Backup, Fans, EMU, PDU, OCP, Power Supplies

**Identify and install the supported disks and disk enclosures**
- Disk Enclosure 42xx,43xx
- Disk Enclosure BA370
- SBB Disk
- StorageWorks Universal Disks

**Describe Multi-Port Failover or Transparent Failover configurations**
- Cabling

**Identify the required power distribution requirements.**
- RA8000 N+1 or 2N
- MAX000
- MA and Disk Enclosure AC power distributions

**Identify the Modular Array controller and controller components**
- Identify the controller bezel
- Identify the controller blowers
- Locate and describe the cache battery assembly installation procedure
- Locate and identify the HSG Controller operator control panel features
- Recognize how to input data with the HSG operator control panel
- Identify the FC transceiver connections and functions
- Describe the Status LEDs of the MA and RA controller
- Describe the status indicators and LEDs of the MA and RA EMU
- Describe the meaning of the MA and RA power supply LEDs

**Identify the Management Appliance requirements.**
- Identify and perform procedures used to update the SWMA.
- Recognize the physical attributes of the SWMA versions.
- Recognize and identify the SWMA software architecture.
- Demonstrate the ability to access the SWMA through the Remote Insight Board
- Demonstrate the ability to access the SWMA through the Microsoft Terminal Services
- Demonstrate the ability to access the SWMA through a web browser using the default passwords
- Demonstrate the knowledge and ability to restore the SWMA using the Restore CDs
- Demonstrate the knowledge and ability to change Network settings on the SWMA

Explain and demonstrate the use of the various Modular Array configuration utilities and tools
- Command Line Interface and associated utilities
- SW Command Console "SWCC" GUI
- Steam Agent, integration into CIM
- LPUTIL (KGPSA)
- QLogic View

List the steps in the correct sequence for power on, hardware component configuration, or firmware upgrade of the Modular Array
- Sequence the steps in the Modular Array storage subsystem installation and power up/down procedure.
- Sequence the steps to configure FC adapter boards with storage devices, in proper order
- Describe the controller considerations—connection table—on Modular Array SSP
- Identify and perform procedures used to do code load firmware upgrades on the Modular Array.

Describe the boot, initialization and configuration sequence on a Modular Array storage subsystem.
- Boot sequence
- MA Initialization sequence
  - Describe the initial steps to setup the HSGxx Controller
  - Describe the initial steps to introduce SBBs or Universal Disks
  - Describe the initial steps to configure disks into an disk array
  - Describe the initial steps to present disk arrays as LUNs
- Configuration sequence
  - Describe how to view and change properties of the HSGxx controller
  - Describe how to view and change properties of the disk arrays
  - Demonstrate the ability to delete or move a disk array and describe the implications
• Demonstrate the ability to scan host bus adaptors and administrate the host connection table
  ◆ Demonstrate the ability to set up LUN masking — Offset
  ◆ Demonstrate the ability to set up LUN mapping — SSP
  ◆ Access to all by default
• Demonstrate the ability to create a Disk Array, associate it with cache attributes, and present it to a host or a group of hosts
• Demonstrate the ability to create snapshots and clones within the Modular Array environment.
• Describe the command line interface and its relationship to the Modular Array structure, and obtain information regarding the configuration of the Modular Array

Demonstrate how to use the HP Software support matrix for the operating System Components
■ Recognize Server support for the Modular Array
  • Operating systems boot support with the Modular Array
    ◆ WWIDMGR
  • Secure path version support
  • DRM version support
  • HBA Firmware and driver support on supported platforms
  • GUI support by operating system — CIM, SWCC
  • FC switch support for the Modular Array
  • Demonstrate the knowledge to collect all necessary preliminary information for the Modular Array storage system configuration
  • Supported single path configuration
■ Recognize service offerings
  • Installation and startup services:
    ◆ Basic Post Warranty Services
    ◆ SAN implementation services

5.0 Perform proper performance tuning and optimize the solution
Analyze the steps and approaches to properly tune or optimize the Modular Array subsystem to meet customer requirements.
■ Inspect the performance of the subsystem configuration
  • DILX
  • VTDPY
■ Inspect Storage Set configuration
• RAID Level
• Chunk Size

Set the appropriate parameters to configure the controller behavior on behalf of the customers needs.

• Settings for single or dual-controller configurations
• Settings for Transparent or MultiBus Failover Mode
• Storage Set settings
• Set the caching parameters

Configure drive enclosures to meet the requirements.

■ Disk drive size used
■ Performance of the disk drives
■ Configuration of the enclosure buses
■ Mixing Ultra2 and Ultra3 drives in consideration of the Controller SCSI Buses

Analyze the host configuration and interconnects relying on the environment.

■ Arbitrated Loop
  • Single pathing
  • Dual pathing
■ Switched Fabric
  • Single pathing
  • Dual pathing
■ Describe and interpret Secure Path Configuration
  • Maximum paths
  • Maximum LUNs
  • Load distribution
  • Load balancing
  • Preferred controller

6.0 Perform proper troubleshooting and repair practices and procedures

Given a problem scenario, identify the cause of a MA storage subsystem problem.

■ Describe utilities and tools that should be used and common questions that should be asked when determining a customer MA storage problem.
■ Identify which information to collect for support if the problem cannot be solved
List common symptoms for MA storage-related problems.

- List common visual symptoms for MA storage-related problems
  
  - Identify and determine environmental problems as causes for storage system failures
- Determine if a given problem is hardware or software related.
  
  - List and perform the steps for logical troubleshooting on the MA
- Identify common errors, interpret operating system and diagnostic messages, and identify the failed components for a given MA problem.
  
  - Interpret system LED messages
    
    - MA controller
    - EMU module
    - ECB module
    - Fan module
    - Power supply module
    - Disk drive indicator
  
  - Display messages
  
  - Audible alarms
- Describe how to retrieve and interpret driver messages
  
  - Interpret host error log events and operating system messages to analyze storage subsystem errors and isolate fault conditions.
  
  - Interpret CIM alarms and SWCC error messages.

Given a problem scenario, choose the best method to repair or replace the defective subsystem or components.

- HBA replacement
- Connection table
- Disk replacement
- Cache battery
- TPRLO
- Unflushed cache data
- Controller replacement with different setup options

7.0 Administer and operate the solution

Identify the system components used to access the storage system

- Storage System
- Management Appliance
- System with a supported web browser/GUI
Describe how to verify the operational state of the storage system
- Describe the possible error indications on the OCP
- Describe how to verify the operation of already-configured logical drives
- Describe how to check that there are sufficient system resources available to change or extend the configuration

Describe how to verify the operational state of the Management Appliance
- Describe how to access the Appliance through the web browser
- Identify how the error reporting environment is set on the appliance

Identify the steps to access the storage system with the GUI
- Describe how to launch SWCC
- Describe the setting of the system options
  - Save configuration — single controller environment
- Describe how to identify that the storage system is currently managed by another management appliance

Describe how to access the storage system with the CLI
- List reasons to use the CLI instead of the GUI to operate the storage system

Describe the logical steps to configure a LUN and present it to a host
- Describe the options to create storage sets
- Describe the options to manage hosts connections
- Describe the options to manage LUNs
- Re-creation of an existing LUN/storage system

Describe the logical steps and options to create snapshots and clones

Recommended training and study references

This section lists training courses and documents that can help you acquire a majority of the knowledge and skills needed to pass the exam. You must also gain the practical experience outlined in this guide

You are not required to take the courses listed in this section. However, HP strongly recommends that you attend the classes, participate in class labs, and thoroughly review all course material and documents before taking the exam, even if you believe you have sufficient on-the-job experience.
Instructor-led training

Use the information in this guide and the practical experience you have gained to determine your need for the instructor-led training.

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Web-based training

Self-paced training and technical documentation may provide appropriate learning alternatives to instructor-led training for more experienced candidates.

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**Documentation and other reference material**

A comprehensive list of documentation and references is provided in the training material.

**Sample Test Items**

The sample test items give you a preview of what the actual test items will look like. It is important to note that these items WILL NOT be on the exam itself; however, they are representative of the actual items and they should help you become familiar with the format and complexity of the test items. These sample test items are not a check for readiness.

1. Which storage solution best describes the EMA12000?
A. virtualized storage  
B. entry-level direct attached storage  
C. NAS  
D. storage consolidation

2. Which replication technology will have useful data after a failure of the production volume?  
   A. Virtual Replicator  
   B. preallocated snapshots  
   C. clones  
   D. capacity free snapshots

3. The default password for the administrator account on the Management Appliance is ______ with any alpha-character from the serial number capitalized.  
   A. admin followed by the last six digits of the serial number  
   B. admin followed by the last six digits of the serial number reversed  
   C. Admin followed by the last six digits of the serial number reversed  
   D. Admin followed by all digits of the serial number reversed.

4. The port ID of an HSG80 controller port is ______.  
   A. combined from the host WWN and the node ID  
   B. automatically assigned during the boot process  
   C. printed on a tag at the bottom of the cabinet  
   D. constructed from the WWN of the controller by adding the specific port number

5. In Transparent Failover mode, logical units are handled by the ______.  
   A. surviving controller and the host software  
   B. features of Secure Path  
   C. features within the host operating system  
   D. surviving controller, invisible to the hosts

6. You are unable to clone a storageset unit. What is a possible cause?  
   A. Firmware is an ACS subversion G or F.  
   B. Storageset is of type MIRRORSET.  
   C. Storageset is of a type STRIPESET.
D. Storageset is of a type RAIDSET.

7. What is the only recommended environment in which to use the SAVE_CONFIGURATION parameter of the INITIALIZE command?
   A. single controller
   B. transparent failover
   C. multibus failover
   D. DRM

8. What is the maximum supported operating environmental temperature for a Modular Array?
   A. 82°F/28°C
   B. 86°F/30°C
   C. 95°F/35°C
   D. 140°F/60°C

9. An EMA 16000 storage enclosure provides a maximum of _____ drive shelves. Select TWO.
   A. 6 model 4354
   B. 6 model 4314
   C. 12 model 4314
   D. 12 model 4354
   E. 16 model 4314

10. Unit D2 on your MA8000 is a RAID 0+1 set using the stripeset S1, which consists of two mirrorsets M1 (DISK10000, DISK20000) and M2 (DISK10100, DISK20100). To list the stripesize used by the RAID 0+1 set, you use the CLI command _____.
    A. SHOW D2
    B. SHOW M1
    C. SHOW M2
    D. SHOW S1

Answers:
1. D 5. D 9. C, D
Conclusion

HP wishes you success in the HP Certified Professional Program and in passing the exam for which you are preparing.