Contents

Introduction xxii

Assessment Test li

Chapter 1 Server Hardware 1
Server Form Factors 3
Rack Mount 3
Tower 6
Blade Technology 7
Installing and Configuring Server Components 11
CPU 11
RAM 16
Bus Types, Bus Channels, and Expansion Slots 19
NICs 21
Hard Drives 22
Riser Cards 25
RAID Controllers 26
BIOS/UEFI 26
Firmware 28
USB Interface/Ports 28
Hot-Swappable Component 29
Maintaining Power and Cooling Requirements 29
Power 29
Cooling 34
Summary 37
Exam Essentials 37
Review Questions 39

Chapter 2 Installing and Configuring Servers 43
Installing and Configuring Server Operating Systems 45
Determining the Server Role/Purpose 45
Updating Firmware 46
BIOS/UEFI Configuration 46
Disk Preparation 49
Configuring Hostnames 54
Local Account Setup 55
Connecting to the Network 56
Joining a Domain/Directory 56
Addressing Security Concerns 57
Enabling Services 58
Installing Features, Roles, Applications, and Drivers 60
Performance Baseline 60
Unattended/Remote Installations 63
Using Access and Control Methods to Administer a Server 66
Local Hardware Administration 66
Network-Based Hardware Administration 69
Network-Based Operating System Administration 71
Purpose and Operation of Virtualization Components 73
Hosts and Guests 73
Management Interface for Virtual Machines 74
Hypervisor 74
Hardware Compatibility List 77
Resource Allocation Between Guest and Host 78
Summary 85
Exam Essentials 85
Review Questions 87

Chapter 3  Server Maintenance 91
Server Roles and Requirements 93
Web Server 93
Application Server 94
Directory Services Server 95
Database Server 96
File Servers 96
Print Server 97
Messaging Server 98
Mail Server 98
Routing and Remote Access Service (RRAS) Server 98
Network Services Server 99
Proper Server Maintenance Techniques 100
Change Management 101
Patch Management 101
Outages and Service-Level Agreements 104
Performance Monitoring 105
Hardware Maintenance 108
Fault Tolerance and High Availability Techniques 120
Asset Management and Documentation 123
Asset Management 123
Documentation 125
Secure Storage of Sensitive Documentation 129
Summary 130
Exam Essentials 130
Review Questions 131
<table>
<thead>
<tr>
<th>Chapter 4</th>
<th>Storage Technologies</th>
<th>135</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hardware and Features of Various Storage Technologies</td>
<td>136</td>
</tr>
<tr>
<td></td>
<td>Direct Attached Storage (DAS)</td>
<td>136</td>
</tr>
<tr>
<td></td>
<td>Network-Attached Storage (NAS)</td>
<td>136</td>
</tr>
<tr>
<td></td>
<td>Storage Area Networks (SANs)</td>
<td>137</td>
</tr>
<tr>
<td></td>
<td>Using iSCSI and FCoE</td>
<td>140</td>
</tr>
<tr>
<td></td>
<td>JBOD</td>
<td>142</td>
</tr>
<tr>
<td></td>
<td>Tape</td>
<td>142</td>
</tr>
<tr>
<td></td>
<td>Optical Drive</td>
<td>144</td>
</tr>
<tr>
<td></td>
<td>Flash, Compact Flash, and USB Drive</td>
<td>144</td>
</tr>
<tr>
<td></td>
<td>Installing and Deploying Primary Storage Devices</td>
<td>144</td>
</tr>
<tr>
<td></td>
<td>Disk Specifications</td>
<td>144</td>
</tr>
<tr>
<td></td>
<td>Interfaces</td>
<td>146</td>
</tr>
<tr>
<td></td>
<td>Hard Drive vs. SSD</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>Summary</td>
<td>152</td>
</tr>
<tr>
<td></td>
<td>Exam Essentials</td>
<td>152</td>
</tr>
<tr>
<td></td>
<td>Review Questions</td>
<td>153</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chapter 5</th>
<th>Identifying Capacity and Fault Tolerance Requirements</th>
<th>157</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Calculating Appropriate Storage Capacity and Planning for Future Growth</td>
<td>158</td>
</tr>
<tr>
<td></td>
<td>Base 10 vs. Base 2 Disk Size Calculation</td>
<td>158</td>
</tr>
<tr>
<td></td>
<td>Disk Quotas</td>
<td>159</td>
</tr>
<tr>
<td></td>
<td>Compression</td>
<td>160</td>
</tr>
<tr>
<td></td>
<td>Capacity Planning Considerations</td>
<td>160</td>
</tr>
<tr>
<td></td>
<td>Configuring RAID</td>
<td>164</td>
</tr>
<tr>
<td></td>
<td>RAID Levels and Performance Considerations</td>
<td>165</td>
</tr>
<tr>
<td></td>
<td>Software vs. Hardware RAID</td>
<td>167</td>
</tr>
<tr>
<td></td>
<td>Configuration Specifications</td>
<td>169</td>
</tr>
<tr>
<td></td>
<td>Hot-Swap Support and Ramifications</td>
<td>171</td>
</tr>
<tr>
<td></td>
<td>Hot Spare vs. Cold Spare</td>
<td>171</td>
</tr>
<tr>
<td></td>
<td>Array Controller</td>
<td>171</td>
</tr>
<tr>
<td></td>
<td>Summary</td>
<td>173</td>
</tr>
<tr>
<td></td>
<td>Exam Essentials</td>
<td>173</td>
</tr>
<tr>
<td></td>
<td>Review Questions</td>
<td>174</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chapter 6</th>
<th>Securing the Server</th>
<th>179</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Physical Security Methods and Concepts</td>
<td>180</td>
</tr>
<tr>
<td></td>
<td>Multifactor Authentication</td>
<td>180</td>
</tr>
<tr>
<td></td>
<td>Security Concepts</td>
<td>181</td>
</tr>
<tr>
<td></td>
<td>Server Hardening Techniques</td>
<td>187</td>
</tr>
</tbody>
</table>
OS Hardening 187
Endpoint Security 189
Remediating Security Issues Based on a Vulnerability Scan 190
Hardware Hardening 192
Proper Environmental Controls and Techniques 196
Power Concepts and Best Practices 197
Safety 206
Summary 215
Exam Essentials 215
Review Questions 216

Chapter 7 Securing Server Data and Network Access 221
Basic Network Security Systems and Protocols 222
  Firewall 222
  Network Access Control 226
  Router Access List 228
  NIDS 229
  Authentication Protocols 229
  PKI 230
  VPN 232
  IPsec 232
  VLAN 233
  Security Zones 234
Logical Access Control Methods 235
  Access Control Lists 235
  Permissions 240
Data Security Methods and Secure Storage Disposal 243
  Techniques 243
  Storage Encryption 243
  Storage Media 245
Summary 247
Exam Essentials 247
Review Questions 248

Chapter 8 Networking 253
Configuring Servers to Use IP Addressing and Network Infrastructure Services 255
  IPv4 vs. IPv6 255
  Default Gateway 256
  CIDR Notation and Subnetting 256
Public and Private IP Addressing 257
Static IP Assignment vs. DHCP 258
DNS 259
Chapter 9  Disaster Recovery 293

Disaster Recovery Principles 294
Site Types 294
Replication Methods 295
Continuity of Operations 297
Backup 298
Methodology 299
Backup Media 304
Media and Restore Best Practices 305
Media Storage Location 307
Chapter 10  Troubleshooting Hardware and Software Issues 315

Troubleshooting Theory and Methodologies 317
  Identifying the Problem and Determining the Scope 317
  Establish a Theory of Probable Cause (Question the Obvious) 319
  Test the Theory to Determine Cause 320
  Establish a Plan of Action to Resolve the Problem and Notify Impacted Users 320
  Implement the Solution or Escalate as Appropriate 320
  Verify Full System Functionality and If Applicable Implement Preventative Measures 321
  Perform a Root Cause Analysis 321
  Document Findings, Actions and Outcomes Throughout the Process 321

Troubleshooting Hardware Problems 322
  Common Problems 322
  Causes of Common Problems 328
  Environmental Issues 331
  Hardware Tools 333

Troubleshooting Software Problems 334
  Common Problems 334
  Cause of Common Problems 343
  Software Tools 348

Summary 360
Exam Essentials 360
Review Questions 361

Chapter 11  Troubleshooting Connectivity Issues 365

Diagnosing Network Problems 366
  Common Problems 366
  Causes of Common Problems 378
  Networking Tools 384

Diagnosing Security Issues 391
  Common Problems 391
  Causes of Common Problems 393
  Security Tools 399

Summary 404
Exam Essentials 405
Review Questions 406
## Chapter 12: Troubleshooting Storage Issues 411

Troubleshooting Storage Problems 412
  - Common Problems 412
  - Causes of Common Problems 418
  - Storage Tools 426
Summary 438
Exam Essentials 439
Review Questions 440

## Appendix: Answers to Review Questions 443

- Chapter 1: Server Hardware 444
- Chapter 2: Installing and Configuring Servers 445
- Chapter 3: Server Maintenance 447
- Chapter 4: Storage Technologies 448
- Chapter 5: Identifying Capacity and Fault Tolerance Requirements 450
- Chapter 6: Securing the Server 451
- Chapter 7: Securing Server Data and Network Access 453
- Chapter 8: Networking 455
- Chapter 9: Disaster Recovery 456
- Chapter 10: Troubleshooting Hardware and Software Issues 458
- Chapter 11: Troubleshooting Connectivity Issues 460
- Chapter 12: Troubleshooting Storage Issues 461

*Index* 463
# Table of Exercises

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise 1.1</td>
<td>Replacing a CPU in a Server</td>
<td>15</td>
</tr>
<tr>
<td>Exercise 2.1</td>
<td>Changing the Boot Order Using the BIOS</td>
<td>47</td>
</tr>
<tr>
<td>Exercise 2.2</td>
<td>Changing the Boot Order Using the UEFI</td>
<td>49</td>
</tr>
<tr>
<td>Exercise 2.3</td>
<td>Disabling a Service in Windows Server 2012 R2</td>
<td>59</td>
</tr>
<tr>
<td>Exercise 2.4</td>
<td>Disabling a Service in Linux</td>
<td>60</td>
</tr>
<tr>
<td>Exercise 3.1</td>
<td>Using Windows Update</td>
<td>101</td>
</tr>
<tr>
<td>Exercise 3.2</td>
<td>Replacing the Back Panel Fan in a Dell PowerEdge</td>
<td>112</td>
</tr>
<tr>
<td>Exercise 3.3</td>
<td>Changing a Drive on a Dell 1850</td>
<td>113</td>
</tr>
<tr>
<td>Exercise 3.4</td>
<td>Changing RAM in an IBM Blade Server</td>
<td>114</td>
</tr>
<tr>
<td>Exercise 3.5</td>
<td>Replacing the SCSI Backplane.</td>
<td>115</td>
</tr>
<tr>
<td>Exercise 3.6</td>
<td>Replacing the Battery in an IBM Server</td>
<td>118</td>
</tr>
<tr>
<td>Exercise 4.1</td>
<td>Installing a SATA Drive</td>
<td>150</td>
</tr>
<tr>
<td>Exercise 6.1</td>
<td>Disabling the Network Adaptor in Windows Server 2012 R2</td>
<td>193</td>
</tr>
<tr>
<td>Exercise 8.1</td>
<td>Configuring a Suffix Search List</td>
<td>260</td>
</tr>
<tr>
<td>Exercise 8.2</td>
<td>Configuring a Suffix Search List as a Policy</td>
<td>262</td>
</tr>
<tr>
<td>Exercise 8.3</td>
<td>Configuring a Server to Use a WINS Server</td>
<td>265</td>
</tr>
<tr>
<td>Exercise 8.4</td>
<td>Configuring a NIC Team</td>
<td>269</td>
</tr>
<tr>
<td>Exercise 8.5</td>
<td>Configuring a NIC Team</td>
<td>273</td>
</tr>
<tr>
<td>Exercise 9.1</td>
<td>Creating a Bare-Metal Backup</td>
<td>301</td>
</tr>
<tr>
<td>Exercise 10.1</td>
<td>Troubleshooting Expansion Cards in a Dell PowerEdge T110</td>
<td>324</td>
</tr>
<tr>
<td>Exercise 10.2</td>
<td>Repairing Boot Files in Windows Server 2012 R2</td>
<td>337</td>
</tr>
<tr>
<td>Exercise 11.1</td>
<td>Identifying an IP Address Conflict</td>
<td>369</td>
</tr>
<tr>
<td>Exercise 11.2</td>
<td>Using a Sniffer to Identify the Code Number</td>
<td>375</td>
</tr>
<tr>
<td>Exercise 11.3</td>
<td>Installing the Telnet Client</td>
<td>402</td>
</tr>
<tr>
<td>Exercise 12.1</td>
<td>Repairing the System in Windows Server 2012 R2</td>
<td>420</td>
</tr>
<tr>
<td>Exercise 12.2</td>
<td>Restoring Linux’s Boot Sector with GRUB</td>
<td>421</td>
</tr>
<tr>
<td>Exercise 12.3</td>
<td>Checking the Disk in Windows Server 2012 R2</td>
<td>423</td>
</tr>
</tbody>
</table>