Contents

Preface —— **vii**

Chapter 1 Introduction —— 1
What is UEFI? —— **1**
What Do We Mean by *Shell?* —— **4**
A Short History of the UEFI Shell —— **5**
Brief Overview of the UEFI Shell —— **5**
UEFI Shell APIs —— **6**
Command Line Interface Features —— **6**
Why a Shell at all? —— **7**

Chapter 2 Under the UEFI Shell —— 9
Shell and UEFI —— **9**
Evolution and Revolution —— **13**

Chapter 3 What Is the UEFI Shell? —— 15
What Is Contained in the UEFI Shell? —— **16**
What Kind of Shell Do You Have? —— **16**
What!? No Shell? No Problem! —— **17**
Programmatic Shell Environment —— **19**
Using UEFI Shell Commands —— **20**
Interactive Shell Environment —— **22**
Scripting —— **22**
Program Launch —— **24**
File-System Abstractions —— **29**
Shell Script Resolves into a UEFI Firmware Action —— **31**

Chapter 4 Why We Need an Execution Environment before the OS —— 33
Evolution of a Machine —— **33**
The Platform Initialization Flow —— **34**
UEFI Transitions —— **36**
States of a Platform —— **38**
Readiness of UEFI —— **41**
Migration Using the UEFI Shell —— **44**
Going Forward —— **45**

Chapter 5 Manufacturing —— 47
Throughput —— **47**
Manufacturing Test Tools —— **49**

Hardware Access with Manufacturing Tools — 50
Converting Manufacturing Tools — 53
Conclusion — 54

Chapter 6 Bare Metal Provisionig — 55
Provisioning with the UEFI Shell — 55
UEFI Networking Stack — 56
Securing the Network — 58
Speeding Up the Network — 62
Example of Putting It Together — 62
Summary — 68

Chapter 7 Configuration of Provisioned Material — 69
Initialization Timeline — 69
Configuration Infrastructure Overview — 71
Using the Configuration Infrastructure — 72
Driver Model Interactions — 73
Provisioning the Platform — 75
Configuring through the UEFI Shell — 76
Basic Configuration — 76
Advanced Configuration Abilities — 79

Chapter 8 The Use of UEFI for Diagnostics — 85
Types of Diagnostics — 85
SMBIOS Table Organization — 87
SMBIOS Structure Table Entry Point — 88
Table Organization Graph — 88
Structure Standards — 89
Structure Evolution and Usage Guidelines — 90
Text Strings — 90
Required Structures and Data — 91
Features — 91
User Interface Design — 92
Design Guide — 92
Usage — 93
Examples — 93
Architecture Design — 94
Data Structure — 95
SMBIOS_STRUCTURE_TABLE — 95
SMBIOS_HEADER — 97
SMBIOS_STRUCTURE_POINTER — 98
STRUCTURE_STATISTICS — 99

Source Code for the Utility — 100
Summary — 105

Chapter 9 UEFI Shell Scripting — 107
Hello, World! — 108
Echo — 108
Echo All Parameters — 109
Echo All Parameters (Improved Version) — 110
Concatenate Text Files — 112
List Only Selected "ls" Information — 113
Install Script — 115
How to Make a Shell Script Appear as a Boot Option — 119

Chapter 10 UEFI Shell Programming — 121
A Simple UEFI Shell Application: HelloWorld — 121
The Source File: HelloWorld.c — 121
The Component Information (.inf) File — 123
A Simple Standard Application: HelloWorld2 — 124
The Source File: HelloWorld2.c — 124
The Component Information (.inf) File: HelloWorld2.inf — 125
Read Keyboard Input in UEFI Shell Scripts: GetKey — 126
The Source File: GetKey.c — 127
The Component Information (.inf) File: GetKey.inf — 137
The Build Description (.dsc) File — 139
Calculate Math Expressions: Math — 139
The Source File: Math.c — 140
The Component Information (.inf) File: Math.inf — 154
Convert ASCII to Unicode and Back: UniCodeDecode — 154
The Source File: UniCodeDecode.c — 155
The Component Information (.inf) File — 163

Chapter 11 Managing UEFI Drivers Using the Shell — 165
Testing Specific Protocols — 166
Loading and Unloading UEFI Drivers — 167
Load — 168
LoadPciRom — 168
Unload — 169
Connecting UEFI Drivers — 169
Connect — 169
Disconnect — 170
Reconnect — 170
Driver and Device Information — 171

Drivers — 171
Devices — 172
DevTree — 172
Dh –d — 173
OpenInfo — 173
Testing the Driver Configuration and Driver Diagnostics Protocols — 174
DrvCfg — 174
DrvDiag — 174
Debugging Code Statements — 175
POST Codes — 177
Post Card Debug — 178
Text-Mode VGA Frame Buffer — 179
Other Options — 179

Appendix A Security Considerations — 181
UEFI Shell Binary Integrity — 181
Overview — 181
Signed Executable Overview — 182
Digital Signature — 183
Signed Executable Processing — 185
Signed Executable Generation Application (SignTool) — 185
UEFI Load Image — 186
SignTool — 186
Build Environment — 186
Example usage — 187

Appendix B Command Reference — 189
Command Profiles and Support Levels — 189
Command List — 189
Standardizing Command Output — 192
Command Details — 193
alias — 193
attrib — 194
bcfg — 194
cd — 196
cls — 197
comp — 197
connect — 198
cp/copy — 199
date — 199
dblk — 200
del — 200

devices — 200
devtree — 201
dh — 201
dir/ls — 202
disconnect — 202
dmem — 203
dmpstore — 204
drivers — 204
drvcfg — 205
drvdiag — 206
echo — 206
edit — 207
eficompress — 207
efidecompress — 207
exit — 207
for — 208
getmtc — 209
goto — 209
help — 209
hexedit — 210
if — 210
ifconfig — 214
ifconfig6 — 214
load — 215
loadpcirom — 216
ls — 216
map — 217
md — 218
mem — 218
memmap — 218
mkdir — 219
mm — 219
mode — 220
mv — 220
openinfo — 220
parse — 221
pause — 221
pci — 221
ping — 222
ping6 — 222
reconnect — 223
reset — 223

rm — 224
sermode — 224
set — 225
setsize — 226
setvar — 226
shift — 227
smbiosview — 227
stall — 228
time — 228
time — 229
touch — 229
type — 230
unload — 230
ver — 230
vol — 230

Appendix C Programming Reference — 233
Script-based Programming — 233
Parameter Passing — 233
Redirection and Piping — 234
Return Codes — 235
Environment Variables — 236
Non-Script-based Programming — 237
Shell Protocol — 238
Shell Parameters Protocol — 240

Appendix D UEFI Shell Library — 241
Functions — 241
File I/O Functions — 241
Miscellaneous Functions — 242
Command Line Parsing — 243
Text I/O — 244
String Functions — 244
ShellCloseFile() — 245
ShellCloseFileMetaArg() — 246
ShellCommandLineCheckDuplicate() — 246
ShellCommandLineFreeVarList() — 247
ShellCommandLineGetCount() — 247
ShellCommandLineGetFlag() — 248
ShellCommandLineGetValue() — 248
ShellCommandLineGetRawValue() — 249
ShellCommandLineParseEx() — 250

ShellCopySearchAndReplace() — 251
ShellConvertStringToUint64() — 252
ShellCreateDirectory() — 253
ShellDeleteFile() — 254
ShellDeleteFileByName() — 254
ShellExecute() — 255
ShellFileExists() — 257
ShellFileHandleReturnLine() — 257
ShellFileHandleReadLine() — 258
ShellFindFilePath() — 259
ShellFindFilePathEx() — 260
ShellFindFirstFile() — 260
ShellFindNextFile() — 261
ShellFlushFile() — 262
SHELL_FREE_NON_NULL() — 263
ShellGetCurrentDir() — 263
ShellGetEnvironmentVariable() — 264
ShellGetExecutionBreakFlag() — 265
ShellGetFileInfo() — 265
ShellGetFilePosition() — 266
ShellGetFileSize() — 266
ShellHexStrToUintn() — 267
ShellInitialize() — 268
ShellIsDecimalDigitCharacter() — 268
ShellIsDirectory() — 269
ShellIsFile() — 269
ShellIsFileInPath() — 270
ShellIsHexaDecimalDigitCharacter() — 270
ShellIsHexOrDecimalNumber() — 271
ShellOpenFileByDevicePath() — 271
ShellOpenFileByName() — 273
ShellOpenFileMetaArg() — 274
ShellPrintEx() — 275
ShellPrintHelp() — 276
ShellPrintHiiEx() — 277
ShellPromptForResponse() — 278
ShellPromptForResponseHii() — 279
ShellReadFile() — 281
ShellSetFileInfo() — 282
ShellSetFilePosition() — 283
ShellSetEnvironmentVariable() — 284
ShellSetPageBreakMode() — 285

ShellStrToUintn() — 285
ShellWriteFile() — 286
StrnCatGrow() — 287
Data Structures — 288
Format Strings — 288
Shell Parameters — 289

Index — 291