

Index

A

access logging valve, 105

- implementation, 105
- log files, scope, 106–108

AJP connector, 245

- Apache JServ protocol, 245
- native code Apache modules, 244–245
- ports, setting different, 275

AJP protocol (Apache JServ Protocol), 61–62

Ant, 182–183, 597

- all target, 606
- automated testing, 614
- build logs, 610–611
- build notifications, e-mail and, 611–613
- build.xml file, 604
- clean target, 604
- command-line options, 601–602
- compile target, 185, 187, 605
- continuous integration, 615
- directory structure, 603
- dist target, 605
- init target, 604
- installation, 598
- introduction, 598–601
- javadoc target, 605
- JSPs, compiling, 608–609
- password property, 186
- <project> element, 184, 599
- scripts
 - command-line parameters and, 609–610
 - property files and, 609–610
 - reusable, 609–610
- source control systems and, 613–614
- target, 599
- task reference, 616–618
- Tomcat Manager and, 182–188
 - undeploying web applications, 188
- web applications, building, 602–607

Apache

- Apache License, 4
- virtual hosting
 - deployment scenario, 388–389
 - IP-based, 389–392
 - name-based, 392–395

Apache Ant. See Ant

Apache project, 2

application server configuration, 75–76

- Engine component, 76–77
- Host component, 79–82
- Realm component, 78

APR (Apache Portable Runtime)

- connector, 228
 - attributes, configurable, 229–230
 - enabling, 229
 - kernel mode file transfer, 230
 - OpenSSL support, 231–232
 - scalable keep-alive poller, 230–231
- installation, 47–48

ASF (Apache Software Foundation), 3

authentication

- configuration, 358–359
- form, 359
- form-based, 357
- web applications, 355–359

B

BASIC authentication mechanism, 356

bin directory, 52

bootstrap class loader, 207

browsers, Tomcat 6 clustering, 466

C

Catalina engine, 277

CATALINA_HOME, Tomcat startup files, 274–275

catalina.policy, 94–97

catalina.properties, 97

CGI scripts, 13–14

CGI servlet

- configuration, 89–90
- mappings, 92–93

CGI support, configuration, 232–234

class caching, 210

class loaders

- bootstrap, 207
- class caching, 210
- common class loader, 215–216
- custom
 - creating, 211
 - reasons for, 211–212
- delegation model, 208–209
- dynamic class reloading, 217–218
- Endorsed Standards Override Mechanism, 209–210, 215
- extension, 207–208
- lazy loading, 210
- namespaces, separate, 210–211
- overview, 205–206
- packages split among, 218

class loaders (continued)

class loaders (continued)

- security
 - core class restriction, 212–213
 - delegation, 212
 - SecurityManager, 213
 - separate class loader namespaces, 213
- singletons, 218–219
- system, 208
- system class loader, 215
- web application class loader, 216–217
- XML parsers, 219–220

classes directory, 138

clustering

- <Cluster> element, 473–480
- fail-over behavioral pattern, 458–459
- Farm deployer, 481
- JvmRouteBinderValve, 481
- listeners, 481
- load balancing, 460–461
- <Manager> element, 484
- master-backup topological pattern, 457–458
- performance and, 490–491
- Persistent Session Manager
 - JDBC Store, 487–490
 - shared file store and, 484–486
- response time and, 491
- scalability, 456
- session sharing, sticky sessions, 461–463
- SimpleTcpCluster, 472
- <Store> element, 485
- Tomcat 6
 - browsers, 466
 - configuring, 466–471
 - cookies, 466
 - in-memory replication configuration, 472–784
 - load balancing via Apache mod_jk, 471–472
 - session management, 465–466
- <Valve> element, 480

command-line options, Ant, 601–602

common class loader, 215–216

conf directory, 52–53

configuration

- by architecture, Tomcat, 66–67
- authentication, tomcat-users.xml file, 86
- bootstrapping, 97
- CGI servlet, 89–90
- context.xml file, default, 82–86
- default deployment descriptor, web.xml file, 86–91
- invoker servlet, 88
- JSPServlet, 88–89
- Persistent Session Manager, 115–118
- server, 71
 - server.xml, 72–75
- session timeout, 93
- SSI servlet, 89–90
- Tomcat 6, 70–71
 - \$CATALINA_HOME/conf, 71
 - web-based GUI configurator, 98–100
- tomcat-users.xml file, 86
- web application context definitions, 82
- web.xml file, 86–91

connection pool managers, c3p0 pooling manager, 326–327

- deploying, 327

connector protocols

- AJP protocol, 61–62
- HTTP protocol, 62–63

connectors

- AJP history, 63
- AJP JK, 63
- JK2, 64
- proxy, 64
- webapp, 63

context descriptors

- server.xml file and, 91–94
- web.xml file and, 91–94

Context file, 140

<context-param>, 145

context.xml file, default, 82–86

cookies, Tomcat 6 clustering, 466

c3p0 pooling manager, 326–327

- deploying, 327
- testing with Tomcat 6 JNDI-compatible lookup, 331

D

DataSource realm, 78

DefaultServlet, 383–384

delegation model, class loaders, 208–209

deployer, 203

deployment descriptor, 140–141

- servlet 2.4/2.5-style deployment descriptor, 154–156
 - context-param, 157
 - description, 157–158
 - display-name, 158
 - distributable, 158
 - ejb-local-ref, 158
 - ejb-ref, 158–159
 - env-entry, 159
 - error-page, 159–160
 - filter, 160–161
 - filter-mapping, 161–162
 - icon, 162–163
 - jsp-config, 163–164
 - listener, 164
 - locale-encoding-mapping, 165
 - login-config, 165
 - message-destination, 165–166, 166
 - mime-mapping, 166
 - resource-env-ref, 166
 - resource-ref, 167
 - security-constraint, 167–168
 - security-role, 168
 - service-ref, 168–169
 - servlet, 169–170
 - servlet-mapping, 170
 - session-config, 170–171
 - web-app, 156–157
 - welcome-file-list, 171
- servlet 2.3-style deployment descriptor, 141–143
 - <context-param>, 145
 - <description>, 144–145

<display-name>, 144
 <distributable>, 145
 DTD declaration, 143
 <env-entry>, 154
 <error-page>, 149–150
 <filter>, 145–146
 <icon>, 144
 <listener>, 145–146
 <login-config>, 153
 <mime-mapping>, 148
 <resource-ref>, 151
 <security-constraint>, 151–153
 <security-role>, 153
 <servlet>, 146–147
 <session-config>, 147–148
 <taglib>, 150–151
 <web-app>, 144
 <welcome-file-list>, 149
 XML header, 143

<description>, 144–145

DIGEST algorithm, 362

DIGEST authentication mechanism, 356

directives, httpd.conf, 277

directories, Tomcat

bin, 52
 conf, 52–53
 lib, 53
 logs, 53
 temp, 53
 webapps, 53–54
 work, 54

<display-name>, 144

<distributable>, 145

downloads, verifying integrity

MD5 DIGEST, 336–338
 PGP 338–340

dynamic class reloading, 217–218

dynamic MBeans, 428

E

Eclipse

Apache Ant and, 593
 downloading, 585
 remote web application, debugging, 586–588
 Sysdeo Tomcat plugin, 589–591
 WTP (Web Tools Platform), 591–592

embedded Tomcat, 494

application scenarios, 495
 developing with, 495–502
 MyWebServer example, 502–503

encryption, SSL and, 377–378

JSSE, 378–379
 protecting resources, 381–383

Endorsed Standards Override Mechanism, 215

engine, valves and, 104

Engine component, application server configuration, 76–77

<env-entry>, 154

<error-page>, 149–150

extension class loader, 207–208

F

fail-over behavioral pattern, clustering, 458–459

Farm deployer, 481

file system, securing

Linux, 344–346
 Windows, 344–346

<filter>, 145–146

form authenticator valve, 112

form-based authentication, 357

FQDN (Fully Qualified Domain Name), 387–388

G

GNU

GPL (General Public License), 5
 LGPL (Lesser General Public License), 5

H

Host component, application server configuration, 79–82

host-manager application, Tomcat, 341, 409

HTTP/1.1 connector, disabling, 276

HTTP Connectors, 222–223

APR connector, 228–232
 Comet asynchronous IO support, 228
 NIO Connector, 227
 Tomcat 6 HTTP/1.1 Connector
 configuration, 223–226
 configuring Tomcat 6 for SSL, 226–227

HTTP (Hypertext Transfer Protocol), 13

httpd.conf, directives, 277

HTTPS client certificate, 357

I

<icon>, 144

IDEs (Integrated Development Environments)

Eclipse, 585–593
 NetBeans, 593–596

IIS (Internet Information Services), 285

Tomcat and, scalable architectures and, 305–307
 Tomcat configuration, 286–287
 IIS 5 isolation mode, 295–296
 installation verification, 287–288
 ISAP plug-in as ISS filter, 300–302
 ISAP plug-in as web app ext, 302
 ISAP plug-in installation, 288–289
 JK connector, 288
 request forwarding, 291–292
 testing, 303
 troubleshooting, 303–305
 URL rewrite rules, 292
 virtual directory creation, 296–299
 Windows registry, 292–295
 workers, 289–291

in-memory replication configuration, Tomcat 6 clustering, 472–784

in-memory session replication, 463–465

installation

- JMeter, 537–538
- JVM (Java Virtual Machine)
 - Linux, 32–34
 - Windows, 30–32
- Tomcat
 - Linux, 42–44
 - troubleshooting, 48–49
 - Windows installer, 36–41

interfaces, Lifecycle, 65–66

invoker servlet, configuration, 88

ISAPI (Internet Services Application Programming Interface), 285

- plug-in, 285–286

J

JAAS realm, 78

- configuration, 374–377

Java

- APIs, 6–7
- JCP (Java Community Process), 7
- JSP (JavaServer pages), 19–20

Java EE, 6

- APIs, 7–8
- application servers, 8

JavaServer Pages. See JSP (JavaServer pages)

jconsole, 447–450

JCP (Java Community Process), 7

JDBC (Java Database Connectivity), 309

- alternative configuration, 326
- connections
 - JNDI mapping, 330–331
 - obtaining without JNDI lookup, 327–329
- database connection pooling, 313–315
- DataSource, configuration, 124–126
- drivers, types, 312–313
- overview, 310–311
 - connections, establishing and terminating, 311
 - versions, 311–312
- realms, 363–368
 - digested passwords, 365
 - MySQL-based, 367–368
 - MySQL tables, 365–366
 - testing, 368

JDBC realm, 78

JMeter

- alternatives to, 558
- assertions, 551–552
- config elements, 550
 - HTTP authorization manager, 550
 - HTTP cookie manager, 550–551
 - HTTP header manager, 550
 - HTTP request defaults, 551
- distributed load testing, 554–555
- HTTP Proxy Server, 552–554
- installation, 537–538

interpreting test results, 555–557

- listener, 544
 - assertion results, 546
 - data listeners, 545–546
 - visualization listeners, 545
- logic controller, 547
 - if controller, 548
 - interleave controller, 547–548
 - loop controller, 548
 - module controller, 548
 - once only controller, 548
 - random controller, 549
 - recording controller, 549
 - simple controller, 548
 - switch controller, 548
 - throughput controller, 549
 - while controller, 548
- sampler, 549–550
- test plans, 538–542
- timer, 543–544

JMX (Java Management Extension), 419, 422

- agent level, 425
 - agent services, 427
 - connectors, 426–427
 - MBean Server, 425
 - protocol adapters, 426–427
 - architecture, 422–423
 - distributed services level, 427–428
 - instrumentation level, 424
 - manageable nested components, 433–434
 - Manager, 434
 - Realm, 433
 - Valve, 434
 - manageable resource object, 436–441
 - Cache, 440–441
 - Environment, 436
 - exposed internal Tomcat objects, 439
 - NamingResources, 436
 - RequestProcessor, 440
 - Resource, 436–437
 - ResourceLink, 437
 - Servlet, 439
 - ThreadPool, 441
 - WebModule, 437–439
 - manageable runtime data objects, 435–436
 - Role, 435–436
 - User, 435
 - UserDatabase, 435
 - manageable Tomcat 6 architectural components
 - Connector, 431–433
 - Engine, 431
 - Server, 430
 - Service, 430
 - Manager proxy and, 441–452
 - remote API, 428
- ### **JNDI (Java Naming and Directory Interface)**
- emulation, 315–316
 - JDBC DataSource, configuration, 124–126
 - mail sessions, configuration, 126–128
 - overview, 118–119
 - pooling, 315–316

- realms, 369–370
 - configuring, 370, 373
 - installing LDAP driver, 370
 - LDAP schema, 371
 - populating directory, 371–373
 - roles, removing, 373
 - users, removing, 373
 - resource configuration, 118, 121
 - JDBC resource, 321–324
 - MySQL test database, 319–321
 - read-only user, 321
 - <Resource> element, 122, 317–319
 - <ResourceLink> element, 123
 - <ResourceParams> element, 123
 - testing, 324–325
 - resources, 120
 - Tomcat and, 119–120
 - JNDI realm, 78**
 - JSP (JavaServer pages), 19–20**
 - EL (Expression Language), 23
 - Model 1 architecture, 20–21
 - Model 2 architecture, 21–22
 - MVC architecture, 24–25
 - tag libraries, 22–23
 - JSPServlet, configuration, 88–89**
 - JSE (Java Secure Socket Implementation), certificate keystore, 378–379**
 - JULI**
 - filters, 529
 - formatter, 529
 - handler, 528
 - levels, 528
 - log files, 531–532
 - logger, 528
 - tutorial, 529–531
 - JVM (Java Virtual Machine)**
 - installation, 29–30
 - Linux, 32–34
 - Windows, 30–32
 - Security Manager
 - enabling system, 350
 - grant entry, 347–348
 - permissions, 347, 348–350
 - recommended practices, 353–355
 - Tomcat and, 350–353
 - jvmRoute, 276**
 - JvmRouteBinderValve, 481**
- L**
- lazy loading, class loaders, 210**
 - LGPL (Lesser General Public License), 5**
 - lib directory, 53, 139**
 - Lifecycle interface, 65–66**
 - Lifecycle listeners, configuration**
 - APR Lifecycle listener, 132
 - default, removing, 131–132
 - events sent by Tomcat components, 129
 - <Listener> element, 129–130
 - MBeans, 130–131
 - native SSL engine configuration, 132–133
 - lifecycleEvent() method, 66**
 - LifecycleListener interface, 65–66**
 - Linux**
 - file system, securing, 344–346
 - JVM (Java Virtual Machine), installation, 32–34
 - Tomcat, installation, 42–44
 - <listener>, 146**
 - <Listener> element, 129–130**
 - load balancing**
 - clustering, 460–461
 - testing load balancer, 279–280
 - different load factors, 283–284
 - round-robin behavior, 281–283
 - sticky sessions, 280–281
 - Tomcat
 - Apache and, 273–279
 - Apache mod_jk, 471–472
 - log files, scope, 106–108**
 - logging**
 - log4j
 - architecture, 506–509
 - configuration, 509–514
 - custom formatting of messages, 520–521
 - e-mail log messages, 522–523
 - installation, 509–514
 - log files, 526–527
 - logging from web application, 515–516
 - logging messages as HTML, 521–522
 - logging to console, 517
 - logging to file, 517
 - logging to multiple destinations, 517–518
 - nested diagnostic context, 525–526
 - NT event log, 523–525
 - rolling log files by date, 518–519
 - rolling log files by size, 518
 - separating messages by level, 519–520
 - specific packages or classes, 520
 - tutorial, 514–515
 - Tomcat 5 changes, 505–506
 - <login-config>, 153**
 - log4j**
 - appender, 507–508
 - architecture, 506
 - configuration, 510
 - programmatic, 511–512
 - XML configuration file, 512–513
 - custom formatting of messages, 520–521
 - e-mail log messages, 522–523
 - filters, 509
 - layout, 509
 - levels, 508
 - log files, 526–527
 - logger, 507
 - logging
 - to console, 517
 - to file, 517
 - messages as HTML, 521–522
 - to multiple destinations, 517–518
 - from web application, 515–516

log4j (continued)

- nested diagnostic context, 525–526
- NT event log, 523–525
- properties file, 510–511
- rolling log files
 - by date, 518–519
 - by size, 518
- separating messages by level, 519–520
- specific packages or classes, 520
- tutorial, 514–515

logs directory, 53

M

mail sessions, configuration, 126–128

manager application, 341

- access, enabling, 176–178
- configuration
 - context entry, 178
 - deployment descriptor, 178–179

Manifest file, 139–140

master-backup topological pattern, clustering, 457–458

MBeans, 428

- attributes, modifying, 444–446
- dynamic, 428
- model, 429
- open, 429
- standard, 428

McCool, Rob, 2

MD5 DIGEST, verifying, 336–338

Memory realm, 78

META-INF directory

- Context file, 140
- Manifest file, 139–140

methods, lifecycleEvent(), 66

mime mappings, 93–94

<mime-mappings>, 148

model MBeans, 429

mod_jk module, 253–259

mod_proxy module, 259–263

MySQL, Tomcat users, 366–367

N

namespaces, separate, 210–211

NCSA (National Center for Supercomputer Applications), 2

NetBeans

- remote web applications, debugging, 594–595
- web applications, debugging, 596

O

open MBeans, 429

P

performance testing

- JMeter
 - installation, 537–538
 - running, 537–538
- measuring performance, 535–537
- scalability, 534–535
- user's perspective, 535
- what to measure, 533–534

performance tuning

- baseline, 563
- best practices, 561–564
- bottlenecks, 564
- configuration attributes, 239–240
- diagnosing performance issues, 564–566
- JSPs, precompiling, 569–571
- JVM parameters, 567–569
- TCP/IP stack tuning, 240–241
- test bed setup, 562–563
- Tomcat configuration, tuning, 571–582
- web servers, static content, 582–583

Persistent Session Manager

- configuration, 115–118
- <Manager> element, 116–117

persistent sessions, need for, 115

PGP, 338–340

ports

- AJP connector, setting different, 275–276
- server, setting different, 275–276

proxy server, 238–239

R

RDBMSs (relational database management systems), 309

Realm component, application server configuration, 78

realms

- JAAS, configuration, 374–377
 - JDBC, 363–368
 - JNDI, 369–370
 - configuring, 370, 373
 - installing LDAP driver, 370
 - LDAP schema, 371
 - populating directory, 371–373
 - roles, removing, 373
 - users, removing, 373
 - security
 - roles, 360
 - users, 360
 - UserDatabase, 361–363
 - web applications, 355–359
- ### reference implementation (RI), 3
- ### remote monitoring, 450–452
- ### replication, <Valve> element, 480
- ### request dump valve, 105, 114–115
- ### request filtering valve, 105
- configuration, 113–114

remote address filter, 112–113
remote host filter, 113

<resource-ref>, 151

RI (reference implementation), 3

roles, security realms, 360

ROOT application, 341

S

scalability

clustering and, 456
performance testing and, 534–535

security

class loaders

core class restriction, 212–213
delegation, 212
separate class loader namespaces, 213
SeparateManager, 213
DefaultServlet, 383–384
downloads, verifying integrity, 336–340
JVM (Java Virtual Machine), 346–347
Security Manager, 347–350
Security Manager, recommended practices, 353–355
Security Manager, Tomcat and, 350–353

Linux file system, 344–346

realms

JDBC, 363–368
roles, 360
UserDatabase, 361–363
users, 360

server installation, 340–342

SSL, encryption with, 377–383

virtual hosting, 409–410

web applications

authentication, 355–359
realms, 355–359

Windows file system, 344–346

<security-constraint>, 151–153

<security-role>, 153

servers

configuration, 71
server.xml, 72–75
installation, securing, 340–342
ports, setting different, 275–276
proxy server, 238–239

server.xml

Connector component, 74–75
context descriptors and, 91–94
Server component, 72–73
Service component, 73–74
web.xml and, 91–94

<servlet>, 146–147

servlet container, 1

servlets (Java)

accessing, 18–19
interface, 15–17
mappings, 90–91

<session-config>, 147–148

session management, Tomcat 6, clustering, 465–466

session sharing, clustering

in-memory session replication, 463–465
sticky sessions
no clustered session sharing, 461–462
Persistence Manager and JDBC-based store, 463
Persistence Manager and shared file store, 462–463

session timeout, configuration, 93

SimpleTcpCluster, 472

single sign-on valve, 105

configuration, 111–112
implementation, 108–112
multiple sign-on without, 109–111

SLL (Secure Sockets Layer), encryption with, 377–378

JSE, 378–379

special account, 342–344

SSI servlet

configuration, 89–90
mappings, 92–93

SSI support, configuration, 234–238

SSL (Secure Sockets Layer), 305

configuration
mod_ssl for Apache, 264–269
SSL-enabled Apache-Tomcat setup, 271–273
testing SSL-enabled Apache setup, 269–271
encryption, protecting resources, 381–383

standard MBeans, 428

sticky sessions, load balancing, 460–461

system class loader, 208, 215

T

tag libraries (JSP), 22–23

<taglib>, 150–151

tags directory, 138

temp directory, 53

Tomcat

Apache License, 4
application servers, 9
architecture, 54–55
classes, 59
configuration by, 66–67
Connectors, 56, 59–64
Context, 58–59
Engine, 56–57
Host, 58
lifecycle, 64–66
Loggers, 58
Realm, 57
Server, 55
Service, 56
Valves, 57–58
building from source
building source release, 45
downloading source release, 44
subversion repository, 45

Tomcat (continued)

- Connector architecture, 59–60
 - connector protocols, 61–63
 - connectors, choosing, 63–64
- deployer, 203
- directories, 51
 - bin, 52
 - conf, 52–53
 - lib, 53
 - logs, 53
 - temp, 53
 - webapps, 53–54
 - work, 53–54
- distributing, 4
- embedded, 494
 - application scenarios, 495
 - developing with, 495–502
 - MyWebServer example, 502–503
- host-manager application, 409
- installation
 - distribution, deciding on, 34–35
 - downloaded file, verifying, 35–36
 - Linux, 42–44
 - Windows, ZIP file, 41–42
 - Windows installer, 36–41
- installation directory, 46–47
- load balancing, Apache and, 273–279
- running with special account, 342–344
- server, installation, securing, 340–342
- virtual hosting, 395–396
 - Apache, configuring, 406–408
 - with Apache, 405–406
 - deployment scenario, 396–398
 - Java Security Manager restrictions, 416–417
 - JVMs, memory limits, 414–416
 - JVMs, separate, 410–414
 - Tomcat as standalone server, 398–405
- web servers and, 9–10
- workers, multiple, 246–251

Tomcat 6

- clustering
 - browsers, 466
 - configuring, 466–471
 - cookies, 466
 - in-memory replication configuration, 472–784
 - load balancing via Apache mod_jk, 471–472
 - session management, 465–466
- configuration, 70–71
 - \$(CATALINA_HOME)/conf, 71
- connecting Tomcat with Apache
 - apache web server configuration, 252–253
 - configuration, 251–252
 - mod_jk module, 253–259
 - mod_proxy module, 259–263
 - web-based GUI configurator, 98–100

tomcat-docs application, 341

Tomcat Manager

- Ant and, 182–188
 - undeploying web applications, 188
- errors, 200–201
- HTTP requests, 189–190

- deploying applications, Tomcat 6, 191–192
- deploying applications from local path, 192–194
- deploying applications remotely, 192
- deploying new applications, 190–191
- displaying session statistics, 198–199
- installing applications, Tomcat 6, 191–192
- listing deployed applications, 190
- listing JNDI resources, 195–196
- listing OS and JVM properties, 196
- querying Tomcat internals, JMX Proxy servlet and, 199–200
- reloading applications, 194–195
- setting Tomcat internals, JMX proxy servlet and, 200
- starting stopped applications, 197
- stopping applications, 196–197
- undeploying web applications, 198

Tomcat project, 3

tomcat user, 343–344

tomcat-users.xml file, 86

troubleshooting, Tomcat installation, 48–49

U

user, non-privileged, 343

UserDatabase realm, 78, 361–363

users, security realms, 360

user's perspective, performance and, 535

V

<Valve> element, 480

valves, 104–105

- access logging, 105
 - implementation, 105
 - log files, scope, 106–108
- Engine and, 104
- form authenticator, 112
- request dump, 105, 114–115
- request filtering, 105
 - configuration, 113–114
 - remote address, 112–113
 - remote host, 113
- single sign-on, 105
 - configuration, 109–111
 - implementation, 108–112
 - multiple sign-on without, 109–111

virtual hosting

- Apache
 - deployment scenario, 388–389
 - IP-based, 389–392
 - name-based, 392–395
- host-manager application, Tomcat, 409
- performance, 409–410
- security, 409–410
- stability, 409–410
- Tomcat
 - Apache, configuring, 406–408
 - with Apache, 405–406
 - deployment scenario, 396–398

Java Security Manager restrictions, 416–417
 JVMs, memory limits, 414–416
 JVMs, separate, 410–414
 as standalone server, 398–405

W

<web-app>, 144

web application class loader, 216–217

web applications

- authentication, 355–359
- building, 26–27
- CGI scripts and, 13–14
- contents, 135–136
- context definitions, 82
- deploying, 182
- distributing, 26–27
- HTTP, 13
- managing, 181–182
- META-INF directory
 - Context file, 140
 - Manifest file, 139–140
- public resources, 136–137
- realms, 355–359
- security, 201–203
- servlets (Java), 14–15
 - accessing, 18–19
 - interface, 15–17
- technologies, 25–26
- undeploying, failure during, 188

WEB-INF directory

- classes directory, 138
- lib directory, 139
- tags directory, 138–139

WEB-INF directory

- classes directory, 138
- lib directory, 139
- tags directory, 138–139

Web interface

- server status, displaying, 180–181
- web applications
 - deploying, 182
 - managing, 181–182

web server, front ending with, 241–242

webapps directory, 53–54

web.xml file, 86–91

- context descriptors and, 91–94
- server.xml and, 91–94

welcome file, 94

<welcome-file-list>, 149

Windows

- file system, securing, 344–346
- JVM (Java Virtual Machine), installation, 30–32

Windows installer, Tomcat

- default installation, viewing, 40
- environment variables, 37
- port numbers, assigning, 40–41
- Service component, 36–37
- testing installation, 37–40

work directory, 54

workers.properties, configuration, 277–279

