

Index

Symbols & Numerics

@ (at) symbol, 158–159, 390

4FD (Fast Freddy's Five Finger Discount) case study

existing application and infrastructure

database design, 462–463

overview of, 462

partnership information, 463–464

shortcomings of, 464

Web Service use, 464

XML use, 463

integrating features

HTTP endpoints, 478–480

routines, 483–484

SQLXML Managed Classes, 480–483

xml data type, 465–478

purpose of, 461

selecting features, 464–465

table for, 469–471, 475

<message> element of WSDL file, 358–360

<portType> of WSDL file, 360–362

<row> element name, specifying, 151–152

/ (slash)

column name and, 159

path expression and, 91, 486

<types> element of WSDL file, 357–358

A

absolute path expression, 91

access to SQL Server, 314

account and vendor information for case study, 463

ActiveX Data Object (ADO) extensions

overview of, 200

SQLXML 4.0 queries with, 202–206

Add Counters dialog box, 331

Add Database Reference dialog box, 436

Add New Item dialog box, 177–178, 436

Add Reference dialog box, 203, 265, 302

Add Web Reference dialog box, 342, 350

ADO (ActiveX Data Object) extensions

overview of, 200

SQLXML 4.0 queries with, 202–206

ADO.NET 2.0

asynchronous operations, 446–448,
458–459

features of, 441

Multiple Active Result Sets, 449–450,
457–458

query notification, 451–453, 459

xml data type, support for, 441–446,
455–457

AdventureWords database, 40, 53

after keyword, 99

aggregate functions (XQuery), 496–499

ALGORITHM argument, 322

ALTER ENDPOINT statement, 317, 324–325

ALTER permissions for endpoints, 327–328

**ALTER TABLE statement and xml data type
column, 58–59**

altering

case study application, 471–473, 475

contents of schema collection, 141–142

data with updategram

deleting, 242–245

inserting, 235–242

overview of, 234–235

updating, 245–249

endpoints, 324–325

schema collection, 136–138

table for case study, 475

untyped XML to typed XML, 56

XML index, 122–124

- Analysis Services and collation, 44–45**
- analytical functions, 174**
- And Or operator, 493–494**
- annotated schema (views)**
 - best practices for using, 228
 - creating on `xml` data type column, 79–80
 - overview of, 211–212
 - querying, 220–228
 - `sql:field` annotation, 212–213
 - `sql:key-fields` annotation, 218–220
 - `sql:relation` annotation, 213–214
 - `sql:relationship` annotation, 214–218
- ANSI SQL, 174**
- application settings, 473**
- application user configuration for case study, 462**
- APPLY operator, 71–72**
- argument, passing into procedure, 420–421**
- ARITHABORT option, 125**
- arithmetic operators (XQuery), 492–493**
- as first keyword, 99, 100–101**
- as last keyword, 99, 102**
- AS part of CREATE ENDPOINT statement, 317–319**
- assembly**
 - building and deploying, 402–410
 - creating, 401
 - deploying, 179
 - description of, 174, 397–398
 - `PERMISSION_SET` levels, 408–409
 - routine and, 417
 - security and, 414
 - stored procedure and, 400–410
 - user-defined function and, 410–414
- assigning**
 - `FOR XML` results, 32–33
 - schema to variable, 133
- associating schema or schema collection to `xml` data type column, 56–57**
- asynchronous operations, 446–448, 458–459**
- `Async=True` keyword, 446**
- at (@) symbol, 158–159, 390**
- at-identity attribute, 239–241**
- atomization and XQuery, 24, 88**

- attribute**
 - at-identity, 239–241
 - inserting into XML instance, 102–104
 - mapping column as, 159
 - name of, 166–167
 - `ReturnID`, 239–241
 - `sql:relationship` annotation and, 215
 - updating, 107–110
 - `updg:id`, 248–249
 - `updg:nullvalue`, 253–254
 - value of, sorting by, 98
- Attribute axis, 92**
- attribute-centric mapping, 236**
- AUTHENTICATION argument, 321**
- authentication type, 318**
- AUTO mode of FOR XML statement**
 - client-side formatting and, 208, 209
 - overview of, 148, 153–154
- avg() function (XQuery), 498**
- axis, 487**
- Axis step, 92–93**

B

- Base Path property of SQLXMLOLEDB provider, 278, 282–285, 287–288**
- BasePath property of `SqlXmlCommand` object, 381**
- BASIC authentication, 318, 351–352**
- before keyword, 99**
- `BeginExecuteXmlReader` method of `SqlCommand` class, 448**
- binary large object (BLOB)**
 - reading and writing, 201
 - `xml` data type and, 19
 - XML instances and, 111
- binding, 362–363**
- blind update, 251**
- blocking, 458–459**
- body of XQuery expression, 89, 487–488**
- b-tree structure, 111**
- Build menu, 179**
- building client application**
 - comparing WSDL, 349–351
 - consuming Web Service, 341–349
- BULK INSERT statement, 257**

Bulk Load utility

- guidelines and limitations of, 270–271
 - .NET Framework and, 265–270
 - object model
 - BulkLoad property, 260
 - CheckConstraint property, 260
 - ConnectionString property, 260–261
 - ConnectionString property, 261
 - ErrorLogFile property, 261
 - Execute method, 259
 - ForceTableLock property, 261
 - IgnoreDuplicateKeys property, 262
 - KeepIdentity property, 262
 - SchemaGen property, 262–263
 - SGDropTables property, 263
 - SGUseID property, 263
 - TempFilePath property, 263–264
 - Transaction property, 264
 - XMLFragment property, 264
 - operation modes, 258–259
 - overview of, 257–258
 - security issues and, 270
 - XML data streaming and, 258
- BulkLoad property of Bulk Load utility, 260**

C**canceling command, 459****CAS (Code Access Security), 414****case study (Fast Freddy's Five Finger Discount)**

- existing application and infrastructure
 - database design, 462–463
 - overview of, 462
 - partnership information, 463–464
 - shortcomings of, 464
 - Web Service use, 464
 - XML use, 463
- integrating features
 - HTTP endpoints, 478–480
 - routines, 483–484
 - SQLXML Managed Classes, 480–483
 - xml data type, 465–478
- purpose of, 461
- selecting features, 464–465
- table for, 469–471, 475

CAST function, 73, 77**casting numeric values, 73, 89****CDATA directive of FOR XML statement, 155–156****CERTIFICATE argument, 321****certificate authority, 352****check constraint, 74–75****CheckConstraint property of Bulk Load utility, 260****Child axis, 92****classes**

- access to, 180
- compiling into CLR stored procedure, 177–180
- managed classes in SQLXML, 288–292
- SqlCommand
 - BeginExecuteXmlReader method, 448
 - ExecuteXmlReader method, 445, 457
- SqlDataReader
 - Close() and Dispose() methods, 459
 - GetSqlXml method, 443–444, 455–457
- SqlDataRecord, 419, 422–423
- SqlPipe, 405, 419
- SqlTriggerContext, 424
- SqlXml
 - CreateReader method, 188
 - inserting data with, 197–198
 - overview of, 187–188
 - updating data with, 195–197
 - using, 188–195
- StringWriter, 306
- XmlReader, 5, 11, 444–445
- XmlReaderSettings, 11–12
- XmlResolver, 308
- XmlTextReader, 5
- XmlTextWriter, 5
- XmlUrlResolver, 305
- XmlWriter, 5, 11, 304, 305
- XmlWriterSettings, 11–12
- XPathDocument, 8–9, 304
- XPathNavigator, 9–10, 304
- XslCompiledTransform, 301–304, 307–308
- XslCompileTransform, 10–11
- XslTransform, 307
- XsltSettings, 306–307

ClearParameters() method of SqlCommand object

ClearParameters() method of SqlCommand object, 379

Click event code

- for SqlCommand button, 192–193
- for SQLXMLEDB button, 281–282
- for XML View button, 223–224

client-side formatting with FOR XML statement, 206–209

client-side processing with SQLXML, 199

client-side support for xml data type

- overview of, 187
- SqlCommand class
 - CreateReader method, 188
 - inserting data with, 197–198
 - overview of, 187–188
 - updating data with, 195–197
 - using, 188–195

ClientSideXml property

- SqlCommand object, 381
- SQLXMLEDB provider, 277, 278, 280

Close() method of SqlDataReader class, 459

CLR (Common Language Runtime). See also CLR routine

- description of, 171
- enabling, 49, 398–400
- integration of
 - advantages, 180–181
 - overview, 172–174
- managed code and, 176–180
- mapping SQL Server types to, 365–366
- security model, 182–183

CLR routine

- building, 483–484
- data access and, 418
- description of, 417–418
- namespace requirements, 418
- scalar-valued UDF, 433–435
- SqlContext object and, 418
- SqlDataRecord class and, 419
- SqlPipe class and, 419
- trigger and
 - creating, 435–438
 - DELETE operation, using on, 428–430
 - INSERT operation, using on, 425–428
 - overview of, 423–424

- SqlTriggerContext class, 424
- UPDATE operation, using on, 430–433
- user-defined functions and
 - ByRef output parameter, 420–421
 - overview of, 420
- SqlDataRecord object, 422–423

clustered index, 19, 114

Code Access Security (CAS), 414

Collation Settings, 44–45

column

- full-text index and, 118
- mapping as attribute, 159
- mapping to, 212–213
- relational, 503–505
- xml data type
 - associating schema or schema collection to, 56–57
 - computed columns, 76–78
 - constraints, 74–76
 - converting from untyped to typed, 59
 - defaults, 73–74
 - inserting data into using updategram, 241–242
 - making changes to, 58–59
 - views, creating on, 79–80

column-level constraints, 74–75

COM (Component Object Model), 176

command, canceling, 459

command dialect, 284

CommandStream property of SqlCommand object, 381–382

CommandText property of SqlCommand object, 382

CommandType property of SqlCommand object, 382

Common Language Runtime (CLR). See also CLR routine

- description of, 171
- enabling, 49, 398–400
- integration of
 - advantages, 180–181
 - overview, 172–174
- managed code and, 176–180
- mapping SQL Server types to, 365–366
- security model, 182–183

- comparison operators (XQuery), 490–492**
 - compiling class into CLR stored procedure, 177–180**
 - Component Object Model (COM), 176**
 - components required, 36–37**
 - computed column, 76–78**
 - Computer Management dialog box, 339–340**
 - concurrency**
 - high-level protection, 252–253
 - low-level protection, 251–252
 - medium-level protection, 252
 - overview of, 251
 - conditional statements**
 - inserting element or attribute using, 104
 - updating node value and, 108–110
 - configuring SOAP**
 - endpoints
 - altering, 324–325
 - deleting, 325
 - DLL and, 317–324
 - overview of, 316
 - permissions and, 326–329
 - Web Methods
 - stored procedures, 315–316
 - user-defined functions, 316
 - CONNECT permissions for endpoints, 328, 334**
 - connect pipe, 405**
 - connection string, 418**
 - ConnectionCommand property of Bulk Load utility, 260–261**
 - ConnectionString property of Bulk Load utility, 261**
 - constraints**
 - adding to xml data type column, 74–76
 - uses of, 82
 - construction, 21**
 - constructors (XQuery), 93–95, 501–503**
 - consuming Web Service, 342–349**
 - CONTAINS () keyword, 120–122**
 - content indexing**
 - CONTAINS () keyword and, 120–122
 - overview of, 118–120
 - context connection keyword, 418**
 - context functions (XQuery), 499–501**
 - context node, 299**
 - CONVERT function, 63**
 - count () function (XQuery), 497**
 - CREATE ASSEMBLY statement, 398, 401, 403**
 - CREATE ENDPOINT statement**
 - AS part of, 317–319
 - FOR part of, 319–324
 - overview of, 317
 - CREATE FULLTEXT CATALOG statement, 119–120**
 - CREATE FUNCTION statement, 412**
 - CREATE permissions for endpoints, 327**
 - CREATE PROCEDURE statement, 403**
 - CREATE QUEUE statement, 451**
 - CREATE ROUTE statement, 451**
 - CREATE SERVICE statement, 451**
 - CREATE TABLE statement, 77**
 - CREATE TRIGGER statement, 424**
 - CreateParameter () method of SqlXmlCommand object, 379**
 - CreateReader () method of SqlXml class, 188, 193, 195, 202**
 - creating**
 - assembly, 401
 - CLR trigger and UDF, 435–438
 - Custom WSDL file, 367–372
 - document and writing to file, 12–13
 - endpoints, 317–324, 329, 479–480
 - index, 125
 - managed code, 400–401
 - schema collections, 128–135, 466–469, 474–475
 - stored procedure, 478–479
 - table
 - for case study, 469–471
 - overview of, 54
 - view on xml data type column, 79–80
 - CROSS APPLY operator, 71, 72**
 - current node, 299**
 - cursor scrolling, 458**
 - cursor, server-side, 458**
 - Custom WSDL file, 313, 330, 367–372**
- D**
- data**
 - explicitly casting to XML type, 73, 89
 - implicitly casting to XML type, 73, 89

data (continued)

- inserting
 - with `SqlXml` class, 197–198
 - with updategram, 235–242
- modifying with updategram
 - deleting, 242–245
 - overview of, 234–235
 - updating, 245–249
- retrieving
 - dynamically, 93–95
 - to populate form, 480–481
 - T-SQL and, 182
- streaming, 258
- updating
 - with `SqlXml` class, 195–197
 - in table, 391–394
 - with updategram, 245–249

data access in routine, 418

Data Definition Language (DDL) and schema collections, 128

`data()` function (XQuery), 495–496

data manipulation and managed code, 182

data streaming, 258

database design for case study, 462–463

datetime value, 253

DDL (Data Definition Language) and schema collections, 128

Default instance, 41

default mapping, 233, 255

default namespace, declaring, 90–91

default result set, 458

default WSDL file

- endpoints and, 349–351, 364–366
- native XML and, 313

defaults

- applying to `xml` data type column, 73
- endpoints, creating, and, 334

delete keyword, 105–106

DELETE operation, using CLR trigger on, 428–430

deleting

- data with updategram, 242–245
- endpoints, 325
- item from XML document, 28, 105–106
- schema collections, 135–136

denying permissions on schema collection, 142–144

deploying

- assembly, 179
- native XML Web Services, 334–335

dereference, 487

Descendant axis, 92

Descendant-or-self axis, 92

Diffgram, building, 481–483

DIGEST authentication, 318

disabling Windows Guest account, 333

`Dispose()` method of `SqlDataReader` class, 459

distributed partitioned view, 80

.dll file, 398

document, 12–13. See also XML document

`document()` function (XSLT), 306, 308

`document()` method of `XslCompiledTransform` class, 301

DOM

- alternative to, 8
- shortcomings of, 9

DROP_EXISTING option, 125

dropping. See deleting

dynamically retrieving data, 93–95

E

element

- inserting into XML instance, 99–102
- mapping to table, 218–220
- name of
 - duplicate, 166–167
 - sorting by, 98–99
- nesting hierarchically, 214–218
- value of, sorting by, 97–98

element-centric mapping, 236–237

ELEMENTS directive of FOR XML statement, 154

ELEMENTS XSINIL directive of FOR XML statement, 160

elementxsinil directive of FOR XML statement, 156–157

enabling

- CLR, 49
- CLR integration, 398–400
- remote connection, 47–49

encapsulation, 181

ENCRYPTION argument, 322

endpoints

altering, 324–325

building client application

 comparing WSDL, 349–351

 consuming Web Service, 341–349

 securing, 351–352

consuming and using, 337–339

creating, 317–324, 329, 479–480

defaults, 334

deleting, 325

granting permissions, 339–341

overview of, 316

permissions, 326–329, 334

state, managing, 334

stored procedure, creating, 478–479

WSDL argument and, 356

Error and Usage Report Settings, 45–46

error handling, 459

error log file, 270

ErrorLogFile property of Bulk Load utility, 261

Execute method of Bulk Load utility, 259

ExecuteAndSend method of SqlPipe class, 419

ExecuteNonQuery() method of SqlCommand object, 379

ExecuteScalar() method, 411, 413

ExecuteStream() method of SqlCommand object, 379

ExecuteToStream() method of SqlCommand object, 380

ExecuteXMLReader method of SqlCommand object, 445, 457

executing queries using SQLXMLEDB provider, 279–280

exist() method of xml data type

 index and, 113

 overview of, 64–66

Existential quantification, 24–25, 88–89

explicit mapping, 233–234

EXPLICIT mode of FOR XML statement

 client-side formatting and, 208

 overview of, 148, 155–157

explicitly casting data to XML type, 73, 89

EXTERNAL_ACCESS permissions, 414

F

F5 (run project), 192

Fast Freddy's Five Finger Discount (4FD) case study

 existing application and infrastructure

 database design, 462–463

 overview of, 462

 partnership information, 463–464

 shortcomings of, 464

 Web Service use, 464

 XML use, 463

 integrating features

 HTTP endpoints, 478–480

 routines, 483–484

 SQLXML Managed Classes, 480–483

 xml data type, 465–478

 purpose of, 461

 selecting features, 464–465

 table for, 469–471, 475

Fill() method of SqlXmlAdapter object, 384

FILLFACTOR option, 123

filtering

 full-text index and, 121–122

 query, 406

firewall, 333

FLWOR statement

 FOR clause of, 488

 GROUP BY clause of, 97–99

 order by clause of, 489

 overview of, 95–97, 488

 return clause of, 489

 WHERE clause of, 488–489

FOR clause of FLWOR statement, 488

FOR part of CREATE ENDPOINT statement

 DATABASE_MIRRORING option, 320–324

 overview of, 319

 SERVICE_BROKER option, 320, 321–324

 shared arguments, 321–324

 SOAP value, 319

FOR XML clause

- assigning results, 32–33
- AUTO mode of, 153–154, 208, 209
- cautions with, 166–167
- client-side formatting with, 206–209
- EXPLICIT mode of, 155–157, 208
- history of, 211–212
- nesting expressions, 30–31, 162–164
- overview of, 29–30, 148
- PATH mode of, 31–32, 157–162
- RAW mode of
 - client-side formatting and, 208
 - overview of, 148
 - specifying root element, 152–153
 - specifying <row> element name, 151–152
- TYPE directive, 148
- xml data type integration, 30
- XSD schema generation, 164–166

ForceTableLock property of Bulk Load utility, 261

formatting XML on client side, 206–209

4FD (Fast Freddy's Five Finger Discount) case study

- existing application and infrastructure
 - database design, 462–463
 - overview of, 462
 - partnership information, 463–464
 - shortcomings of, 464
 - Web Service use, 464
 - XML use, 463
- integrating features
 - HTTP endpoints, 478–480
 - routines, 483–484
 - SQLXML Managed Classes, 480–483
 - xml data type, 465–478
- purpose of, 461
- selecting features, 464–465
- table for, 469–471, 475

full-text index

- CONTAINS() keyword and, 120–122
- overview of, 118–120

functions

- analytical, 174
- scalar-valued compared to table-valued, 411
- sql:column() function, 503

- sql:variable() function, 503–505
- user-defined (UDF)
 - applying as constraint to table, 75–76
 - assembly and, 410–414
 - ByRef output parameter, 420–421
 - creating, 435–438
 - endpoints and, 316
 - scalar-valued, 433–435
 - SqlDataRecord object, 422–423
- XQuery
 - aggregate, 496–499
 - context, 499–501
 - data() function, 495–496
 - string() function, 496

G

- gated link, 183**
- gateway, 312**
- GetProducts stored procedure, 275–276, 291**
- GetSqlXml method**
 - SqlDataReader class, 444, 455–457
 - SqlXml class, 192, 193, 194
- GetType() method of SqlXmlCommand object, 380**
- granting permissions**
 - on endpoints, 339–341
 - on schema collection, 140–141
 - on schema collection object, 141–142
- GROUP BY clause of FLWOR statement, 97–99**

H

- high-level concurrency protection, 252–253**
- HTTP endpoint, building, 478–480**
- HTTP listener, 314**
- HTTP SOAP access, 33**
- HTTP, support for, 292–293**
- httpcfg tool, 352**

I

- If-Then-Else operator, 494–495**
- IgnoreDuplicateKeys property of Bulk Load utility, 262**

implicit mapping, 233**implicitly casting data to XML type, 73, 89****importing schema**

- into collection, 146
- multiple, with namespaces, 133–135
- without namespace, 129–130

indexes on xml data type

- altering, 122–124
- best practices for, 124
- full-text
 - CONTAINS () keyword, 120–122
 - overview of, 118–120
- overview of, 19–20, 111
- primary, 112–114
- secondary
 - overview of, 114–115
 - PATH, 115–116
 - PROPERTY, 117–118
 - VALUE, 116–117
- setting options for, 124
- ten commandments for creating, 125

inheritance, 181**insert keyword, 99–104****INSERT operation, using CLR trigger on, 425–428****inserting**

- data
 - with SqlXml class, 197–198
 - with updategram, 235–242
- item into XML document, 27–28
- nodes into existing document, 99–104
- into untyped XML data type column, 54

installing

- Advanced button, 39–40
- Authentication Mode, 41, 42–43
- Collation Settings, 44–45
- components, choosing, 39–40
- components required, 36–37
- configuration settings, 47–50
- Error and Usage Report Settings, 45–46
- instance, selecting, 40–41
- progress of, 47, 48
- Ready to Install screen, 46–47
- Report Server setup, 45

- Service Account setup, 41–42
- SQL Native Client, 201, 275
- SQL Server Installation Wizard, 36, 37
- System Configuration Check, 38
- Welcome/Start screen, 36

INTEGRATED authentication, 318**integrating features for case study**

- HTTP endpoints, 478–480
- overview of, 465–466
- reporting and, 466–473
- routines, 483–484
- SQLXML Managed Classes, 480–483
- user information and, 473–478

integration of Common Language Runtime (CLR), 172–174, 180–181, 398–400**into keyword, 99****invocation link, 182****IRowsetFastLoad interface, 259****IsDBNull method, 456–457****ISequentialStream interface, 201****item, 23****K****KeepIdentity property of Bulk Load utility, 262****Kerberos authentication, 333****keywords**

- after, 99
- as first, 99, 100–101
- as last, 99, 102
- Async=True, 446
- before, 99
- CONTAINS (), 120–122
- context connection, 418
- delete, 105–106
- insert, 99–104
- into, 99
- NEAR, 121
- replace value of, 106–110
- update, 106–110
- XMLSCHEMA, 165

L

last () function (XQuery), 499–500

link, 182

Load method of XslCompiledTransform class, 301

locking, 458

logical operators (XQuery), 493–495

Login-New dialog box, 326, 340

low-level concurrency protection, 251–252

M

Managed Classes in SQLXML

Diffgram, building, 481–483

examples, 385–395

object model

 SqlXmlAdapter object, 384–385

 SqlXmlCommand object, 378–383

 SqlXmlParameter object, 383–384

overview of, 288–292, 480

retrieving data, 480–481

managed code. *See also* routine

advantages of, over T-SQL, 180–181

assembly and, 397–398

choosing between T-SQL and, 181–182

creating, 400–401

examples of, 400

overview of, 171, 176–180, 417

managing

endpoint state, 334

schema collections

 altering, 136–138

 creating, 128–135

 dropping, 135–136

 overview of, 128

mapping

attribute-centric, 236

to column in table, 212–213

default, 233, 255

element to table, 218–220

element-centric, 236–237

mixed mode, 237–239

node to table, 213–214

relationships among three tables, 224–226

SQL Server to CLR types, 365–366

SQL Server to XSD types, 63, 364–365

mapping schema. *See also* views

 applying to delete updategram, 244

 description of, 232

 updategrams and, 233–234

Mapping Schema property of SQLXMLEDB provider, 278, 287–288

Match Template, 300

max () function (XQuery), 498

MAXDOP option, 123

MDAC (Microsoft Data Access Components)

and SQL Native Client, 200, 201, 274–275

medium-level concurrency protection, 252

memory garbage collection, 173

<message> element of WSDL file, 358–360

methods

 BeginExecuteXmlReader method of
 SqlCommand class, 448

 CreateReader () method of SqlXml class,
 188, 193, 195, 202

 Execute method of Bulk Load utility, 259

 ExecuteScalar (), 411, 413

 ExecuteXMLReader method of
 SqlCommand object, 445, 457

 exist ()

 index and, 113

 overview of, 64–66

 GetSqlXml

 of SqlDataReader, 444, 455–457

 of SqlXml class, 192, 193, 194

 IsDBNull, 456–457

 for returning XML data, 448

 SqlPipe class, 419

 SqlXmlAdapter object, 384–385

 SqlXmlCommand object, 378–380

 Transform method of XslCompiled-
 Transform class, 301, 304–306

 xml data type

 combining, 69–71

 exist (), 64–66

 modify (), 68–69, 477–478

 nodes (), 66–68

 overview of, 59–60

 query (), 60–61, 476–477

 using operators with, 71–72

 value (), 61–63

 XQuery expression and, 85

 XslCompiledTransform class, 301

Microsoft Certificate Services, 352
Microsoft Data Access Components (MDAC) and SQL Native Client, 200, 201, 274–275
Microsoft Intermediate Language (MSIL), 176
Microsoft SQL Server 2005 Beta 2 Setup Support Files as required component, 36–37
Microsoft SQL Server 2005→Configuration Tools, 398
min() function (XQuery), 497
Mixed Mode authentication, 43
mixed mode mapping, 237–239
modify() method of xml data type, 68–69, 477–478
modifying
 case study application, 471–473, 475
 contents of schema collection, 141–142
 data with updategram
 deleting, 242–245
 inserting, 235–242
 overview of, 234–235
 updating, 245–249
 endpoints, 324–325
 schema collection, 136–138
 table for case study, 475
 untyped XML to typed XML, 56
 XML index, 122–124
MSIL (Microsoft Intermediate Language), 176
Multiple Active Result Sets, 449–450, 457–458

N

Name property of SqlXmlParameter object, 384
Named instance, 41
Named Template, 300
namespace
 default, declaring, 90–91
 description of, 22
 importing
 multiple schemas with, 133–135
 schema without, 129–130
 routine and, 418
 specifying when creating endpoint, 330
 System.Data.SqlTypes namespace, 187
 System.xml namespace
 enhancement to, 4
 functionality in, 3
 performance, 5–6
 type support, 6–8
 XML query architecture, 10–11
 XmlReader and XmlWriter classes, 11–13
 XPathDocument, 8–9
 XPathNavigator, 9–10
 System.Xml.Xsl namespace, 301
 WSDL file, 357
namespace prefix, declaring, 90
Namespace property of SqlXmlCommand object, 382
namespaces property of SQLXMLEDB provider, 278
native XML
 access benefits, 314
 operation of, 312–313
 performance and, 330–332
 security and, 333–334
 SOAP and, 312
 support requirements, 314
NEAR keyword, 121
NESTED mode of FOR XML statement and client-side formatting, 208–209
nesting
 elements hierarchically, 214–218
 FOR XML statements, 30–31, 162–163
.NET Framework 2.0. See also CLR (Common Language Runtime)
 Bulk Load utility and, 265–270
 developing objects using, 177–180
 downloading, 36
 managed code and, 397
 as required component, 36–37
 T-SQL compared to, 174–175
.NET Framework for XML, 3–4
.NET routine, building, 483–484
New Project screen, 177, 435
node
 deleting
 from xml data type column, 106
 from xml data type variable, 105

node (continued)

- inserting into existing document, 99–104
 - mapping to table, 213–214
 - XML document and, 299
- node test, 92–93, 487**
- nodes () method of xml data type, 66–68**
- non-preemptive threading, 173**
- Non-Transacted mode of Bulk Load utility, 259, 270**
- Notification operation, 362**
- NULL handling and updategram, 253–254**

O

- object, developing using .NET Framework, 177–180**
- Object Explorer window, 326, 341**
- object-oriented capabilities of CLR, 181**
- ODBC driver, 200**
- OLE DB provider, 200**
- One-way operation, 360–361**
- OPENXML clause**
- enhancements to, 167–169
 - overview of, 29, 33
- OPENXML feature of SQLXML 4.0, 231, 232**
- operators**
- relational, 174
 - UNION ALL, 80
 - using with xml data type methods, 71–72
 - XQuery
 - arithmetic, 492–493
 - comparison, 490–492
 - logical, 493–495
 - value comparison, 492
- Optimistic Concurrency Control, 251**
- order by clause of FLWOR statement, 489**
- OUTER APPLY operator, 71–72**
- OutputEncoding property of SqlCommand object, 382–383**
-
- P**
- Parent axis, 92**
- partnership information for case study, 463–464**
- passing argument into procedure, 420–421**

passing parameters

- Managed Classes and, 390
 - querying and, 406–410
 - updategrams and, 249–251
- password, choosing, 43**
- path expressions**
- Axis step, 92–93
 - overview of, 85, 91–92, 487–488
- PATH index, 20, 115–116**
- PATH mode of FOR XML clause, 31–32, 157–162**
- performance**
- enhancements to .NET Framework, 5–6
 - integrating CLR and, 173
 - native XML Web Services and, 330–332, 334
 - SQLXMLOLEDB provider and, 288
 - untyped XML and, 54
- performance counters, 331–332**
- Performance Monitor application, 331**
- permissions**
- assemblies and, 408–409, 414
 - Bulk Load utility and, 270
 - CLR security model and, 182–183
 - on endpoints
 - granting, 339–341
 - types of, 326–329, 334
 - on schema collections
 - denying, 142–144
 - granting, 140–142
 - revoking, 144–145
- polymorphism, 181**
- <portType> of WSDL file, 360–362**
- position () function (XQuery), 500–501**
- predicate, 61, 66, 487**
- preemptive threading, 173**
- primary (parent) key, 215**
- primary XML index, 19, 112–114**
- Prolog of XQuery expression, 89–91, 487**
- properties**
- Bulk Load utility, 260–264
 - SqlCommand object, 380–383
 - SQLXMLOLEDB provider, 277–279
 - SqlParameter object, 383–384
- PROPERTY index, 20, 117–118**
- proximity search, 120**

Q**quantification and XQuery**

- Existential, 24–25
- overview of, 88–89
- Universal, 25–26

query() method of xml data type, 60–61, 476–477**query notification, 451–453, 459****querying**

- filtering and, 406
- with inline T-SQL statements, 385–387
- parameters and, 406–410
- SQLXML 4.0 and ADO, 202–206
- SQLXMLOLEDB provider, using, 279–280
- with stored procedure, 390–391
- with template, 387–390
- template queries, executing, 285–288
- xml data type with XQuery language
 - atomization and, 88
 - FLWOR statement, 95–97
 - overview of, 85–86
 - path expressions, 91–93
 - Prolog, 89–91
 - quantification and, 88–89
 - sequence, 87–88
 - sorting, 97–99
 - structure of, 86
 - type promotion and, 89
 - XML construction, 93–95
- XML views, 220–228
- XPath query
 - SQLXMLOLEDB provider and, 280–282
 - XSD schema and, 227–228

R**RAW mode of FOR XML statement**

- client-side formatting and, 208
- overview of, 148
- specifying root element, 152–153
- specifying <row> element name, 151–152

ReadOuterXML method of XmlReader class, 444–445**ReadValueAs method of XmlReader class, 7****real-time transaction processing, 335****rebuilding index, 123****records, inserting multiple at one time, 238–239****recursive query, 174****relational operators, 174****relational schema, 128****relational variable and column, 503–505****relative path expression, 91****reliability and integrating CLR, 173****remote connections, enabling, 47–49****replace value of keyword, 106–110****Report Server setup, 45****reporting information for case study, 463****Request-response operation, 361****retrieving data**

- dynamically, 93–95
- to populate form, 480–481
- T-SQL and, 182

return clause of FLWOR statement, 489**return value, xml data type as, 18–19****ReturnID attribute, 239–241****returning**

- entire XML document, 188–193
- value from XML document, 193–195

revoking permissions on schema collection, 144–145**ROOT directive of FOR XML statement, 152–153****RootTag property of SqlXmlCommand object, 383****routine**

- building, 483–484
- data access and, 418
- description of, 417–418
- namespace requirements, 418
- scalar-valued UDF, 433–435
- SqlContext object and, 418
- SqlDataRecord class and, 419
- SqlPipe class and, 419
- trigger and
 - creating, 435–438
 - DELETE operation, using on, 428–430
 - INSERT operation, using on, 425–428
 - overview of, 423–424
 - SqlTriggerContext class, 424
 - UPDATE operation, using on, 430–433

routine (continued)

- user-defined functions and
 - ByRef output parameter, 420–421
 - overview of, 420
 - SqlDataRecord object, 422–423
- <row> element name, specifying, 151–152**

S

SAFE permissions, 414

scalability and integrating CLR, 173

scalar-valued function, 411, 433–435

schema. See also schema collections; views

- finding specific, in collection, 139
- generating, and FOR XML clause, 164–166
- preparing for import into collection, 146
- storing, 138, 139
- typed XML and, 56–58
- untyped XML and, 54–55

schema collections

- altering, 136–138
- components of, 128–129
- creating, 128–135, 466–469, 474–475
- dropping, 135–136
- guidelines and limitations, 146
- managing, 128
- overview of, 127
- permissions
 - denying, 142–144
 - granting, 140–142
 - revoking, 144–145
- validation and, 130–132, 135
- viewing, 138–139

SchemaGen property of Bulk Load utility, 262–263

SchemaPath property of SqlXmlCommand object, 383

secondary XML index

- overview of, 19–20, 114–115
- PATH, 115–116
- PROPERTY, 117–118
- VALUE, 116–117

securing endpoint, 351–352

security

- annotated schemas and, 228
- assembly and, 414

- Bulk Load utility and, 270
- integrating CLR and, 174
- native XML Web Services and, 333–334
- updategram and, 255

security models, 182–183

SELECT CASE statement, 427

SELECT statement and FOR XML statement, 148, 162

selecting

- features for case study, 464–465
- xml data type, 17

Self axis, 92

Send method of SqlPipe class, 419

sequence and XQuery, 23, 87–88

server-side cursor, 458

server-side formatting, 207–208

service, 363

Service Account setup, 41–42

Service Broker, 451

Service Oriented Architecture, 335

Service Pack 3, 311

SGDropTables property of Bulk Load utility, 263

SGUseID property of Bulk Load utility, 263

shredding, 66, 111

Simple WSDL file

- endpoints and, 349–351, 366–367
- native XML and, 313
- Web Services and, 330

slash (/)

- column name and, 159
- path expression and, 91, 486

SOAP

- configuring
 - endpoints, 316–329
 - overview of, 314
 - Web methods, 314–316
- deployment scenarios, 334–335
- endpoints
 - building client application, 341–351
 - consuming and using, 337–339
 - granting permissions, 339–341
 - securing, 351–352
- guidelines and limitations of, 329–330
- native XML and, 312–314
- overview of, 311–312

- performance and, 330–332
- security and, 333–334
- support for, 292–293
- Solicit-response operation, 361–362**
- Solution Explorer (Visual Studio 2005), 265, 343, 351**
- sorting behavior, 44**
- sorting in XQuery, 97–99**
- SQL Native Client. See also SQLXMLEDB provider**
 - deployment of, 201, 275
 - MDAC differences and, 201, 274–275
 - overview of, 200–201, 273, 274
 - as required component, 36–37
 - xml data type support, 201, 275
- SQL Server Installation Wizard, 36, 37**
- SQL Server Management Studio, 57**
- SQL Server Reporting Services, 335**
- SQL Server 2005**
 - downloading, 35
 - improvements for XML support, 16
 - version of, 35
- sql:column() function, 503**
- SqlCommand class**
 - BeginExecuteXmlReader method, 448
 - ExecuteXmlReader method, 445, 457
- SqlContext object, 405, 418**
- SqlDataReader class**
 - Close() and Dispose() methods, 459
 - GetSqlXml method, 443–444, 455–457
- SqlDataRecord class, 419, 422–423**
- sql:field annotation, 212–213**
- sql:key-fields annotation, 218–220**
- SqlMetaData object, 422–423**
- SQLOLEDB provider, 207**
- SqlPipe class, 405, 419**
- sql:relation annotation, 213–214**
- sql:relationship annotation, 214–218**
- SqlTriggerContext class, 424**
- sql:variable() function, 503–505**
- SQLXML 4.0**
 - Bulk Load utility
 - BulkLoad property, 260
 - CheckConstraint property, 260
 - ConnectionCommand property, 260–261
 - ConnectionString property, 261
 - ErrorLogFile property, 261
 - Execute method, 259
 - ForceTableLock property, 261
 - guidelines and limitations of, 270–271
 - IgnoreDuplicateKeys property, 262
 - KeepIdentity property, 262
 - .NET Framework and, 265–270
 - operation modes, 258–259
 - overview of, 257–258
 - SchemaGen property, 262–263
 - security issues and, 270
 - SGDropTables property, 263
 - SGUseID property, 263
 - TempFilePath property, 263–264
 - Transaction property, 264
 - XML data streaming and, 258
 - XMLFragment property, 264
 - client-side formatting and, 206–209
 - data provider options, 376
 - history of, 273
 - Managed Classes
 - Diffgram, building, 481–483
 - examples, 385–395
 - overview of, 288–292, 480
 - retrieving data, 480–481
 - SqlXmlAdapter object, 384–385
 - SqlXmlCommand object, 378–383
 - SqlXmlParameter object, 383–384
 - OPENXML feature of, 231, 232
 - overview of, 199
 - queries with ADO, 202–206
 - SQL Native Client and, 200–202
 - Web Services, 292–293
- SqlXml class**
 - CreateReader method, 188
 - inserting data with, 197–198
 - overview of, 187–188
 - updating data with, 195–197
 - using, 188–195
- SqlXmlAdapter object, 384–385**
- SqlXmlCommand object**
 - methods, 378–380
 - overview of, 378
 - properties, 380–383

SQLXMLOLEDB provider

- executing queries using, 279–280
- overview of, 207, 275–277
- properties of, 277–279
- requirements for, 277
- template queries, executing, 285–288
- XPath queries and, 280–282
- XSL transform and, 282–285

SqlXmlParameter object, 383–384

SSL, 333, 351–352

static typing, 62

step in path expression, 91–92

step qualifier, 487

stored procedure

- access to class by, 180
- assembly and, 400–410
- compiling class into CLR, 177–180
- creating, 478–479
- endpoints and, 315–316
- GetProducts stored procedure, 275–276, 291
- native XML Web Services and, 334
- querying with, 390–391

storing schema, 138, 139

streaming data, 258

string() function (XQuery), 496

StringWriter class, 306

Strong Password enforcement, 43

style sheet (XSLT)

- compiling, 301
- description of, 297

sum() function (XQuery), 499

Surface Area Configuration dialog box, 399

Surface Area Configuration for Features form, 399

Surface Area Configuration form, 47, 48–50

Surface Area Configuration tool, 398

sys.endpoints system table, 324

sys.endpoint_webmethod system table, 324

sys.soap.endpoint system table, 324

sys.sys schema collection, 58

System Configuration Check, 38

System.Data.SqlTypes namespace, 187

System.xml namespace

- enhancement to
 - overview of, 4
 - performance, 5–6
 - type support, 6–8
- XML query architecture, 10–11
- XmlReader and XmlWriter classes, 11–13
- XPathDocument, 8–9
- XPathNavigator, 9–10
- functionality in, 3

System.Xml.Xsl namespace, 301

T

table

- for case study
 - creating, 469–471
 - modifying, 475
- data in, updating, 391–394
- full-text index and, 118
- mapping
 - to column in, 212–213
 - element to, 218–220
 - to node in, 213–214
- xml column, creating, 54

table-access link, 182

table-level constraints, 75–76

table-valued function, 411

Tabular Data Stream (TDS), 314

TAKE OWNERSHIP permissions for endpoints, 328–329

TempFilePath property of Bulk Load utility, 263–264

template

- querying with, 387–390
- updategram as, 249
- XSLT style sheet and, 300

template queries, executing using SQLXMLOLEDB provider, 285–288

timestamp value, 253

ToString() method of SqlXmlCommand object, 380

Transacted mode of Bulk Load utility, 258–259, 270

Transaction property of Bulk Load utility, 264

Transact-SQL (T-SQL)

- benefits of, 172
- choosing between managed code and, 181–182
- CONVERT function, 63
- DDL (Data Definition Language) statements
 - ALTER ENDPOINT, 324–325
 - CREATE ENDPOINT, 317–324
 - DROP ENDPOINT, 325
 - overview of, 317
- enhancements to, 29–33, 147
- FOR XML clause
 - assigning results, 32–33
 - AUTO mode of, 153–154, 208, 209
 - cautions with, 166–167
 - client-side formatting with, 206–209
 - EXPLICIT mode of, 155–157, 208
 - history of, 211–212
 - nesting expressions, 30–31, 162–164
 - overview of, 29–30, 148
 - PATH mode of, 31–32, 157–162
 - RAW mode of, 148, 151–153, 208
 - TYPE directive, 148
 - xml data type integration, 30
 - XSD schema generation, 164–166
- limitations of, 174–176
- managed code compared to, 180–181
- OPENXML clause
 - enhancements to, 167–169
 - overview of, 29, 33
- querying data with inline statements, 385–387
- transform, 298**
- Transform method of XslCompiled-Transform class, 301, 304–306**
- transformation, applying, 11**
- trigger**
 - access to class by, 180
 - CLR compared to T-SQL, 424
 - creating, 435–438
 - DELETE operation, using on, 428–430
 - INSERT operation, using on, 425–428
 - overview of, 423–424

- SqlTriggerContext class, 424
- UPDATE operation, using on, 430–433
- Visual Studio-generated, 437

T-SQL. See Transact-SQL

T-SQL declaration, 417

TYPE directive of FOR XML clause, 148–151

type promotion and XQuery, 26, 89

type support, enhancements to, 6–8

typed XML, 16, 56–58, 81

<types> element of WSDL file, 357–358

U

UDF (user-defined function)

- applying as constraint to table, 75–76
- assembly and, 410–414
- ByRef output parameter, 420–421
- creating, 435–438
- endpoints and, 316
- scalar-valued, 433–435
- SqlDataRecord object, 422–423

UNION ALL operator, 80

Universal quantification, 25–26, 88–89

UNSAFE permissions, 414

untyped XML, 16, 54–55, 81

update keyword, 106–110

Update() method of SqlXmlAdapter object, 385

UPDATE operation, using CLR trigger on, 430–433

updategram

- concurrency and, 251–253
- description of, 231
- guidelines and limitations for, 255
- mapping schema and, 233–234
- modifying data with
 - deleting, 242–245
 - inserting, 235–242
 - overview of, 234–235
 - updating, 245–249
- NULL handling and, 253–254
- passing parameters and, 249–251
- security issues and, 255
- structure of, 232

updating

- data
 - with `SqlXml` class, 197–198
 - in table, 391–394
 - with updategram, 245–249
 - node value in XML instance, 106–110
 - XML document, 28–29
- updg:id attribute, 248–249**
- updg:nullvalue attribute, 253–254**
- user code, interrogation of, 181**
- user information, setting up xml data type for, 473–478**
- user-authentication, 182**
- user-defined function (UDF)**
 - applying as constraint to table, 75–76
 - assembly and, 410–414
 - ByRef output parameter, 420–421
 - creating, 435–438
 - endpoints and, 316
 - scalar-valued, 433–435
 - `SqlDataRecord` object, 422–423
- user-defined trigger. See trigger**

V

- validation**
 - schema collections and, 127, 130–132, 135
 - of successful insert, 197
- value comparison operators (XQuery), 492**
- VALUE index, 20, 116–117**
- value() method of xml data type, 61–63**
- Value property of `SqlXmlParameter` object, 384**
- variable, relational, 503–505**
- vbc command, 290**
- viewing schema collections, 138–139**
- views. See also updategram**
 - best practices for using, 228
 - creating on xml data type column, 79–80
 - overview of, 211–212
 - querying, 220–228
 - `sql:field` annotation, 212–213
 - `sql:key-fields` annotation, 218–220
 - `sql:relation` annotation, 213–214
 - `sql:relationship` annotation, 214–218

virtual server, installing SQL Server 2005 as, 39

Visual Studio

- CLR trigger and UDF, creating, 435–438
- remote connections and, 47
- Solution Explorer, 265, 343, 351

W

Web Methods

- description of, 312, 339
- stored procedures and, 315–316
- user-defined functions and, 316

Web Service

- for case study, 464
- consuming, 342–349

Web Service Definition Language. See WSDL

Web Services, 292–293, 312

websites

- book, dedicated page for, 435
- Microsoft SQL Server 2005, 35
- .NET Framework 2.0, 36
- SOAP specification, 311

Welcome/Start screen, 36

WHERE clause of FLWOR statement, 488–489

Windows Authentication Mode, 43

Windows Guest account, disabling, 333

WriteValue method of `XmlWriter` class, 7–8

Wrox database, 53

WSDL (Web Service Definition Language)

- file
 - binding, 362–363
 - contents of, 356–357
 - Custom, 313, 330, 367–372
 - default, 364–366
 - description of, 355–356
 - endpoint and, 349–351
 - `<message>` element, 358–360
 - namespace, 357
 - native XML and, 312–313
 - `<portType>` of, 360–362
 - services, 363
 - Simple, 313, 330, 349–351, 366–367

<types> element, 357–358
 Web Services and, 330
 support for, 292

X

XML. *See also native XML*

typed, 16, 56–58, 81
 untyped, 16, 54–55, 81

XML Data Modification Language (DML)

DELETE, 28, 105–106
 FOR XML clause and, 150–151
 INSERT, 27–28, 99–104
 modify method, 28–29
 overview of, 26
 replace value of keyword, 106–110

xml data type. *See also client-side support for xml data type; indexes on xml data type; querying, xml data type with XQuery language; xml data type column*

ADO.NET support for, 441–446, 455–457
 best practices, 81–82
 for case study
 overview of, 465–466
 reporting and, 466–473
 user information and, 473–478

Column type, 17

Default WSDL file and, 366

FOR XML clause and, 30

Function return type, 18–19

indexes on, 19–20

limitations of, 82

methods

 combining, 69–71
 exist(), 64–66
 modify(), 68–69, 477–478
 nodes(), 66–68
 overview of, 59–60
 query(), 60–61, 476–477
 using operators with, 71–72
 value(), 61–63
 XQuery expression and, 85

overview of, 16–17, 53

Parameter type, 18

settings options, 80

SQL Native Client support for, 201, 275

typed XML and, 56–58

untyped XML and, 54–55

Variable type, 17–18

xml data type column

 associating schema or schema collection to,
 56–57

 computed columns, 76–78

 constraints, 74–76

 converting from untyped to typed, 59

 defaults, 73–74

 inserting data into using updategram,
 241–242

 making changes to, 58–59

 views, creating on, 79–80

XML document. *See also querying, xml data type with XQuery language; xml data type; XSLT*

 deleting item from, 28, 105–106

 inserting

 item into, 27–28

 node into, 99–104

 returning

 entire, 188–193

 value from, 193–195

 typed, 56–58

 untyped, 54–55

 updating, 28–29

 XQuery and, 26

XML query architecture, enhancements to, 10–11

xml root property of SQLXMLEADB provider, 278–279

XML schema namespace property, 17

XML Schema validation performance, 6

XML support in SQL Server, 15–16

XML use in case study, 463

XML views. *See views*

XmlConvert method of XmlReader class, 6

XmlFragment property of Bulk Load utility, 258, 264

XmlReader class

 enhancements to, 5

 new methods for, 11

 ReadOuterXML method, 444–445

XmlReaderSettings class

XmlReaderSettings class, 11–12

XmlResolver class, 308

XMLSCHEMA keyword, 165

xml_schema_namespace function, 138–139

XMLTextReader, enhancements to, 5

XMLTextWriter, enhancements to, 5

XmlUrlResolver class, 305

XmlWriter class

enhancements to, 5

new methods for, 11

Transform method and, 304, 305

XmlWriterSettings class, 11–12

XPath

expression, 486–487

overview of, 486

query

SQLXMLELEDB provider and, 280–282

XSD schema and, 227–228

XPathDocument class, 8–9, 304

XPathNavigator class, 9–10, 304

XQuery language

advantages of, 485–486

atomization and, 24, 88

constructors, 501–503

creating XML using, 501–503

description of, 21, 487

FLWOR statement, 95–97, 488–489

functions

aggregate, 496–499

context, 499–501

data() function, 495–496

string() function, 496

operators

arithmetic, 492–493

comparison, 490–492

logical, 493–495

value comparison, 492

overview of, 85–86

path expressions

Axis step, 92–93

overview of, 85, 91–92, 487–488

Prolog, 89–91, 487

quantification and, 24–26, 88–89

relational variables and columns, 502–505

sequence and, 23, 87–88

sorting, 97–99

structure of, 21–22, 86

support for, 4, 85

type promotion and, 26, 89

XML construction, 93–95

XML Data Modification Language and, 26

XPath and, 486–487

XSD data type to SQL Server 2005 data type mappings, 63, 364–365

XSD schema

executing XPath query against, 280–282

generating, and FOR XML clause, 164–166

preparing for import into collection, 146

XML views and, 212

XSD, using within WSDL file, 357

XSINIL directive of FOR XML statement, 167

xml property of SQLXMLELEDB provider, 279, 282–285

XslCompiledTransform class, 301–304, 307–308

XslCompileTransform class, 10–11

XslPath property of SqlXmlCommand object, 383

XSLT

document, components of, 298–299

enhancements to, 295

guidelines for, 308

nodes, 299

overview of, 296–299

templates, 300–301

Transform method of XslCompiledTransform class, 304–306

XslCompiledTransform class, 301–304, 307–308

XsltSettings class, 306–307

XSLT processing performance, 5

XslTransform class, 307

XsltSettings class, 306–307

