Index

A
abort method, 292, 295
about attribute, 399
abs operation, 538
absolute measurements, 495
abstract SWRL syntax, 235–237
acceptance myth, 22
access APIs, 142, 474
Active Ontology tab, 246
ad hoc ontology translation, 366
Add External JARs option, 39
add mathematical operation, 538
add method
combining models, 283
CustomGraph, 297
for D2RQ models, 499
Jena, 289
JenaSpatialIndex, 454, 459, 461
populating models, 280
SpatialGraph, 454, 456–457
TemporalGraph, 465
TemporalTripleIndex, 463
addBoxedPrimitiveValue method, 355
addDataFromFile method, 279
addDatafromOntology method, 280
addDataFromStatements method, 280
addDataFromURL method, 279
addDayTimeDurations operation, 543
addDayTimeDurationToDate operation, 543
addDayTimeDurationToDateTime operation, 543
addDayTimeDurationToTime operation, 543
addedStatement method, 293
addition in SPARQL, 215
additionalFriends.owl file, 49
additionalFriendsSchema.owl file, 51
addLiteral method, 350
addReifiedStatements method, 281–282
addSameAs method, 281
addYearMonthDurations operation, 543
addYearMonthDurationToDate operation, 543
addYearMonthDurationToDateTime operation, 544
Aduna Cluster Maps, 515–516
aggregation
disparate data sources, 468–472
SPARQL, 228
aggregation (continued)
UNION statements, 219
aggregators, 478–479
AI (artificial intelligence), 22
aligning ontologies, 361–362
with code, 381–382
constructs, 362–365
data source, 361–362
FriendTracker application, 366–372
future possibilities, 500–505
Hello Semantic Web World application, 51–56
with OWL and SWRL, 372–376
with RDFS, 382–385
record linkage, 385–388
translations, 365–366
with XSLT, 376–381
Alignment API project, 500–505
AllegroGraph project, 155
alt predicate, 444
ambiguity in spatial information, 438–439
AND operations
SPARQL, 215
SWRL, 235
annotations
OWL ontologies, 106, 109, 526–527
unstructured data, 472–477
Ant builds, 430
ant-wsmx.jar file, 430
antecedents
SWRL, 234, 237
XML, 239–240
anyURI operation, 547–548
Apache Tomcat, 154
Apache Velocity project, 336
Aperature application, 405
application ontologies, 362
application programming interfaces (APIs), 143, 147
applications
decoupling knowledge models from, 173–174
sharing across, 174–175
apply-templates element, 319
aquireMemoryForData function, 276–278
argument1 keyword, 550
argument2 keyword, 550
arguments keyword, 550
artificial intelligence (AI), 22
ASC modifier, 210–211
ASK statements, 196, 225–226
associatedWith relationships, 15
assumptions, OWL, 103–104, 525–526
assumptions limiting, rules for, 233
asterisks (*) in SPARQL, 197
Atom keyword, 549–550
atoms
joining, 236
SWRL, 234, 549–550
XML, 240–243
attributes in RDFa, 396–402
automatic alignment, 500
avg function, 228
axioms
annotations, 109
OWL ontologies, 104

B
backward chaining
Jena rules, 257
OWL semantics, 148, 152–153
bad data management, 487
BASE keyword, 204–205
Basic Formal Ontology (BFO) project, 177–178
Basic Geo Vocabulary, 444–446
Basic Logic Dialect (BLD), 231, 259–260
BasicAlign class, 501–502
Bayesian extension to OWL, 509
Bechhofer, Sean, 157
Beckett, Dave, 405
begin method, 292
Berners-Lee, Tim, 3, 24, 189, 337, 492–493
best practices. See patterns and best practices
BFO (Basic Formal Ontology) project, 177–178
Big OWLIM store, 156
binary object serialization, 66–67
binary operations in SPARQL, 215, 561–562
binary predicates, 85
bindDigReasoner method, 288
binding
Jena rules, 257
reasoners to models, 575
SPARQL, 195–196
XML, 328–329
benefits and costs, 336–337
Java, 329–331
unmarshalling XML data into Java, 331–333
Velocity template engine, 333–336
bindJenaInferenceReasoner method, 286
bindJenaRuleReasoner method, 287
bindPelletReasoner method, 288
bindReasoner function, 55
bindSchema method, 257
biological orders, 174–175
BioPortal repository, 181
blank nodes
RDF, 84–87, 520
RDFa, 402–403
SPARQL, 207
BLD (Basic Logic Dialect), 231, 259–260
blog posts on Facebook, 367
bodies
Jena, 257, 287
SWRL, 234
body keyword, 550
_body keyword, 239, 550
Boley, Harold, 234
Boolean data types, 122
boolean operations, 537–538
booleanNot operation, 537
bottom properties, 116
Brachman, Ronald J., 25
browsers
navigation, 186–187
RDF, 146
brute-force approach in ontology translation, 365
built-ins
rules for, 232–233
SWRL, 244–245, 471
builtin keyword, 550–551
Builtin keyword, 550
builtinAtom keyword, 243, 551
BuiltinAtom keyword, 551
ByteArrayOutputStream class, 298, 349

C
Calegari, Siliva, 509
Calendar class, 464
call-template element, 319
callback objects, 292
CamelCase variables, 193
cardinality restrictions, 130–134
carrot marks (\^), 236
Turtle, 81
Cartesian coordinate system, 453
ceiling operation, 538
chaining
backward, 152–153
forward, 148–153
chains, property, 118–119
change is difficult myth, 22
chat application, 308
child nodes in XML, 309
choose element, 319
class extensions, 110
classAtom keyword, 240–241, 251, 551
ClassAtom keyword, 551
classes, 16
creating, 38, 40, 47
classes, (continued)
disjoint, 136–137
equivalence among, 139
Jena, 567–574
mapping, 253–256
ontology management, 476
OWL, 105, 110–111, 134–137,
  527–528
RDFS, 101
ClassMap class, 340
classPredicate keyword, 551
clearAndCloseData method, 290
client applications, unstructured
  data sources for, 476–477
close method, 284, 291, 295
closed containers, 521
closed world assumption, 103
Clustering Coefficient data, 517
code
  aligning ontologies with, 381–382
code-editing tools, 36
collections in RDF, 521–523
colons (:) for blank nodes, 86
combineData method, 282–283
combining information, 301–302
  in data development life cycle, 268
FriendTracker data sources,
  307–308
Jabber, 346–351
Java objects, 352–359
Jena Semantic Web data, 282–283
relational databases, 337–346
representing information, 303–304
translating between
  representations, 304–307
XML-based web services, 309–310
weather.gov XML feeds, 310–311
XML bindings and velocity,
  328–337
XSL Transformations. See XSL
  Transformations (XSLT)
comments
  Jena rules, 258
  N-Triples, 81
  RDF/XML syntax, 75–76
  Turtle, 79
commit method, 292
common languages in sharing
  information, 65
communication, syntax and
  semantics in, 65–67
compact URIs (CURIEs), 395,
  398–401
Company class, 448
compareTo method, 462
comparison operations in SWRL,
  537–538
compiling and execution tools, 36
complement-of operation, 125,
  134–135
complexity, unnecessary, 23
CompositeProcess class, 429
composition in SWS, 425–426
concepts in Semantic Web, 3–4, 98
conceptual overlap in foundational
  ontologies, 177
concurrency, 269, 293–295
condition-response frameworks,
  260
conditions in RIF, 260
conjunctions and conjunctive rules
  OWL, 148
  QL profile, 161
  RL profile, 162
  SWRL, 234, 236, 471
connections in semantics, 5–6
consequents
  SWRL, 234, 236
  XML, 240
consistent URIs, 481–482
constraints, 11
  OWL 2, 107
  Swoogle, 191
CONSTRUCT queries, 216
distributed, 498
esentials, 222–224
Index C–D 589

semantic pipes, 497
SPARQL, 196, 471
construction tools, 12
containers
  RDF, 88–90, 521–523
  value, 485–486
contains method, 295–296
contains operation, 540
contains relationships, 120
containsIgnoreCase operation, 540–541
containsModel method, 279
content attribute, 398
contractual agreements, 421
contradictory data, 18
convertOneEvent method, 381
convertOneVenue method, 381–382
convertStatus method, 384
Cool URIs Don’t Change
documentation, 480
Cool URIs for the Semantic Web
documentation, 480
coordinating semantic services, 478–479
Core, RIF, 259–260
correcting data, limitations on, 20
cos operation, 539
count function, 228
crawlers, 190
create method, 285
createCustomModel method, 295
createDefaultModel method, 83
createInfModel method, 286
createModel method, 277, 375–376
createModelForGraph method, 297, 465
createModelRDBMaker method, 279
createOntologyModel method, 44, 277, 279
createReifiedStatement method, 282
createResource method, 280, 284
createStatement method, 280
critical regions, 294
criticalRegionWrite method, 294
CURIEs (compact URIs), 395, 398–401
curly brackets ({}), 205–206, 215
XSLT, 317
CurrentObservation.java class, 331, 333–334
CustomGraph class, 295
customization, 269
cut method, 502
Cyc project, 178

D
D-entailment, 226–227
“D1.2.3 Methods of Ontology Evaluation” (Hartmann), 496
D2RQ tool, 338
benefits and costs, 345–346
database queries, 342–345
distributing queries, 498–500
installation guide, 577–578
instance wrapping in Jena model, 341–342
mappings, 339–341
for WordPress, 308, 338–346
DARPA Agent Markup Language (DAML) program, 234
DARQ website, 500
data
dynamic and flexible, 18–19
Jena, 270
Data Description Language (DDL), 9
data failures, 17
data friction, 17
data modification in SPARQL, 228
data perspective, 20
data providers, 478
data source ontologies, 361–362
data sources in disparate data, 469–470
data types
  OWL, 106, 122–125, 530–531
  units of measurement, 484
Index

D

- databases
  - data perspective in, 20
  - limitations, 15
  - relational, 66–67
- dataRange keyword, 551
- datarangeAtom keyword, 241, 552
- DataRangeAtom keyword, 552
- datatype attribute in RDFa, 401
- datatype keyword in SWRL, 552
- Datatypes and Built-Ins 1.0 (DTB), RIF, 259–260
- DataValue keyword, 552
- datavaluedPropertyAtom keyword, 242, 552
- DatavaluedPropertyAtom keyword, 242, 552
- date operation, 544
- date operations in SWRL, 543–547
- date spacing technique, 481
- date type, 441
- dateTime operation, 544
- dateTime type, 441, 443
- DateTimeDescription class, 442–443
- DateTimeInterval class, 442
- Davis, Ian, 395
- dayTimeDuration operation, 544
- DBConnection class, 279
- DBpedia, 194, 200
- dbpedia.org/sparql, 32
- DDL (Data Description Language), 9
- deallocating resources
  - in data development life cycle, 269
  - Semantic Web, 290–291
- Dean, Mike, 234
- debugging SPARQL queries, 201–202
- Decentralized Information Group (DIG)
  - Disco, 187–189
  - reasoners, 271, 286, 288
- Decidability in SWRL, 245, 250
- decimal degrees, 444
- decoupling knowledge models from applications, 173–174
- :def constraint, 191
- default graphs in SPARQL, 202
- degrees, decimal, 444
- delete method, 296
- dependence property in ontologies, 495
- dependsOn method, 296
- DERI Web Data Pipes, 497
- DESC modifier, 210–211
- DESCRIBE query form, 216
- essentials, 224–225
- SPARQL, 196–197
- description logic
  - origin of, 24–25
  - OWL DL, 159
- Description Logic Programs (DLPs), 234
- descriptions
  - classes, 134–137
  - Semantic Web, 98
  - destinations in ontology mapping, 253
- development environment
  - Jena, 276
  - setup, 36–38
- dialects in RIF, 260
- difference method, 283
- differentIndividualsAtom keyword, 243, 553
- DifferentIndividualsAtom keyword, 552
- DIG (Decentralized Information Group)
  - Disco, 187–189
  - reasoners, 271, 286, 288
  - DIGReasoner class, 567
  - DIGReasonerFactory class, 568
  - dirty data, 20
- Disco browser, 187–189
- discovering information, 185–186
- navigating, 186–190
  - querying. See queries; SPARQL
    (SPARQL Protocol and RDF Query Language)
searching, 190–192
discovery in Semantic Services, 424
disjoint classes, 136–137
disjoint properties, 117–118
disjunctions and disjunctive rules
OWL, 148
SWRL, 235
DISTINCT modifier
SELECT, 209–210
SPARQL, 199–200, 202
distributed knowledge
OWL, 102–104
RDFa for, 395
distributed queries, 497–500
divide operation, 539
divideDayTimeDuration operation, 544
divideYearMonthDurations operation, 545
division in SPARQL, 215
DL-safe rules, 245–253
DLPs (Description Logic Programs), 234
Document Object Model (DOM) for Upcoming.org, 308
XML feeds, 358–359
documents
Jena, 276
RIF, 260
DOLCE ontology, 179
dollar signs ($) in SPARQL, 194
domain-independent properties, 495
domain knowledge models, data for, 470–471
domain ontologies, 362, 468
domains
OWL properties, 114–115
sharing across, 174–175
translations, 469
dots (.)
SPARQL, 198
Turtle, 79, 349
XPath expressions, 313
double quotes (") in Turtle, 80
Drucker, Peter F., 421
drunkard’s walk, 186
Dublin Core Metadata Initiative, 179
duplicate statements, 74
duration operations in SWRL, 543–547
DurationDescription class, 441–442
dynamic data, 18–19

E
EBNF (Extended Backus-Naur Form) notations, 235–236
Eclipse IDE, 44
code-editing tools, 36–37
installation guide, 578
edges in RDF, 71–72
Edison, Thomas, 231
editors
code, 36–37
Protege, 47–50, 250
effective predicate, 449
Einstein, Albert, 437
#else directive, 335
e-mail addresses, 257–258
empty graph patterns, 206
empty operation, 548
#end directive, 335
endpoints
entailment, 227
SPARQL, 192, 202, 404–408, 499–500
UNION statements, 219
endsWith operation, 541
entailments
derivation, 143–144
forward chaining, 148–149
SPARQL, 226–227
enterCriticalSection method, 294
enterprise service bus (ESB), 422
Entity-Relational (ER) models, 338
enumerating class membership, 134
equal operation, 537
equals method, 283
equals operator (=) in reflexive properties, 120
equivalence in OWL, 137–139
ER (Entity-Relational) models, 338
eRDF (embedded RDF), 392–395
error handling in Semantic Services, 425
ESB (enterprise service bus), 422
ETL (Extract, Transform, and Load) approach, 20
Euler, Leonhard, 24
evaluate method, 334–335
events
Facebook, 367
generating, 292–293
Jena, 270
Semantic Web, 269
ex: prefix, 108
ex:hasOwner property, 122, 129
ex:NegativePropertyAssertion class, 126
ex:registeredName property, 128
exceptions in Java, 275
exclamation points (!) in RDF/XML comments, 75–76
execConstruct method, 342
execSelect method, 46
existential variables, 84
explicit facts, 143
explicit ontology translation, 365–366
exporting
in data development life cycle, 269
Jena models, 290, 575
exposing techniques
Jabber with RDF writers, 346–351
Java objects using Reflection, 352–359
relational databases as RDF, 337–346
XML-based web services as RDF, 309–310
weather.gov XML feeds, 310–311
XML bindings and velocity, 328–337
XSL Transformations. See XSL Transformations (XSLT)
Extended Backus-Naur Form (EBNF) notations, 235–236
eXtended MetaData Registry (XMNR), 492
extending ontologies, 181–182
Extensible Markup Language. See XML (Extensible Markup Language)
Extensible Messaging and Presence Protocol (XMPP), 308, 408–409
Extensible Stylesheet Language Transformations. See XSL Transformations (XSLT)
external reasoners, 271, 286, 288
Extract, Transform, and Load (ETL) approach, 20
extractFriends method, 376
extractPosts method, 381

F
F-Logic rule language, 259
Facebook, 26, 366–367
foundational ontologies, 176
FriendTracker. See FriendTracker application
XSLT with, 322–326
FacebookFriendSource class, 369, 375
facet restrictions, 122–123, 530
FaCT++ reasoning engine, 157
Factory methods, 292
facts, 143
Falcons search engine, 190
Faviki project, 473
Fensel, D., 513
fidelity in data translation, 305
FileOutputStream class, 290, 349
files statements, 8–9
FILTER modifier, 213, 215
finally clause, 294
find method, 296
findWithin method, 454, 460–461
Firefox Semantic Radar, 30–32
first operation, 548
first-order logic in OWL DL, 159
Fisher, Matt, 187–189
fixing data, limitations of, 20
FLD (Framework for Logic Dialects), 259–260
flexibility of semantics, 20–21
flexible data, 18–19
Flickcurl application, 405
Flickr.com, 26
floor operation, 539
flow of data, initiating, 472
FOAF-a-Matic site, 41–44, 46, 180
FOAF ontology, 41–43
FOAF project, 29–30, 180
FoafOwl class, 272–273
for-each element, 319
foreign keys in relational databases, 9
formatting instructions, 4
forward chaining
Jena rules, 257
OWL semantics, 148–153
foundational ontologies, 175–183
4Suite framework, 154
Framework for Logic Dialects (FLD), 259–260
free discovery, 185
Friend class, 246, 373
Friend of a Friend project, 29–30
friend statements, 53
FriendTracker application, 298–299
aligning ontologies, 366–372
with code, 381–382
with OWL and SWRL, 372–376
with RDFS, 382–385
with XSLT, 376–381
data sources, 302, 307–308, 322
in RDFa, 411–417
in Welkin, 515
FROM clause, 202–203
FROM NAMED clause, 202, 205–207
Fulghum, Robert, 389
functional properties, 120–121
future possibilities, 489–490
integration, 497–505
ontologies, 491–496
reasoning, 506–513
visualization, 514–517
fuzzy ontologies, 509
“Fuzzy Ontology-Approach to Improve Semantic Information Retrieval” (Calegari and Sanchez), 509
Fuzzzy project, 473
fxml namespace, 324

G

Galilei, Galileo, 185
“garbage in, garbage out” phenomenon, 18
GChat application, 308
generalized rules in SWRL, 251
generate_mapping class, 339
GeoRSS ontology, 180, 443–444
get method in Jena, 286
getBulkUpdateHandler method, 296
getCapabilities method, 296
getConnection method, 278
dataStatus method, 291
gEntries method, 348
gEventManager method, 296
gFriends method, 376
getName method, 350
getReasoner method, 289
getReifier method, 296
gSearchEnvelope method, 459–460
gSource method, 284
getSpatialSubgraph method, 454, 456–457
getStatisticsHandler method, 296
getTemporalSubgraph method, 464–465
geretter methods in Reflection, 354–355
getime method, 462
getTransactionHandler method, 296
getTriple method, 462–463
getTriples method, 463–464
getURI method, 272–273
getUser method, 350
ggetX method, 458
ggetY method, 458
Gleaning Resource Descriptions from Dialects of Languages (GRDDL), 493
Global Positioning System (GPS), 443
gmail.com email friends, 257–258
Godel, Escher, Bach: An Eternal Golden Braid (Hofstadter), 23
goodness measurements, 495
Google chat application, 308
Google maps, 26
GPS (Global Positioning System), 443
grammar rules, 5
granularity in spatial information, 439–440
Graph interface, 568
graph stores, 142, 145–146
graph theory, 24
graphs
instance, 43–44
Jena, 271
queries, 193–194
RDF, 69–72
SPARQL, 202–203
statements, 7–8
GRDDL (Gleaning Resource Descriptions from Dialects of Languages), 493
greater than (>) operator
irreflexive property, 120
ORDER BY, 210
RDF/XML comments, 75–76
Turtle, 79
greaterThan operation, 537
greaterThanOrEqual operation, 537–538
Grosof, Benjamin, 234
gzipped files, 583

H

<H1> tags, 4
Hartmann, Jens, 496
has child—has parent relationships, 116
has part—is a part of relationships, 116
hasComponent property, 133
hash symbols (#)
Jena rules, 258
Turtle, 79
hasX method, 458
hasY method, 458
Hawthorne, Nathaniel, 301
hCalendar microformat, 392
hCard microformat, 391–392
head keyword, 553
<head keyword, 240, 553
headers, ontology, 105, 108
head keyword, SWRL, 234
Hello Semantic Web World tour, 35
application programming, 38–59
development environment setup, 36–38
HelloSemanticWeb class, 38, 44
Hendler, James, 24
Hermit reasoning engine, 157
hints, semantic, 5
Hofstadter, Douglas R., 23
Horn clauses in SWRL, 234–235
Horrocks, Ian, 157, 234
href attribute, 399
hReview microformat, 392
human acceptance myth, 22
human readability, 514–517
hybrid reasoners, 148
hype, 22–23

IDBConnection interface, 568
IDE (Integrated Development Environment), 36–37
identifies—identified by
relationships, 116
identity property for ontologies, 495
# if directive, 335
if element, 319
if-then statements, 234–235
ImageType.java class, 331
imp keyword, 239, 553
Imp keyword, 553
implications
SWRL, 234
XML, 239
implicit facts, 143
importModel method, 298
In Degree data in Welkin, 517
inclusiveness of Semantic Web, 19
inDateTime predicate, 442
indexes
spatial, 452, 460–461
WWW, 95
Individual class, 47, 281
Individual keyword, 553
individualPropertyAtom keyword, 241–242, 554
IndividualPropertyAtom keyword, 553
individuals
equivalence among, 138
OWL, 105, 110–111, 527
inequalities in SPARQL, 215
inference
OWL, 163–172
in Semantic Web, 18
SWRL, 247–252
InferenceExample class, 166–169
Inferred Axiom tab, 246
InfModel interface, 568
information navigation, 18
inherently unique artifacts, 17
initialize method, 375–376
inputFileFormat method, 83
InputStream class, 279, 322
InputStreamReader class, 334
installation reference guide, 577
D2RQ, 577–578
Eclipse IDE, 578
Java classpath, 578–580
JAXB-RI, 580–581
JDBC driver for MySQL, 582
Jena Semantic Web framework, 580–581
Pellet reasoner, 582
Protege ontology editor, 582
tar/gzipped files, 583
Velocity, 583
instance graphs, 43–44
instance-of relationships, 112
instances, 15–16
creating, 47–48
description, 12
ontology management, 476
vs. subclasses, 112–113
wrapping, 341–342
instants, 441
integerDivide operation, 539
Integrated Development Environment (IDE), 36–37
integration iceberg, 17
integration possibilities, 497
alignment, 500–505
distributed queries, 498–500
semantic pipes, 497
internal reasoners, 271, 286
Internationalized Resource Identifiers (IRIs), 11
graphs, 204
resources, 69–70, 519
interrogation
in data development life cycle, 268–269
Semantic Web data, 283–285
tools, 12
intersection method, 283
intersection-of operation, 125, 134–135
intersections in SWRL, 234
intervals, 441–442
intra-dialect compatibility, 260
Introduction to Description Logics (Nardi and Brachman), 25
inverse properties, 116–117, 120–121
invocation in Semantic Services, 424–425
inXSDDateTime predicate, 443
IOException class, 279, 290
IRIs (Internationalized Resource Identifiers), 11
graphs, 204
resources, 69–70, 519
irreflexive properties, 120
isBestFriendOd property, 246–247
isClean method, 289
isClosed method, 296
isEmpty method, 291, 297
isIsomorphicWith method, 283, 297
iterators, 282

J
Jabber, 308
Facebook, 367
foundational ontologies, 176
RDF writers for, 346–351
JabberFriendSource class, 369
JabberToRdf class, 346
.jar files, 272, 276, 288
Java
bindings for XML data, 329–331
classpath installation, 578–580
exceptions, 275
Reflection API, 352–359
unmarshalling XML data into, 331–333
Java Build Path option, 39
Java Database Connectivity (JDBC), 66, 582
Java Runtime Environment (JRE), 38
Java Software Development Kit (SDK), 36
Java XML Bindings (JAXB), 310, 328–330
Javadoc RDFizer application, 405
JavaObjectRdfSerializer class, 352, 356
JavaObjectsToRdf class, 352
JavaServer Pages Standard Tag Library (JSTL), 328
jax-ws.jar file, 430
JAXB (Java XML Bindings), 310, 328–330
JAXB Reference Implementation Project, 329–330
JAXB-RI installation guide, 580–581
JAXBContext class, 333
JDBC (Java Database Connectivity), 66, 582
Jena framework, 36–37, 153–155, 269, 567
classes, 567–574
combining data, 282–283
concepts, 269–272
concurrency, 293–295
customizing, 295–297
D2RQ conversions, 577–578
deallocating resources, 290–291
development environment, 276
events, 292–293
exporting data, 290, 575
FriendTracker application, 298–299
installation guide, 580–581
interrogating data, 283–285
knowledgebases, 276–279
libraries, 39
managing data, 291–298
populating, 279–282
programming with, 273–275, 574–575
reasoning across data, 285–290
rules, 257–258
serialization, 297–298
spatiotemporal data. See spatiotemporal data
wrapping instances in, 341–342
Jena Graph interface, 295
Jena Javadocs, 276, 280
Jena property, 280
jena.rdfcopy program, 83
JenaExploration class, 274–275
JenaListener class, 292–293
JenaSource class, 368–369, 375–376, 384
JenaSpatialIndex class, 454, 457–461
Jess rule language, 259
JMX MBeans (Java Management Extensions Management Beans), 430
JNI interface, 288
Joseki application, 405–408
JRE (Java Runtime Environment), 38
JSTL (JavaServer Pages Standard Tag Library), 328
JTS Topology Suite (JTS), 452
Juster, Norton, 93

K
KAON2 reasoning engine, 157
keys
OWL, 121–122, 531–532
relational databases, 9
keywords
limitations, 5–6
RDFa, 396–397
searching, 185–186
Semantic Web, 8
SPARQL, 563–565
SWRL, 549–554
Klein, Michel, 493
knowledge domain integration, 97–98
knowledge models
combined, 303–304
decoupling from applications, 173–174
knowledge networks, 27–28
knowledge representation, 23
knowledgebases, 142–144
disparate data, 469
Jena, 276–279
performance, 157–158
statements, 8–9
storing information in, 472
truth maintenance in, 150–151

L
Language-Integrated Query (LINQ) package, 155
languages
description, 11
RDFa support, 403–404
relational databases, 9
rules, 233–234, 259
in semantics, 5, 8
in sharing information, 65
Large Knowledge Collider (LarKC) reasoner, 513–514
Lassila, Ora, 24
lat predicate, 444
leaveCriticalSection method, 294

Lehigh University Benchmark (LUBM), 158
length operation, 548
less than(<) operator
irreflexive property, 120
ORDER BY, 210
RDF/XML comments, 75–76
Turtle, 79
lessThan operation, 538
lessThanOrEqual operation, 538
lib directory, 39
libraries
  external, 39–41
  spatial, 452
Libraries window, 39
liftingSchemaMapping attribute, 433
LIMIT modifier
  SELECT, 211–213
  SPARQL, 202
limiting assumptions, rules for,
  233
line breaks in Turtle, 80
link semantics, 7
linkage, record, 385–388
Linked Data project, 492–493
linking data, 87
LINQ (Language-Integrated Query)
  package, 155
LinqToRDF framework, 155
listConcat operation, 548
listIntersection operation, 549
listNameSpaces method, 292
listProperties method, 284
lists
  RDF, 90–91
  SWRL, 548–549
listSubtraction operation, 549
literals
  N-Triples, 81–82
  RDF, 69–70, 519
  RDF/XML syntax, 77
  Turtle, 80–81, 350
Lloyd-Topor transformations,
  235
load time in performance, 157
local reasoners, 271
Location class, 457–461
location in Facebook, 373
locks in Jena, 293–294
logical expressions, 25
logical operations in SWRL, 215,
  235, 471
logspace in OWL QL, 161
long predicate, 444
Longwell tool, 517
lowercase operation, 541
loweringSchemaMapping attribute,
  433
LUBM (Lehigh University
  Benchmark), 158

M
machine automation support, 423
machine readability, 16–17
map prefix, 340
mapping
  D2RQ, 339–341
  ontologies, 252–257, 362–363
  mapping providers, 478–479
  MappingGenerator method, 499
  mash-ups, 497
matches operation, 541
mathematical operations
  SPARQL, 215
  SWRL, 471, 538–540
max function, 228
McLuhan, Marshall, 265
meaning, 4–5
measurement units
  properties and datatypes, 484
  specifying, 483–484
  statement reification, 485
  value containers, 485–486
MEBN (Multi-Entity Bayesian
  Networks), 509
mediation, ontological, 233, 252–257
member operation, 549
memory-based OWL model, 276
merging
  statements, 73
  trees, 72
<META> tag, 5
metadata
  in sharing information, 67–68
  Snoggle, 254
metamodelling, 108
Metcalf’s Law, 490
meteorological and hydrological
data
XML feeds
  overview, 310–311
  RDF generators for, 356–358
  XSL Transformations. See XSL Transformations (XSLT)
metrics
  knowledgebase performance, 157
  ontologies, 495–496
  microformats, 30–32, 390–392
min function, 228
mindswap group, 429
minus signs (−) in RDF/XML comments, 75–76
mod operation, 539
Model class, 276
Model interface, 568–569
ModelFactory class, 569
modeling information, 61
RDF. See Resource Description Framework (RDF)
in software, 62–66
ModelMaker class, 277
ModelMaker interface, 569–570
monitoring Semantic Services, 425
Moore’s Law, 490
motivating factors for Semantic Web, 94–98
Mulgara store, 156
Multi-Entity Bayesian Networks (MEBN), 509
multiple threads in concurrency, 293–295
multiplication in SPARQL, 215
multiply operation, 539
multiplyDayTimeDurations operation, 545
multiplyYearMonthDuration operation, 545
Murrow, Edward R., 361
myFriends function, 46
mySelf function, 45
MySpace.com, 26
myths about Semantic Web, 21–22

N
n-ary relationships, 486–487
N-Triples, 81–82, 290, 520
N3 format, 290
NAF (negation as failure) technique, 233
named classes in SWRL rules, 251
named graphs in SPARQL, 202, 204–207
names and namespaces
  challenges, 17
  Jena, 272
no unique names assumption, 104, 138, 480, 526
OWL, 101
RDFS, 100
resources, 69
SWRL, 536–537
URI, 11
XML, 76–77
Nardi, Daniele, 25
National Oceanic and Atmospheric Administration, 310
National Weather Service
  XML feeds
    overview, 310–311
    RDF generators for, 356–358
  XSL Transformations. See XSL Transformations (XSLT)
navigation, 185–186
information, 18–19
Jena, 283–285
Semantic Web, 186–190
negation as failure (NAF) technique, 233
negation rules, 148
negative property assertions, 126
negative risk in change, 22
negotiation in Semantic Services, 425
newInstance method, 464
NIH (Not Invented Here) myth, 22
no unique names assumption, 104, 138, 480, 526
nodes
  blank, 207, 402–403
  graphs, 24
  RDF, 69–71
semantic services, 478–479
XML, 309–310
noisy data, 20
normalizeSpace operation, 541
Not Invented Here (NIH) myth, 22
NOT operations in SPARQL, 215
notEqual operation, 538
notifyEvent method, 293
numeric data types in OWL, 122

O
OAEI (Ontology Alignment Evaluation Initiative), 500
object-oriented programming (OOP), 111
ObjectFactory.java class, 331
ObjectListener class, 292–293, 570–571
objects
  Java, 352–359
  Jena, 270
  object-oriented solutions, 15–16, 62
  RDF, 519
serialized, 66–67
in statements, 10–11, 68
Turtle, 79
occursAt predicate, 372
ODBC (Open Database Connectivity), 66
OFFSET modifier, 211–213
one data model myth, 21
one view myth, 21–22
one-way functions in data translation, 306
OnlineStatus enumeration, 372
OntClass interface, 281, 571
OntModel interface, 571
OntModelSpec class, 570
OntoClean, 495–496
ontological mediation, 233, 252–257
ontologies, 6, 172–173
  aligning. See aligning ontologies
  choosing, 183
constructs, 363–365
data source, 361–362
description, 11
ing not in SPARQL, 215
editing tools, 36–37
FOAF, 41–43
future possibilities, 491–496
GeoRSS, 180, 443–444
Jena, 271
linked data, 492–493
management, 475–477
metrics, 495–496
OWL. See OWL Web Ontology Language
PML, 510–513
RDF, 100
real world modeling, 172–173
decoupling knowledge models from applications, 173–174
foundational, 175–183
sharing across domain and application boundaries, 174–175
reasoners. See reasoners
repositories and registries, 491–492
reusing and extending, 181–182
statements in, 8
versioning, 493–494
WSMO, 422, 426, 429–432
Ontology Alignment Evaluation Initiative (OAEI), 500
Ontology interface, 571–572
ontology-mapping tools, 252
ontology ranks, 190
OntoMetric methodology, 496
OntProperty interface, 572
OntResource interface, 572
OOP (object-oriented programming), 111
open containers, 521
Open Database Connectivity (ODBC), 66
Open Ontology Repository (OOR) project, 182, 492
open world assumption, 103–104, 525
OpenCyc project, 178
OpenLink Virtuoso tool, 156, 338
openModel method, 279
OPTIONAL modifier, 215–219
OR operations
SPARQL, 215
SWRL, 235
Oracle 11g store, 156
ORDER BY modifier, 210–211
ordering statements, 74
organizational constructs in RDF, 88–91
otherwise element, 319
Out Degree data in Welkin, 517
outputFileFormat method, 83
OutputStream class, 322
overhead
   backward chaining, 153
   forward chaining, 150
owl namespace, 101, 526
owl:AllDifferent property, 138, 527
owl:AllDisjointClasses property, 137, 528
owl:AllDisjointProperties property, 118, 529
owl:allValuesFrom property, 127–128, 532
owl:AnnotationProperty property, 109, 526
owl:assertionProperty property, 530
owl:AsymmetricProperty property, 119–120, 529
owl:backwardCompatibleWith property, 108, 494, 527
owl:bottomDataProperty property, 116
owl:bottomObjectProperty property, 116
owl:cardinality property, 130, 532
owl:Class resource, 110
owl:complementOf operation, 134–135, 528
owl:datatypeComplementOf property, 124, 531
owl:DatatypeProperty class, 113–114, 528
owl:deprecated property, 526
owl:DeprecatedClass property, 526
owl:DeprecatedProperty property, 526
owl:differentFrom property, 137, 527
owl:disjointPropertyWith property, 117
owl:disjointUnionOf property, 137, 528
owl:disjointWith property, 136, 528
owl:distinctMembers property, 138
owl:equivalentClass property, 127, 139, 363, 373, 383, 470, 527, 531
owl:equivalentProperty property, 139, 363, 373, 383, 470, 528
owl:FunctionalProperty property, 119–120, 529
owl:hasKey property, 121, 385–386, 532
owl:hasValue property, 127–129, 532
owl:imports property, 108
owl:incompatibleWith property, 108, 494, 527
owl:intersectionOf property, 124–125, 134–135, 528, 531
owl:InverseFunctionalProperty property, 119–121, 529
owl:IrreflexiveProperty property, 119–120, 529
owl:maxCardinality property, 130, 532
owl:maxQualifiedCardinality property, 132, 532
owl:members property, 118
owl:minCardinality property, 130, 532
owl:minQualifiedCardinality property, 132, 532
owl:NegativePropertyAssertion property, 529
owl:Nothing class, 113
owl:Nothing property, 528
owl:ObjectProperty class, 113–114, 528
owl:onClass property, 133, 532
owl:onDataRange property, 133
owl:onDatatype property, 530
owl:oneOf property, 528, 531
owl:onProperty property, 127, 531–532
owl:priorVersion property, 108, 494, 527
owl:Property property, 532
owl:propertyChain property, 529
owl:propertyDisjointWith property, 117, 529
owl:qualifiedCardinality property, 132, 532
owl:ReflexiveProperty property, 119–120, 529
owl:Restriction construct, 126, 531
owl:sameAs property, 137–138, 363, 387, 527
owl:SelfProperty property, 532
owl:SelfRestriction class, 130
owl:someValuesFrom property, 127–128, 532
owl:sourceIndividual property, 529
owl:SymmetricProperty property, 119–120, 529
owl:targetIndividual property, 126, 530
owl:targetValue property, 126, 530
owl:Thing class, 113–114, 528
OWL-Time ontology, 180, 441, 444, 449
owl:topDataProperty property, 116
owl:topObjectProperty property, 116
owl:TransitiveProperty property, 119–120, 529
owl:unionOf property, 124, 134–135, 528, 531
owl:versionInfo property, 109, 494
OWL Web Ontology Language, 61, 100–102, 154–156
aligning, 372–376
annotations, 106, 109, 526–527
assumptions, 103–104, 525–526
basic classification, 110–113
classes, 105, 110–111, 134–137, 527–528
construct support, 363–365
data types, 106, 122–125, 530–531
distributed knowledge, 102–104
for domain knowledge models, 470
elements, 104–105, 107
equivalence in, 137–139
headers, 105, 108
individuals, 105, 110–111, 527
inference, 163–172
keys, 121–122, 531–532
knowledgebases, 276
memory-based model, 276–279
OWL 2 typing, 107–108
profiles, 158–159
OWL EL, 160–161
OWL Full and OWL DL, 159
OWL QL, 161–162
OWL RL, 162
OWL-S, 427–429
properties, 105–106, 113–114, 528–530
annotations, 526–527
chains, 118–119
disjoint, 117–118
domain and range, 114–115
functional, 120–121
inverse, 116–117, 120–121
negative property assertions, 126
rdfs:subPropertyOf, 115–116
restrictions, 127–134
symmetric, reflexive, and transitive, 119–120
top and bottom, 116
restrictions, 122–123, 531
semantics, 147–148
backward chaining, 152–153
forward chaining, 148–153
owl:withRestrictions property, 531
OWL XML Presentation Syntax, 237
OWLIM store, 156
owlx namespace, 537

P
package-tracking application, 445
page rankings in search engines, 95
Parliament store, 156
part-of-a-whole relationships, 120
partitioning OWL ontologies, 104–105
Patel-Schneider, Peter F., 234
patterns and best practices, 467–468
aggregating data sources, 468–472
annotating unstructured data, 472–477
bad data, 487
coordinating semantic services, 478–479
n-ary relationships, 486–487
units of measurement, 483–486
URLs, 480–483
Pellet reasoner, 36–38, 55
description, 157
installation guide, 582
Jena, 288
libraries, 39
SWRL, 246, 250
PelletReasonerFactory class, 288
People class, 281
performance of knowledgebases, 157–158
performConversionFromUpcomingOntToFriendTrackerOnt method, 381
performMappingQuery method, 384
periods (.)
SPARQL, 198
Turtle, 79, 349
XPath expressions, 313
persistence mechanism in annotation management, 474
Personal Information Managers (PIMs), 38
pipes, 497
PML (Proof Markup Language), 511
PML-J (pmlj prefix) ontology, 511–512
PML-P (pmlp prefix) ontology, 511–512
PML Primer, 511
PML-T (pmlt prefix) ontology, 511
Point class, 444–446
points, statements as, 73–74
polynomial-time computations
OWL EL, 160
OWL QL, 161
PopularFriend class, 246–248
populateFOAFFriends function, 44
populateFOAFSchema function, 51
populateNewFriends function, 49
populateNewFriendsSchema function, 51
population
in data development life cycle, 268
Jena models, 279–282, 575
Position class, 448
positive risk in change, 22
pound signs (#)
Jena rules, 258
Turtle, 79
pow operation, 539
PR-OWL reasoner, 509–510
PRD (Production Rule Dialect), 231, 259–260
PRecEvaluator class, 505–506
predicates. See also properties
Jena, 270
RDF, 71–72, 85, 88, 519
in statements, 10–11, 68
predicates. See also properties (continued)
  Turtle, 79
  XPath expressions, 314–315
  PREFIX keyword, 197
prefixes
  for blank nodes, 86
  Jena rules, 258
  SPARQL, 197
  Turtle, 79–80
  PrefixMapping class, 292
printIndividual method, 167
probabilistic reasoning, 507–510
problem framing
  spatial queries, 453–454
  transaction time-bound queries, 461
Process class, 428
processMethod method, 354
processObject method, 352–353, 355
processors
query, 142
SPARQL, 192
Production Rule Dialect (PRD), 231, 259–260
Profile class, 428
programming and programming frameworks, 265–266
components, 10–13
data dynamics and flexibility, 18–19
Jena. See Jena framework
key areas, 266–269
semantic data, 14–16
sharing data, 16–17
Web data-centric perspective, 13–14
projects, creating, 38–39
Prolog language, 259
Pronto reasoner, 508–509
Proof Markup Language (PML), 511
properties. See also predicates
  creating, 48
  equivalence among, 139
measurement units, 484
ontology management, 476
OWL, 105–106, 113–114, 528–530
  annotations, 526–527
  chaining, 118–119, 232
disjoint, 117–118
domain and range, 114–115
functional, 120–121
inverse, 116–117, 120–121
negative property assertions, 126
  rdfs:subPropertyOf, 115–116
restrictions, 127–134, 531
  symmetric, reflexive, and transitive, 119–120
top and bottom, 116
RDF, 71–72, 519
RDFS, 101
SWRL, 236
Properties window, 39
property attribute, 399–400
PropertyBridge class, 340–341
propertyPredicate keyword, 554
Protege Ontology Editor, 36–37
  FOAF extensions, 245–246
  Hello World application, 47–50
  installation guide, 582
  OntoClean implementation, 495–496
  SWRL editor, 250
provenance information in data translation, 305–306
providers, 478–479
PublishRDFa class, 412–414
Q
quad trees, 452
Quadtree class, 454
qualified cardinality restrictions, 132–134
queries, 147, 186
D2RQ database, 342–345
distributed, 498–500
duration metric, 157
Jena, 270–271, 283–285, 575
Semantic Web, 192
SPARQL. See SPARQL (SPARQL Protocol and RDF Query Language)
spatial data, 453–461
transaction time-bounded, 461–465
Query class, 570
Query Language, 147
query method, 461
query processors, 142
query solutions, 200
queryData method, 284–285
QueryExecution interface, 285, 342, 570
QueryExecutionFactory method, 46
queryHandler method, 297
QueryReader class, 342
QuerySolution interface, 570
question marks (?)
Jena rules variables, 258
SPARQL, 194
SWRL variables, 236

R
RacerPro reasoning engine, 157
Radiant editor, 435
range properties in OWL, 114–115
ranks
ontology, 190
in search engines, 95
RAP RDP API framework, 155
RDBs (relational databases), 66–67
exposing, 337
schema, 9
sharing information, 98
RDF. See Resource Description Framework (RDF)
rdf prefix, 100–101, 526
rdf:about tag, 76
rdf:Alt container, 88, 521–522
RDF and OWL Compatibility (RDF+OWL) document, 260
rdf:Bag container, 88, 521
RDF Data Query Language (RDQL), 192
rdf:datatype tag, 77
rdf:Description tag, 75–76, 78
rdf:first predicate, 91
RDF-Gravity tool, 514–515
rdf:li predicate, 89–90
rdf:List container, 90–91, 521, 523
rdf:nil predicate, 91
rdf:object predicate, 88, 449, 520
rdf:predicate predicate, 88, 449, 520
rdf:RDF tag, 75, 315
rdf:resource tag, 76, 317
rdf:rest predicate, 91
RDF Schema (RDFS), 61
aligning ontologies with, 382–385
inference, 170–171
overview, 100–102
rdf:Seq container, 88–89, 521–523
rdf:Statement type, 88, 520
rdf:subject predicate, 88, 449, 520
rdf:type property, 110, 527
RDF Validator, 78
RDF/XML format, 74–78, 290
RDF/XML-ABBREV format, 290
rdf:XMLLiteral type, 122
RDF123 application, 405
RDFa, 30–32, 395
attributes, 396–402
blank nodes, 402–403
FriendTracker in, 411–417
language support, 403–404
RDFizers, 404–405
RDFNode interface, 285, 572
RDFNode interface, 285, 572
RDFS (RDF Schema), 61
aligning ontologies with, 382–385
inference, 170–171
overview, 100–102
rdfs prefix, 100–101, 526
rdfs:comment property, 106, 109
rdfs:comments property, 526
rdfs:Datatype property, 122, 530
rdfs:domain property, 114, 528
rdfs:isDefinedBy property, 109, 526
106, 109, 350, 526
rdfs:range property, 114–115, 528
rdfs:seeAlso property, 109, 526
rdfs:subClassOf property, 111–112,
127, 142, 148, 363–365, 383, 471,
527, 531
rdfs:subPropertyOf property,
115–116, 118, 127, 363, 383, 528
RDFS Serializer class, 82–83
RDQL (RDF Data Query Language),
192
read method, 83, 279
readability
human, 514–517
machine, 16–17
real world knowledge modeling, 141
common frameworks and
components, 153–157
knowledgebase performance,
157–158
ontologies, 172–173
decoupling knowledge models
from applications, 173–174
foundational, 175–183
sharing across domain and
application boundaries,
174–175
OWL
inference, 163–172
profiles, 158–162
semantics, 147–153
RDF
retrieving information, 146–147,
156
storing information, 144–146,
155–156
Semantic Web
components, 141–143
frameworks, 143–144
realizing OWL semantics, 147–153
Really Simple Syndication (RSS)
feeds, 443
Reasoner interface, 572
ReasonerRegistry class, 286–287
reasoners, 12, 36–38, 142
alignment statements for, 55
binding to models, 575
Jena, 257, 270–271, 286–288
list of, 156–157
OWL, 147
SWRL, 246, 250
reasoning
across data, 285–290
in data development life cycle, 268
future possibilities, 506–513
LarKC, 513–514
probabilistic, 507–510
Rule Interchange Format,
506–507
trust, 510–513
record linkage, 385–388
Redland framework, 155
REDUCED modifier
SELECT, 210
SPARQL, 202
Reflection API, 352–359
reflexive properties, 119–120
regex method, 57, 258, 287
REGEX operations, 215
register method, 293
registries, 491–492
reification
Jena, 270
measurement units, 485
RDF, 88, 520–521
temporal information, 449
rel attribute, 396
Rel-License microformat, 392
relational databases (RDBs), 66–67
exposing, 337
schema, 9
sharing information, 98
relational modeling approach, 62,
145
relationships
graphs, 24
importance, 15–16
inverse, 116–117
n-ary, 486–487
in semantics, 5–8
relative measurements, 495
relevance rankings by search engines, 95
remote reasoners, 271
removeAll method, 290
removeAllReifications method, 291
removeReification method, 291
Reorganization class, 448–449
replace operation, 541
reportsTo predicate, 448
repositories, 181, 491–492
representations
mechanisms, 303–304
translating between, 304–307
reserved keywords in RDFa, 396–398
resolution in spatial information, 439–440
resolvable URIs, 483
resolveURI operation, 548
resource attribute, 400–401
Resource Description Framework (RDF), 61
binary predicates, 85
browsers, 187
containers and collections, 88–90, 521–523
disparate data, 469–470
edges, 71–72
exchanging information with, 72
for Jabber, 346–351
lists, 90–91
nodes, 69–71, 84–87, 520
overview, 68–69, 519–520
reification, 88, 520–521
relational databases as, 337–346
retrieving information, 146–147, 156
semantics in, 98–102
serializations. See serializations statements as points, 73–74
storing information, 142, 144–146, 155–156
SWRL example, 243–244, 533–536
transformational tools, 404–405
triples, 72, 144–145, 187
Upcoming.org XML feeds, 358–359
Velocity for, 336
vocabularies, 99–102
weather.gov XML feeds, 356–358
XML-based web services, 309–310
weather.gov XML feeds, 310–311
XML bindings and velocity, 328–337
XSL Transformations. See XSL Transformations (XSLT)
Resource interface, 573
resources
deallocating, 290–291
RDF, 88, 145, 519–520
nodes, 69–71
RDF/XML syntax, 76–77
responses in RIF, 260
rest operation, 549
RESTful API, 319, 322
restrictions in OWL, 122–123, 531
cardinality, 130–134
value, 127–131
results
Jena, 270–271
SPARQL, 194
ResultSet interface, 285, 573
retrieveFriends method, 346–351
retrieving information in RDF, 146–147, 156
reusing ontologies, 181–182
rev attribute, 398
reversing data translation, 306
Riazanov, Alexandre, 157
Richardson, John M., Jr., 489
RIF (Rule Interchange Format), 259–260, 506–507
RIF Working Group, 234, 259–260
rigidity property, 495
risk in change, 22
_rlab keyword, 239, 554
roadblocks, 19–21
Roster class, 348
round operation, 540
roundHalfToEven operation, 540
RSS (Really Simple Syndication) feeds, 443
rule engines, 57–58
Rule Interchange Format (RIF), 259–260, 506–507
Rule Interchange Format (RIF) Working Group, 231, 259–260
Rule Markup Language (RuleML) Initiative, 233–234, 237
ruleml namespace, 537
rules, 231–232
defined, 232
Jena, 257–258, 270, 287
languages, 233–234, 259
ontology translation, 365
OWL RL, 162
reasoners. See reasoners SWRL. See Semantic Web Rule Language (SWRL)
rules engines, 12–13, 147–148
runJenaRule function, 57
runPellet function, 55
runQuery function, 45

S
safe CURIE notation, 400
SAIL (Sesame Storage and Inference Layer), 156
sameIndividualAtom keyword, 242, 554
SameIndividualAtom keyword, 554
Sanchez, Elie, 509
SAWSDL (Semantic Annotations for WSDL), 422, 426, 432–433
element, 433–434
tools, 434–435
SAWSDL4J API, 434–435
scalability in knowledgebase performance, 157–158
Scalable Highly Expressive Reasoner (SHER), 514
schemas
RDF Schema. See RDF Schema (RDFS)
relational databases, 9
XML, 329
screen scraping, 30
search engines, 95–96, 190–192
searchAndNavigateData method, 284
searching, 185–186
in Jena, 283–285
Semantic Web, 190–192
SELECT statement
DISTINCT modifier, 209–210
essentials, 197–201
FILTER modifier, 213, 215
named graphs, 202–208
OFFSET and LIMIT modifiers, 211–213
OPTIONAL modifier, 215–219
ORDER BY modifier, 210–211
REDUCED modifier, 210
SPARQL, 193, 196
UNION statements, 219–222
self-restrictions, 130
Semantic Annotions for WSDL (SAWSDL), 422, 426, 432–433
element, 433–434
tools, 434–435
Semantic Interoperability of Metadata and Information in unLike Environments (Simile), 515
Semantic Markup for Web Services (OWL-S), 422, 427–429
semantic-mediawiki.org, 26–27
semantic query endpoints, 32
Semantic Radar, 30–32
Semantic Search, 32–33
Semantic Services, 421–422
background, 422–424
Index

composition, 425–426
coordinating, 478–479
discovery, 424
error handling, 425
implementing, 426–427
invocation, 424–425
monitoring, 425
negotiation, 425
Semantic Annotations for WSDL, 432–435
Semantic Markup for Web Services, 427–429
Web Service Modeling Ontology, 429–432
Semantic Web, 93–94
components, 141–143
concept map, 3–4
defining, 4–10
FOAF project, 29–31
frameworks, 36–37, 143–144
hype, 22–23
information sharing, 97–98
motivating factors, 94–98
myths, 21–22
origins, 23–26
programming components, 10–13
programming impacts, 13–19
RDF, 98–102
roadblocks, 19–21
Semantic Query Endpoint, 32
Semantic Search, 32–33
twine, 27–28
wikis, 26–27
vs. World Wide Web, 7
Semantic Web Rule Language (SWRL), 231, 471, 533
abstract syntax, 235–237
aligning ontologies with, 372–376
built-ins, 244–245, 471
comparisons and booleans operations, 537–538
date, time, and duration operations, 543–547
DL-safe rules, 245–253
essentials, 234–235
examples, 533–536
frameworks, 13
keywords, 549–554
list operations, 548–549
mathematics operations, 538–540
namespaces, 536–537
ontological mediation, 252–257
RDF examples, 243–244, 533–535
string operations, 540–542
tips, 251
URLs operations, 547–548
XML concrete syntax, 237–243
Semantic Web Services Language (SWSL) Rules, 234
semantically equivalent ontologies, 50–51
Semantically-Interlinked Online Communities (SIOC) ontology, 495, 502
semantics, 93–94
defined, 4
motivating factors, 94–98
OWL, 147–148
backward chaining, 152–153
forward chaining, 148–153
pipes, 497
programming, 14–16
RDF, 98–102
sharing information, 65–67
semicolons (;)
SPARQL, 198
Turtle, 79, 349
SerializableModel class, 297–298
serializations, 66–67, 74
Java, 352
Jena, 297–298
RDF, 520–521
N-Triples, 81–82
quick hack, 82–84
RDF/XML syntax, 74–78
Turtle, 78–81
serialize method, 352
SeRQL (Sesame RDF Query Language), 192
service chaining, 423
Service class, 427
service-level agreements (SLAs), 425
service-oriented architecture (SOA), 422, 426
ServiceGrounding class, 427–429
ServiceModel class, 427–428
ServiceProfile class, 427–428
Sesame RDF Framework, 143, 146, 153–155
Sesame RDF Query Language (SeRQL), 192
Sesame Storage and Inference Layer (SAIL), 156
set operations, 124–125, 134–135
setEventListener method, 293
setX method, 458
setY method, 458
“Seven Bridges of Konigsberg” (Euler), 24
sharing information, 16–17, 389
description, 97–98
across domain and application boundaries, 174–175
eRDF, 392–395
microformats, 390–392
RDF transformational tools, 404–405
RDFa, 395
attributes, 396–402
blank nodes, 402–403
language support, 403–404
SPARQL endpoints, 404–408
syntax and semantics, 65–67
xOperator, 408–411
SHER (Scalable Highly Expressive Reasoner), 514
shorthand features
RDF/XML syntax, 77–78
Turtle, 81
Simile (Semantic Interoperability of Metadata and Information in unLike Environments), 515
sin operation, 540
Sindice search engine, 190
SIOC (Semantically-Interlinked Online Communities) ontology, 495, 502
size method, 291, 297
SLAs (service-level agreements), 425
slashes (/)
FOAF, 43
Jena rules, 258
XPath expressions, 313–314
slice result sets, 213
Smack API, 308
Snoggle tool, 252–253
mapping with, 253–255
rules, 256–257
SOA (service-oriented architecture), 422, 426
Software Development Kit (SDK), 36
“sort of” relationships, 509
source documents in XSLT, 317
-Source interfaces, 367–369
SourceCollection class, 367
SourceForge site, 429
sources in ontology mapping, 253
space. See spatiotemporal data
SPAN ontologies, 177
SPARQL (SPARQL Protocol and RDF Query Language), 32–33, 147, 192
aggregation, 228
ASK statement, 225–226
CONSTRUCT statement, 222–224
data modification, 228
debugging, 201–202
DESCRIBE statement, 224–225
data modification, 228
description, 97–98
domain and application boundaries, 174–175
descriptions, 97–98
"Seven Bridges of Konigsberg” (Euler), 24
sharing information, 16–17, 389
across domain and application boundaries, 174–175
eRDF, 392–395
microformats, 390–392
RDF transformational tools, 404–405
RDFa, 395
attributes, 396–402
blank nodes, 402–403
language support, 403–404
SPARQL endpoints, 404–408
syntax and semantics, 65–67
xOperator, 408–411
SHER (Scalable Highly Expressive Reasoner), 514
shorthand features
RDF/XML syntax, 77–78
Turtle, 81
Simile (Semantic Interoperability of Metadata and Information in unLike Environments), 515
sin operation, 540
Sindice search engine, 190
SIOC (Semantically-Interlinked Online Communities) ontology, 495, 502
size method, 291, 297
SLAs (service-level agreements), 425
slashes (/)
FOAF, 43
Jena rules, 258
XPath expressions, 313–314
slice result sets, 213
Smack API, 308
Snoggle tool, 252–253
mapping with, 253–255
rules, 256–257
SOA (service-oriented architecture), 422, 426
Software Development Kit (SDK), 36
“sort of” relationships, 509
source documents in XSLT, 317
-Source interfaces, 367–369
SourceCollection class, 367
SourceForge site, 429
sources in ontology mapping, 253
space. See spatiotemporal data
SPAN ontologies, 177
SPARQL (SPARQL Protocol and RDF Query Language), 32–33, 147, 192
aggregation, 228
ASK statement, 225–226
CONSTRUCT statement, 222–224
data modification, 228
debugging, 201–202
DESCRIBE statement, 224–225
data modification, 228
modifers, 208–222
operators, 560–562
query forms, 196–197
quickstart, 192–196
for RDF, 470–471
SELECT. See SELECT statement
subqueries, 228
unsupported functionality, 228
xOperator, 408–411
SPARQL Recommendation, 192
SpatialGraph class, 454–457, 465
spatiotemporal data, 437–440,
450–451
example, 461–465
queries, 453–461
representing, 441–449
working with, 452–453
special features
RDF/XML syntax, 77–78
Turtle, 81
species of owls, 174–175
square brackets ([]) in XPath
expressions, 314
SquirrelRDF tool, 338
src attribute, 399
startsWith operation, 541
Statement interface, 573–574
statements
alignment, 52–55
components, 68
description, 10–11
instance, 15–16
Jena, 270–271
N-Triples, 81
overview, 6–8
as points, 73–74
RDF, 88, 519–520
RDF/XML syntax, 76
reification, 485
Turtle, 79
StmtIterator interface, 574
storage
in data development life cycle,
267
forward chaining, 150
RDF, 144–146, 155–156
strConcat method, 258, 287, 373
streaming RDF writers, 346–351
Streaming Transformations for XML
(STX) project, 327
StreamResult class, 321
StreamSource class, 321
stringEqualIgnoreCase operation, 541
substringAfter operation, 542
substringBefore operation, 542
substring operation, 542
subtract operation, 540
subtractDates operation, 545
subtractDateTimesYieldingDayTimeDuration operation, 545
subtractDateTimesYieldingYearMonthDuration operation, 545
subtractDateTimeTimesYieldingMonthDuration operation, 545
strings
OWL, 122
SWRL, 471, 540–542
Structured Query Language (SQL)
queries, 66
STX (Streaming Transformations for
XML) project, 327
stylesheet definitions, 312
subclass-of relationships, 112
subclasses vs. instances, 112–113
subgraph queries, 206
subjects
Jena, 270
RDF, 519
in statements, 10–11, 68
Turtle, 79
sublist operation, 549
subqueries, 206, 228
substring operation, 542
substringAfter operation, 542
substringBefore operation, 542
subtract operation, 540
subtractDate operation, 545
subtractDateTimesYieldingDayTimeDuration operation, 545
subtractDateTimeTimesYieldingMonthDuration operation, 545
substringAfter operation, 542
substringBefore operation, 542
substring operation, 542
subtract operation, 540
subtractDate operation, 545
subtractDateTimesYieldingDayTimeDuration operation, 545
substringAfter operation, 542
substringBefore operation, 542
substring operation, 542
subtract operation, 540
subtractDate operation, 545
subtractDateTimesYieldingMonthDuration operation, 545
subtractDayTimeDurationFromDate operation, 546
subtractDayTimeDurationFromDateTime operation, 546
subtractDayTimeDurationFromTime operation, 546
subtractDayTimeDurations operation, 546
subtraction in SPARQL, 215
subtractTimes operation, 546
subtractYearMonthDurationFromDate operation, 546–547
subtractYearMonthDurationFromDateTime operation, 547
subtractYearMonthDurations operation, 547
Suggested Upper Merged Ontology (SUMO), 179
sum function, 228
supportsTransactions method, 292
Swift OWLIM store, 156
Swoogle search engine, 181, 190–192
SWRL. See Semantic Web Rule Language (SWRL)
swrlb namespace, 537
SWRLTab, 250
.swrlx file extension, 254
swrlx namespace, 537
SWS. See Semantic Services
SWSE search engine, 190
SWSL (Semantic Web Services Language) Rules, 234
symmetric properties, 119–120
syntactically different ontologies, 50–51
syntax, 15
RDF/XML, 74–78
vs. semantics, 94
sharing information, 65–67
SWRL
abstract, 235–237
XML. See XML (Extensible Markup Language)

T
Tabet, Said, 234
tabular format in Disco, 188
Tabulator Extension for Firefox, 187, 493–494
tagging systems
limitations, 4–5, 15
overview, 472–474	
tar files, 583
taxonomies in RDF, 99–100
templates
velocity, 334–335
XML, 312
temporal information. See spatiotemporal data
TemporalGraph class, 462, 464–465
TemporalTriple class, 463–464
TemporalTripleIndex class, 462–464
ternary operations in SPARQL, 215
Terse RDF Triple Language (Turtle), 74, 520
FOAF project, 29–30
serializations, 78–81
SWRL example, 536
text element, 319
Thing class, 47
time data. See spatiotemporal data
time operation, 547
time operations in SWRL, 543–547
time type in OWL, 122, 441
tokenize operation, 542
TONES Ontology Repository, 181
top properties, 116
Torrent2RDF application, 405
toString method, 355
transaction time, 440–441
transaction time-bounded queries, 461–465
transactionModel method, 294
transactions in Jena, 292–295
transformations
Index

**U**

UDDI (Universal Description, Discovery and Integration), 423–424

UML diagrams, 367–368

unary operations in SPARQL, 215, 560

unaryMinus operation, 540

unaryPlus operation, 540

“uncle” problem, 232

Uniform Resource Identifiers (URIs), 70

consistent, 481–482

creating, 480

description, 10–11

different, 138

N-Triples, 81

OWL, 122

RDF, 86

resolvable, 483

SWRL, 547–548

unique, 480–481

XML, 329–330

Uniform Resource Locators (URLs), 7, 11, 70

Uniform Resource Names (URNs), 11, 70

union method, 283

union-of operation, 125, 134–135

union operation in XPath expressions, 314–315

UNION statements, 219–222

unique artifacts, 17

unique resolvable names, 17

unique URIs, 480–481

units of measurement properties and datatypes, 484 specifying, 483–484

statement reification, 485

value containers, 485–486

unity property, 495

Universal Description, Discovery and Integration (UDDI), 423–424

RDF tools, 404–405

XML. See XSL Transformations (XSLT)

Transformer class, 321

TransformerFactory class, 321

transformerOutputStream class, 321

transitive properties, 119–120

translate operation, 542

translation

ad hoc, 366

explicit, 365–366

between representations, 304–307

rules for, 365

translators, 478–479

transparency in PML, 511

trees

merging, 72

spatial data, 452

XML, 309

trinary operations in SPARQL, 215, 562

triple stores, 142

triples

Disco, 187

RDF, 72, 144–145, 187

reification, 449

SPARQL, 198

in statements, 10–11, 68

Turtle, 79

trust, 510–513

truth maintenance in forward chaining, 150–151

try/catch statements, 294

Tsarkov, Dmitry, 157

Tufte, Edward, 514

Turtle (Terse RDF Triple Language), 74, 520

FOAF project, 29–30

serializations, 78–81

SWRL example, 536

TurtleWriter class, 346, 348–351

Twine, 27–28

typeof attribute, 401–402
<table>
<thead>
<tr>
<th>U–W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universal Resource Locators (URLs), 7, 11, 70</td>
</tr>
<tr>
<td>Unmarshaller class, 333</td>
</tr>
<tr>
<td>unmarshalling XML data into Java, 331–333</td>
</tr>
<tr>
<td>unnecessary complexity, 23</td>
</tr>
<tr>
<td>unstructured data, annotating, 472–477</td>
</tr>
<tr>
<td>unsupported functionality in SPARQL, 228</td>
</tr>
<tr>
<td>Upcoming.org XML web service, 308, 358–359</td>
</tr>
<tr>
<td>UpcomingEventSource class, 369, 381</td>
</tr>
<tr>
<td>upper ontologies, 175–183</td>
</tr>
<tr>
<td>uppercase operation, 542</td>
</tr>
<tr>
<td>URLs. See Uniform Resource Identifiers (URIs)</td>
</tr>
<tr>
<td>URLs (Universal Resource Locators), 7, 11, 70</td>
</tr>
<tr>
<td>URNs (Uniform Resource Names), 11, 70</td>
</tr>
<tr>
<td>Use Cases and Requirements (UCR), 260</td>
</tr>
<tr>
<td>‘Using Vampire to Reason with OWL’ (Tsarkov, Riazanov, Bechhofer, and Horrocks), 157</td>
</tr>
<tr>
<td>UTF-8 encoding, 312</td>
</tr>
<tr>
<td>SWRL, 236, 251</td>
</tr>
<tr>
<td>XML, 238</td>
</tr>
<tr>
<td>varying data in data translation, 306</td>
</tr>
<tr>
<td>Velocity template engine</td>
</tr>
<tr>
<td>exposing XML, 333–336</td>
</tr>
<tr>
<td>benefits and costs, 336–337</td>
</tr>
<tr>
<td>Java bindings, 329–331</td>
</tr>
<tr>
<td>unmarshalling XML data into Java, 331–333</td>
</tr>
<tr>
<td>installation guide, 583</td>
</tr>
<tr>
<td>VelocityContext class, 334</td>
</tr>
<tr>
<td>VelocityEngine class, 334</td>
</tr>
<tr>
<td>Venn diagrams, 226–227</td>
</tr>
<tr>
<td>versioning ontologies, 493–494</td>
</tr>
<tr>
<td>vertical bar characters (|) in XPath expressions, 314</td>
</tr>
<tr>
<td>Virtuoso Universal Server application, 406</td>
</tr>
<tr>
<td>Visual Display of Quantitative Information (Tufte), 514</td>
</tr>
<tr>
<td>visualization</td>
</tr>
<tr>
<td>future possibilities, 514–517</td>
</tr>
<tr>
<td>Semantic Services node, 478–479</td>
</tr>
<tr>
<td>vocabularies, 6, 8</td>
</tr>
<tr>
<td>creating, 47</td>
</tr>
<tr>
<td>RDF, 99–102</td>
</tr>
<tr>
<td>selecting, 43</td>
</tr>
<tr>
<td>volume in data translation, 306–307</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>valid time, 440</td>
</tr>
<tr>
<td>validate method, 289</td>
</tr>
<tr>
<td>validateDataFromModel method, 289</td>
</tr>
<tr>
<td>ValidityReport interface, 574</td>
</tr>
<tr>
<td>value containers, 485–486</td>
</tr>
<tr>
<td>value restrictions, 127–131</td>
</tr>
<tr>
<td>Vampire reasoning engine, 157</td>
</tr>
<tr>
<td>var keyword, 238, 554</td>
</tr>
<tr>
<td>Variable keyword, 554</td>
</tr>
<tr>
<td>variables</td>
</tr>
<tr>
<td>existential, 84</td>
</tr>
<tr>
<td>Jena rules, 258</td>
</tr>
<tr>
<td>SPARQL, 194–196</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watson search engine, 190</td>
</tr>
<tr>
<td>Watterson, Bill, 467</td>
</tr>
<tr>
<td>weather.gov site</td>
</tr>
<tr>
<td>XML feeds</td>
</tr>
<tr>
<td>overview, 310–311</td>
</tr>
<tr>
<td>RDF generators for, 356–358</td>
</tr>
<tr>
<td>XSL Transformations. See XSL Transformations (XSLT)</td>
</tr>
<tr>
<td>WeatherToRdfWithJaxb class, 331–332</td>
</tr>
<tr>
<td>WeatherToRdfWithXslt class, 320–321</td>
</tr>
</tbody>
</table>
web browsers
  navigation, 186–187
  RDF, 146
Web data-centric perspective, 13–14
Web Rule Language (WRL), 234
Web Service Execution Environment (WSMX), 429–431
Web Service Modeling Language (WSML), 429
Web Service Modeling Ontology (WSMO), 422, 426, 429–432
web services, 421, 423–424
Welkin tool, 515
when element, 319
WHERE clause, 193, 197–198, 200
wikis, semantic, 26–27
WordNet tool, 505
WordPress blogs, 307
  D2RQ for, 338–346
database queries, 342–345
  for Facebook, 367
  mappings, 339–341
  relational databases, 308
  for wrapping instances, 341–342
WordPressSource class, 369, 377, 381
WordPressToRdfWithD2RQ class, 341–342
workflow in Semantic Services, 425–426
World Wide Web (WWW)
  vs. Semantic Web, 7
  understanding, 95–96
wrapper objects, 321
wrapping D2RQ instances in Jena model, 341–342
write method, 83, 290
writeData method, 290
writeHasEmailAddressProperty method, 413
writeIsNamedProperty method, 412
WRL (Web Rule Language), 234
WSDL
  in SAWSDL, 432–435
  Servicegrounding, 429
  web services, 422–424
  WsdlGrounding class, 429
  WSML (Web Service Modeling Language), 429
  WSMO (Web Service Modeling Ontology), 422, 426, 429–432
  WSMOStudio editor, 435
  WSMX (Web Service Execution Environment), 429–431
WWW (World Wide Web)
  vs. Semantic Web, 7
understanding, 95–96
www.foaf-project.org, 29–30
www.trueknowledge.com, 32–33
www.twine.com, 27–28

X

XFN (XHTML Friends Network), 392
XMDR (eXtended MetaData Registry), 492
XML (Extensible Markup Language), 66–67
Aduna taxonomy, 515
bindings and velocity, 328–329
  benefits and costs, 336–337
  Java, 329–331
  unmarshalling XML data into Java, 331–333
Velocity template engine, 333–336
  for Facebook, 307–308
  moving to RDF, 309–310
  RDF/XML syntax, 74–78
syntax, 237–238
  `body` element, 239
  `builtinAtom` element, 243
  `classAtom` element, 240–241
  `datatypeAtom` element, 251
XML (Extensible Markup Language), (continued)
datavaluedPropertyAtom element, 242
differentIndividualsAtom element, 243
<head element, 240
<imp element, 239
individualPropertyAtom element, 241–242
<rlab element, 239
sameIndividualAtom element, 242
<var element, 238
tags, 403–404
weather.gov XML feeds, 310–311
XML bindings and velocity, 328–337
XSL Transformations. See XSL Transformations (XSLT)
XML data type in OWL, 122
xml:lang tag, 77
XML Path (XPath) patterns, 313–315
XML Schema Datatypes (XSD), 77
XML Stylesheet Transformations (XSLTs), 67
xmlns attribute, 396
XMPP (Extensible Messaging and Presence Protocol), 308, 408–409
xOperator, 408–411
XOXO microformat, 392
XPath (XPath) patterns, 313–315
XSD (XML Schema Datatypes), 77
<xsd prefix, 100–101, 526
<xsd:anyUri type, 122
<xsd:Boolean type, 122
<xsd:dateTime type, 122
<xsd:decimal type, 122
<xsd:float type, 122
<xsd:fracIonDigits facet restriction, 123
<xsd:fracIonDigitsN facet restriction, 530
<xsd:integer type, 122
<xsd:language type, 122
<xsd:length facet restriction, 123, 530
<xsd:maxExclusive facet restriction, 123, 530
<xsd:maxInclusive facet restriction, 123, 530
<xsd:maxLength facet restriction, 123, 530
<xsd:minExclusive facet restriction, 123, 530
<xsd:minInclusive facet restriction, 123, 530
<xsd:minLength facet restriction, 123, 530
<xsd:pattern facet restriction, 123, 530
<xsd:real type, 122
<xsd:string type, 122, 128
<xsd:token type, 122
<xsd:totalDigits facet restriction, 123, 530
<xsl:for-each element, 324
<xsl:if element, 317
<xsl:output element, 312
<xsl:stylesheet element, 312
<xsl:template element, 312, 324
XSL Transformations (XSLT), 310–311
aligning ontologies with, 376–381
benefits and costs, 326–327
example application, 315–319
with Facebook data source, 322–326
programmatic processing, 319–322
traversing XML documents with XPath, 313–315
<xsl:value-of element, 317

Y
Yahoo Pipes, 497
yearMonthDuration operation, 547