above-ceiling cleaning, 342
access restrictions, 293
cages, 294–296
cameras, 297
door controls, 293–294
locking cabinets, 296
policies, 297–299
rules, 299–306
accessibility of Data Centers, 46
accessories, stocking, 288–290
acquisition of servers, 230–231
adapters, stocking, 274–278
affect load, 124
air handlers
chilled liquid cooling, 196–198
floor grids, 86
positioning, 204
raised floors, 120
spacing, 91
temperature sensors, relocating, 224
air pressure, 202
air sampling, 209
airborne particle counts, 341
airflow
floor tiles, 125
raised floors, 121
aisles, 93–94, 204
alarms
fire signage, 264–265
fire suppression, 210
amenities (Data center site selection), 49
amperage meters, 325
analyzing power needs, 47–49. See also evaluating antitip brackets, 280
applications, mapping, 317, 321
architectural firm (design considerations), 27
Argonite, 207
Arrhenius Rate Law, 195
Arrhenius, Svante, 195
as-built blueprints, 319
asset tagging, 320
associated Data center support rooms, 73–79
attention tags, 284
attenuation, copper cabling, 167
AutoCAD, 84
automated house air, 198
automatic sprinkler heads, 117
automating inventory procedures, 320
availability, 17, 18
metrics, 330
services, confirming, 53–54
avoiding
dirty power, 142
single points of power failure, 136
backup rooms, 78
backward infrastructure installation, 105
bandwidth, cabling, 166
bar codes, 320
batteries, standby power, 148
behavior (promoting good habits), 14
below-ceiling cleaning, 343
best practices
installation, 310–312
labeling, 253–263
blueprints, as-built, 319
brackets, antitip, 280
Broken Window Theory, 336
budget decisions, 22–23
buffer zones, 93
Build Rooms, 14, 75–76
building code for Data Centers, 34
buildings
mapping floor grids, 84–88
planners, 27
obstacles, 102–103
building-to-building connectivity, 179–180
business groups, organizing by, 240
bypass options, 136
Cabinets

- Cables, 163
  - Installing, 184
  - Stringing, 308–309
- Cleaning, 343
- Cooling, 203–206
- Labeling, 257–258
- Locking, 296
- Mapping, 317
- Self-cooling, installing, 224
- Servers, stocking, 278–280
- Space, managing, 310
- Weight, removing, 225

Cabling, 9, 16
- Building-to-building connectivity, 179–180
- Ceilings, 117
- Color-coding materials, 178
- Conduits, separating, 113–115
- Contractors, 27
- Costs, 172–173
- Data Center site selection, evaluating, 48
- Dedicated bin areas, 277
- Design, 161–162
- Installing, 180–186
- Labeling, 183, 254–255
- Maintenance, 10
- Minimum bend radius, 181
- Non-plenum/plenum spaces, 115–116
- Numbering schemes, selecting, 249–253
- Plenum-rated ties, 282
- Reverse floor positioning, 182
- Routing, 312
- Servers, 219
- Stringing, 308–309
- Termination, 176–178
- Testers, 288
- Testing, 187–188
- Trays, 116
- Troubleshooting, 131, 190–192
- Types, 165–172
- Wire management, 188–190

Cages, 294–296

Calculating
- Cooling needs, 199
- Load requirements (standby power), 148
- Cameras, 17
- Closed-circuit television coverage, 297
- Web, remote monitoring, 323
- Canned air, 338
- Card readers, 17
- Ceilings
  - Above-ceiling cleaning, 342
  - Below-ceiling cleaning, 343
  - Components, 116–119
- Cellular phones, 104
- Change management, implementing, 300–309
- Change requests, 304
- Characteristic impedance (copper cabling), 168
- Chemicals, approved cleaning agents, 338
- Chilled liquid cooling, 196–198
- Circuit breaker panels, 138
- Circuits, verifying, 154
- Classifications of zoning for Data Centers, 34
- Cleaning Data Centers, 337–350
- Clearances (Data Center site selection), 49
- Client needs, determining, 9–10
- Clocks, 289
- Closed-circuit television coverage, 297
- Clustering, 97
  - By function, 240
  - Servers, 97
- Cold aisles, 204
- Co-location facilities, 6
- Color-coding
  - Cabling materials, 178
  - Patch cords, 276
- Columns, structural, 102
- Communication, 8
- Compatibility, 244
- Components
  - Ceiling, 116–119
  - Cleaning, 343
  - Data Centers, 15–17
  - Electrical systems, 135–138, 142
  - Infrastructure
    - Fastening, 282
    - Location, 66
  - Raised floors, 119–129
  - Concentrated loads, 123
- Conduits
  - Cabling, separating, 113–115
  - Ceilings, 117
electrical, 138
electrical systems, terminating, 142
labeling, 255
configurations
copper patch cords, 274
wiring, 138
confirming service availability, 53–54
connections
building-to-building, 179–180
cabling, 165–172
overhead installation, 111–112
requirements, 174–175
servers, troubleshooting, 223
under-floor installation, 112–113
connectors, patch cords, 276
consolidation options, 70–72
controlling purchasing, 244–247
controls, EPO signage, 266
convenience outlets (electrical systems), 145
cooling, 17
chilled liquid cooling, 196–198
Data Center site selection (evaluating), 48
design, 199–201
distribution, 202
house air, 198
humidity, 203
layouts, 203–206
makeup air, 199
overhead installation, 111–112
raised floors, 120
redundancy, 201–202
requirements, 195–196
self-cooling cabinets, installing, 224
servers, 223
troubleshooting, 211
under-floor installation, 112–113
copper cabling. See also cabling
crosstalk, 168
minimum bend radius, 181
terminators, 177
copper patch cords, 274–275. See also patch cords
cords (patch), 219, 255
costs
budgets
decisions, 23
designs, 22
cabling, 172–173
Data Centers, sizing, 57–58
overruns, 8
credentials of cleaning companies, 338
cross-functional support, 10
crosstalk (copper cabling), 168
Data Centers
accessories, 288–290
design, 8
aisles, 93–94
buffer zones, 93
components, 15–17
defining physical elements, 89
drawing tools for, 83–84
equipment rows, 95–100
establishing criteria, 17–25
floor grids, 84–88
management, 25–30
obstacles, 102–103
seismic mitigation, 101
server environments, 11–15
shape and placement of, 67–72
sizing, 57–67
structure and finished of, 72–73
support rooms, 73–79
system controls, 103
telephones, 103–104
troubleshooting, 105–107
weight, 101
documentation, 317–323
floor plans, 318
locations
confirming service availability, 53–54
evaluating, 46–53
prioritizing needs, 54
selecting, 33–46
maintenance, 335–336
regular upkeep, 336
troubleshooting, 349–350
managers, 26
metrics, 327–333
monitoring, 323–327
outsourcing, 6–7
retrofitting, 228–229
spares, 290–291
standardization, equipping, 273
tools, 280–287
tours, 313–314
value of, 5–6
data connections
overhead installation, 111–112
power, separating from, 113–115
under-floor installation, 112–113
data infrastructure, mapping, 317
databases, server inventory, 321
deadline-based incentives, 29
dedicated cable bin areas, 277
defining requirements and roles, 7–11
delay skew (copper cabling), 168
delays, 8
design
cabling, 161–162
building-to-building connectivity, 179–180
costs, 172–173
hierarchy, 162–165
installing, 180–186
termination, 176–178
testing, 187–188
troubleshooting, 190–192
types, 165–172
wire management, 188–190
cooling, 199–201, 205
Data Centers, 8
aisles, 93–94
buffer zones, 93
components, 15–17
defining physical elements, 89
drawing tools for, 83–84
equipment rows, 95–100
establishing criteria, 17–25
floor grids, 84–88
management, 25–30
obstacles, 102–103
seismic mitigation, 101
server environments, 11–15
shape and placement of, 67–72
sizing, 57–67
structure and finishes of, 72–73
support rooms, 73–79
system controls, 103
telephones, 103–104
troubleshooting, 105–107
weight, 101
electrical systems
components, 135–138
convenience outlets, 145
emergency power off, 145–147
in-room power, 138–143
installing, 153–154
labeling, 143–153
single reference grids, 154
standby power, 147–152
testing, 154–157
troubleshooting, 157–158
fire suppression, 209
networks
redundancy, 175
rooms, 175
organizing, 237–241
controlling purchasing, 244–247
planning for growth, 242–244
packages, 25
SAN (storage area network), 173
servers, 215–217
acquisitions, 230–231
disorganization of rooms, 218–221
infrastructure shortcomings, 221–226
modifying infrastructure, 227–229
moving, 231–232
new construction, 217–218
standardization, 273
wiring, 142
Design Centers
servers, 217–218
usability, 161
determining power requirements, 139
devices
cleaning, 343
networking, labeling, 259
organizing, 237–241
controlling purchasing, 244–247
planning for growth, 242–244
direct-connect cabling hierarchies, 164
direct-connect power, 139
dirty power, avoiding, 142
disaster recovery options, 47
disorganization of server rooms, 218–221
distributed cabling hierarchies, 164
distribution
cooling, 202
key systems, 52
power, 138–140
servers, 224–226
documentation, 29, 317–323
as-built blueprints, 319
design packages, 25
electrical systems, 143–153
floor plans, 318
door controls, 293–294
drawing tools, 83–84
ducted returns, installing, 224
dust-free surfaces, 73
dynamic loads, 123

earthquakes
Data Center site selection risk, 36
seismic mitigation, 101
electrical systems, 304
circuit analyzers, 289
components, 135–138
conduits, 138, 255
contractors, 27
convenience outlets, 145
emergency power off, 145–147
in-room power, 138–143
installing, 153–154
labeling, 143–153
mapping, 317
numbering schemes, selecting, 249–253
rooms, 73
servers, troubleshooting, 221
single reference grids, 154
standby power, 147–152
testing, 154–157
troubleshooting, 157–158
electromagnetic interference (EMI), 43, 113
electrostatic discharge (ESD), 127
elevators, Data Center site considerations, 50
ELFEXT (equal level far end cross talk), 168
emergency contacts (signage), 269
emergency power off. See EPO
EMI (electromagnetic interference), 43, 113
employee-based sizing methods, 60–63
entrance ramps (raised flooring), 67
environments, server design, 11–15
EPO (emergency power off)
controls, 104
signage, 266
equal level far end cross talk (ELFEXT), 168
equipment
carts, 284
lifts, 282
moving, 322
organizing, 239–241
rows, 95–100
stocking spares, 290–291
equipment-based sizing methods, 63–64
equipping Data Centers, 273
accessories, 288–290
equipment spares, 290–291
patch cords and adapters, 274–280
tools, 280–287
ergonomics, 14–15
ESD (electrostatic discharge), 127
establishing Data Center design criteria, 17–25
evaluating locations, 46–53
extinguishers (handheld fire), 210–211
facilities managers, 26
failures (power), avoiding single points of, 136
false ceilings
above-ceiling cleaning, 342
below-ceiling cleaning, 343
far end cross talk (FEXT), 168
fastening infrastructure components, 282
FE13, 207
ferrous metal tests, 341
FEXT (far end cross talk), 168
fiber cabling, 16. See also cabling
glass housing, labeling, 255
fiber-optic cabling, 169. See also cabling
minimum bend radius, 181
terminators, 177
filaments, zinc whiskers, 347
filters. HEPA, 338
finishes of Data Centers, 72–73
fire (Data Center site selection risk), 41
fire alarm instruction signage, 264–265
fire suppression, 17, 207–208
   air sampling/smoke detection, 209
   alarms, 210
   design, 209
   handheld extinguishers, 210–211
   servers, troubleshooting, 224
   signage, 265
   sprinkler systems, 208–209
fireproof containers, 289
flashlights, 282
flexible server environment design, 12
flexible whips, 142
flight paths (Data Center site selection risk), 46
flooding (Data Center site selection risk), 40
flooring
   cleaning, 344
   grids, 84–88, 105
   height, 120
   low-speed scrubbing machines, 339
   plans, 318
   raised, 131
      components, 119–129
      maintenance, 126
      termination under, 127
   reverse positioning (cabling), 182
   spare panels, 290
   subfloors, 129
   tiles, 130
      redeploying, 221
      static, 127
   types of, 125
   zinc whiskers, 348
floor-standing servers, reorienting, 216
FM-200, 207
form, comparing form and function, 239–241
formatting labeling schemes, 253–263
freight elevators, Data Center site selection, 50
frequency of cleaning, 345
full power tests, 154
function, clustering by, 240

gathering metrics, 327–333
gauge of wire, selecting, 142
general contractors, 27
generators (standby power), 149

grids
   electrical systems, 154
   floor, 84–88, 105
   numbering systems, 249
   grounding electrical systems, 153–154
   groups
      business, organizing by, 240
      manufacturers, organizing, 240
growth plans, 68–69, 242–244
guidelines, server installation, 322

H

handheld fire extinguishers, 210–211
handheld tools, 282
hanging bins, 289
height of floors, 120
HEPA (high-efficiency particulate air), 338
heptafluoropropane, 207
HFC-23, 207
HFC-227, 207
hierarchies (physical)
   cabling, 162–165
   design, 161–162
high availability, 18
high-efficiency particulate air (HEPA), 338
hiring professional cleaning companies, 337–348
hosting ratios, 61
hot aisles, 204
hot spots, cooling requirements, 196
house air, 198
humidity
   cooling, 203
   sensors, 326
testing, 341
hurricanes (Data Center site selection risk), 39
HVAC
   chilled liquid cooling, 196–198
   design, 199–201
distribution, 202
house air, 198
humidity, 203
layouts, 203–206
makeup air, 199
redundancy, 201–202
requirements, 195–196
troubleshooting, 211
hydrofluoric acid, 207
ice storms (Data Center site selection risk), 38
IDC (Internet Data Center), 6
IG-55, 207
IG-451, 207
implementing change management, 300–309
incentives, deadline-based, 29
incident logs, 20, 327–330
Inergen, 207
information tags, 282
information technology. See IT infrastructure
backward installation, 105
ceiling components, 116–119
change requests, 303
cleaning, 343
components
fastening, 282
location of, 66
previewing, 15–17
cooling
chilled liquid cooling, 196–198
design, 199–201
distribution, 202
house air, 198
humidity, 203
layouts, 203–206
makeup air, 199
redundancy, 201–202
requirements, 195–196
troubleshooting, 211
electrical systems
components, 135–138
convenience outlets, 145
emergency power off, 145–147
in-room power, 138–143
installing, 153–154
labeling, 143–145, 152–153
single reference grids, 154
standby power, 147–152
testing, 154–157
troubleshooting, 157–158
evaluating, 47–49
fire suppression, 207–208
air sampling/smoke detection, 209
alarms, 210
design, 209
handheld extinguishers, 210–211
sprinkler systems, 208–209
flexibility of, 13
inspections, 345
mapping, 317
numbering schemes, selecting, 251
overhead installation, 111–112
raised floors, 119–129
scalable network
cabling costs, 172–173
cabling hierarchies, 162–165
cabling termination, 176–178
cabling types, 165–172
connections, 174–175
design, 161–162
installing cabling, 180–186
redundancy, 175
rooms, 175
SAN (storage area network), 173
testing cabling, 187–188
troubleshooting, 190–192
wire management, 188–190
servers
acquisitions, 230–231
modifying, 227–229
moving, 231–232
shortcomings, 221–226
tiers, 19–20
under-floor installation, 112–113
injection tests, 154
in-room electrical (power facilities), 16
in-room power (electrical systems), 138–143
inspections, infrastructure, 345
installing
backward infrastructure, 105
best practices, 310–312
cabinets, 184
cabling, 180–186
ducted returns, 224
electrical systems, 153–154
overhead, 111–112
power strips, 221
self-cooling cabinets, 224
servers, 322
under-floor, 112–113
internal refraction, fiber-optic cabling, 171
Internet Data Center (IDC), 6
inventorying servers, 320
inverse square law, 43
irregular spaces, 102–103
isolated power, 135
IT (information technology), 6
IT managers, 26

K - L

key systems, distribution of, 52
labeling, 249, 270
  best practices, 253–263, 313
  cabinets, 257–258
  cabling, 183, 254–255
  electrical conduits, 255
  label makers, 284
  networking devices, 259
  numbering schemes, selecting, 249–253
  piping, 262
  servers, 259–260
  verifying, 154
labeling (electrical systems), 143–153
lack of organization, 241
ladders, 116, 339
landslides (Data Center site selection risk), 41
layouts. See also design
cooling, 203–206
Data Centers
  aisles, 93–94
  buffer zones, 93
defining physical elements, 89
drawing tools for, 83–84
equipment rows, 95–100
floor grids, 84–88
obstacles, 102–103
seismic mitigation, 101
system controls, 103
telephones, 103–104
troubleshooting, 105–107
weight, 101
leak detection devices, 17
life spans, 22
lifts, 122–123
lights, monitoring (signage), 269
lint-free mops, 339
liquids, approved cleaning agents, 338
load
  bank tests, 154–156
  bearing capabilities of raised floors, 123
  requirements (standby power), 148
loading docks, 50, 75
locations
  confirming service availability, 53–54
evaluating, 46–53
  of infrastructure components, 66
  prioritizing needs, 54
  selecting, 33–46
locking cabinets, 296
logical topologies, 163
logs, incident, 20, 327–330
low smoke/zero Halogen, 115
low-speed floor scrubbing machines, 339

M

maintenance, 335–336
  availability, 18
cabling, 10
  change requests, 303
cleaning, 337–348
electrical system bypass options, 136
patch cords, 277
raised floors, 126
regular upkeep, 336
troubleshooting, 349–350
makeup air, 199
makeup water (chilled liquid cooling), 198
management, 238–239
cabinet space, 310
  change, implementing, 300–309
  Data Centers
    outsourcing, 6–7
    projects, 25–30
    value of, 5–6
remote infrastructure (electrical systems), 137
roles, defining, 7–11
row weight, 226
wire, 188–190, 219
manual controlled sprinkler systems, 208
manufacturers, grouping by, 240
p.369

mapping
  buildings, 84–88
  Data Centers, 317–323
  floor plans, 318
materials, approved cleaning, 338
measurements, 327–333
mechanical contractors, 27
mechanical equipment, 90
media storage areas, 79
mergers, servers, 230–231
metal tests, 341
metrics, 327–333
minimum bend radius (cabling), 181
misplaced infrastructure items, 106
mitigation, seismic, 101
models, UPS, 149
modifying servers
  infrastructure, 227–229
  mergers, 230–231
modular server environment design, 12
monitoring Data Centers, 323–327
monitoring lights
  signage, 269
  standby power, 151
mops, lint-free, 339
moving
  dollies, 284
  equipment, 322
  raised floors, 85
  servers, 231–232
  multimode fiber cabling, 170. See also cabling

N
natural disasters, 35
near end cross talk (NEXT), 168
Network Engineers, 26
networks
  design, 161–162
  cabling costs, 172–173
  cabling hierarchies, 162–165
  cabling termination, 176–178
  cabling types, 165–172
  connections, 174–175
  installing cabling, 180–186
  redundancy, 175
  rooms, 175
SAN (storage area network), 173
testing cabling, 187–188
troubleshooting, 190–192
  wire management, 188–190
  devices
    cleaning, 343
    labeling, 259
    organizing, 237–247
  rooms, 74
  rows, 98, 162
NEXT (near end cross talk), 168
non-plenum spaces, 115–116
numbering schemes, selecting, 249–253

O
obstacles
  building components, 102–103
  Data Center site selection, 49
  operations command centers, 77–78
options
  consolidation, 70–72
  disaster recovery, 47
organization
  controlling purchasing, 244–247
  lack of, 241
  need for, 237–241
  planning for growth, 242–244
orienting rows, 99
outdated servers, removing, 216
outsourcing Data Centers, 6–7
overhead installation, 111–112
overhead gemination, 117
overloading power strips, 312

P
package design, 25
pallet jacks, 284
panels
  circuit breaker, 138
  flooring, 290
  patch, labeling, 255
particle counts, 341
patch cords, 219
  maintenance, 277
  stocking, 274–278
patch panel labeling, 255
perforated floor tiles, 125
pH neutral cleaning chemicals, 338
physical access restrictions, 293
  cages, 294–296
  cameras, 297
  door controls, 293–294
  locking cabinets, 296
  policies, 297–299
  rules, 299–306
physical attributes of Data Center sites, 46–53
physical elements, defining, 89
physical network design, 161–162. See also networks
cabling costs, 172–173
cabling hierarchy, 162–165
cabling termination, 176–178
cabling types, 165–172
connections, 174–175
installing cabling, 180–186
redundancy, 175
rooms, 175
SAN (storage area network), 173
testing cabling, 187–188
troubleshooting, 190–192
wire management, 188–190
piping, 103
labeling, 262
sprinkler systems, 208–209
placement of Data Centers, 67–72
planning for growth, 242–244
plenum-rated cable ties, 282
plenums
  cabling, troubleshooting, 131
  spaces, 115–116
point loads, 123
policies, access, 297–299
political climates, 45
pollution, 42
portable airborne particle counters, 341
positioning
  air handlers, 204
  reverse floor (cabling), 182
  post-cleaning steps, 345
power
data connections, separating from, 113–115
distribution, 90, 138–140
electrical systems. See also electrical systems components, 135–138
certainty outlets, 145
emergency power off, 145–147
in-room power, 138–143
installing, 153–154
labeling, 143–145, 152–153
single reference grids, 154
standby power, 147–152
testing, 154–157
troubleshooting, 157–158
evaluating, 47–49
in-room electrical, 16
overhead installation, 111–112
overloading, 312
redundancy, 141
requirements, determining, 139
schedules, 256
servers, troubleshooting, 221
standby, 16
strips, installing, 221
under-floor installation, 112–113
power sum (PS), 168
power tools, 284
pre-cleaning steps, 339
pre-existing infrastructure, evaluating, 47–49
pressure (air), 202
previewing Data Center components, 15–17
prioritizing needs (Data Center site selection), 54
procedures
  access, 297–299
  cleaning, 341
  security, 306
processes, mapping, 322
professional cleaning companies, hiring, 337–348
project managers, 27
projecting cooling needs, 199
PS (power sum), 168
purchasing, controlling, 244–247
Q
qualifications of cleaning companies, 338
quantities, cooling, 199–201
rack-mountable servers, 216
racks, proper use of, 310
radiation (Data Center site selection risk), 44
radio frequency identification (RFID), 320
radio frequency interference, 43
raised flooring, 16, 67
components, 119–129
maintenance, 126
moving, 85
termination under, 127
tiles, redeploying, 221
troubleshooting, 131
under-floor installation, 112–113
ramps, 122, 123
ranges, temperature, 199–201
ratios, hosting, 61
real estate managers, 27
receptacles, 143, 256
redeploying floor tiles, 221
redundancy
cooling, 201–202
electrical systems, 136
networks, 175
power, 141
refraction, internal, 171
regular maintenance upkeep, 336
regulating relative humidity, 203
reinforcements (structural), 67
relative humidity, regulating, 203
relative location of Data Centers, 46
relocating air handler temperature sensors, 224
remote infrastructure management, 137
remote monitoring tools, 323–327
removing outdated servers, 216
removing trash, 307
reorienting floor-standing servers, 216
repairs, change requests for, 304. See also
maintenance
requests (change), 302–304
requirements
connections, 174–175
cooling, 195–196
defining, 7–11
load (standby power), 148
power, determining, 139
rerack servers, 215
restrictions (physical access), 293
cages, 294–296
cameras, 297
doors controls, 293–294
locking cabinets, 296
policies, 297–299
rules, 299–306
retrofitting Data Centers, 228–229
return loss (copper cabling), 168
reverse floor positioning (cabling), 182
RFID (radio frequency identification), 320
risks, Data Center site selection, 35–45
robust server environment design, 11
roles, defining, 7–11
rolling loads, 123
rooms
backup, 78
build, 75–76
electrical, 73
loading docks, 75
media storage areas, 79
networking, 74, 175
operations command centers, 77–78
selection of, 21
servers, 218
storage, 76, 77
support, 73–79
vendor service areas, 79
routing cables, 312
rows
cabinets, 163
networks, 98, 162
orienting, 99
servers, 66, 163
labeling, 260
signage, 251
weight management, 226
rules, access, 299–306
SAN (storage area network), 173
Sarbanes-Oxley Act of 2002, 298
saving server space, 215
scalable network infrastructure

cabling
installing, 180–186
termination, 176–178
testing, 187–188
troubleshooting, 190–192
wire management, 188–190
connections, 174–175
costs, 172–173
design, 161–162
hierarchy, 162–165
network rooms, 175
redundancy, 175
SAN (storage area network), 173
types, 165–172
schedules, power, 256
screws (cabinet), 281
scrubbing machines, low-speed, 339
security, 10
physical access restrictions, 293
cages, 294–296
cameras, 297
door controls, 293–294
locking cabinets, 296
policies, 297–299
rules, 299–306
procedures, 306
security cameras, 17
seismic activity, Data Center site selection risk, 35
seismic mitigation, 17, 101
selecting
cleaning companies, 337–348
locations, 33–46
numbering schemes, 249–253
patch cords, 219
room sites, 21
wiring gauge, 142
sensors
air handler temperature, relocating, 224
humidity, 326
temperature, 325–326
separation
of key electrical infrastructure, 136
of power and data, 113–115
sequences, numbering schemes, 251
servers, 97
arranging, 96
cabinets, stocking, 278–280
change requests for repairs, 304
cleaning, 343
components, 15–17
controlling purchasing, 244–247
design, 11–15, 215–217
acquisitions, 230–231
disorganization of rooms, 218–221
infrastructure shortcomings, 221–226
modifying infrastructure, 227–229
moving, 231–232
new construction, 217–218
distributing, 224–226
fire suppression materials, 207
installation guidelines, 322
inventory, 320
labeling, 259
mapping, 317
moving, 322
numbering schemes, selecting, 249–253
organizing, 237–241
planning for growth, 242–244
rerack, 215
rows, 163
labeling, 260
spacing around, 66
signage, 251
stocking, 273
temperature sensors, 326
upgrading, 216
wire management, 219
service availability, confirming, 53–54
service level agreements (SLAs), 322
shape of Data Centers, 67–72
Shielded Twisted Pair (STP) cabling, 114
signage, 249, 263, 270
equipment, 269
EPO (Emergency Power Off) systems, 266
fire alarm instructions, 264–265
fire suppression, 265
monitoring lights, 269
server rows, 251
single points of power failures, avoiding, 136
single reference grids, 154
singlemode fiber cabling, 171. See also cabling sizing
Data Centers, 57–67
floor tiles, 125
SLAs (service level agreements), 322
smoke detection, 209
solid copper cables, 166
space, 90
cabinets, managing, 310
cooling infrastructure, 204
physical elements, defining, 89
servers
design, 215–217
new construction, 217–218
rows, 66
troubleshooting, 106
spares
floor panels, 290
stocking, 290–291
specifications
copper cabling, 167
fiber-optic cabling, 172
speed, cabling, 166
sprinklers
chilled liquid cooling (makeup water), 198
heads, 117
systems, 208–209
standardization
accessories, 288–290
cleaning Data Centers, 340
equipment spares, 290–291
equipping Data Centers, 273
patch cords and adapters, 274–278
servers
cabinets, 278–280
environments, 13
equipment, 230–231
tools, 280–287
standby infrastructure maintenance, 303
standby power, 16, 136, 147–152
static
dissipative cleaning chemicals, 338
floor tiles, 127
loads, 123
pressure, 202
static-free surfaces, 73
stepladders, 286
stocking Data Centers, 273
accessories, 288–290
equipment spares, 290–291
patch cords and adapters, 274–278
server cabinets, 278–280
tools, 280–287
storage area network (SAN), 173
storage rooms, 76, 77
STP (Shielded Twisted Pair) cabling, 114
stranded copper cables, 166
strands, 174
stringing cables, 308–309
straps (power), overloading, 312
structural columns, 86, 102
structural reinforcements, 67
structural support, 225
structure of buildings, 52
structured cabling
installing, 180
labeling, 183
structures of Data Centers, 72–73
subfloors, 86, 129, 344
substations, 163
success, tips for, 28
support, cross-functional, 10
support rooms, 73–79

T
tagging (asset), 320
tag information, 282
telephones, 103–104
temperature
control, 195. See also cooling
ranges, 199–201
sensors, 325–326
testing, 341
termination
cabling, 176–178
infrastructure under raised floors, 127
of power (options), 142
overhead, 117
testing
cabling, 187–188, 288
electrical systems, 154–157
ferrous metal tests, 341
humidity, 341
temperatures, 341
theft, 308
TIA/EIA 568 Commercial Building, 166
tiers, infrastructure, 19–20
ties (cabinet), 281
tiles (floor)  
pullers, 286  
redeploying, 221  
static and, 127  
troubleshooting, 130  
types, 125  
tools. See also equipment  
drawing, 83–84  
remote monitoring, 323–327  
stocking, 280–287  
topologies, designing for physical, 163  
torches, 282  
tornadoes (Data Center site selection risk), 39  
tours  
for cleaning company vendors, 339  
of Data Centers, 313–314  
tracking server inventory, 321. See also metrics  
trash, removing, 307  
trifluromethane, 207  
troubleshooting, 130–131  
cabling, 131, 190–192  
cleaning procedures, 349–350  
cooling, 211  
Data Center design, 105–107  
electrical systems, 157–158  
floor tiles, 130  
servers  
connectivity, 223  
cooling, 223  
fire suppression, 224  
power, 221  
structural support, 225  
types, 125  
of cabling, 165–172  
of wiring, 142  

upkeep, regular maintenance, 336  
UPS (uninterruptible power source), 148  
usability, 161  
UTP (Unshielded Twisted Pair) cabling, 114  

V  
vacuums, 338  
value of Data Centers, 5–6  
vendors  
cleaning companies, selecting, 337–348  
service areas, 79  
vented floor tiles, 125  
verifying  
cabling, 187–188  
electrical systems, 154–157  
viable locations for Data Centers, selecting, 33–46  
vibration (Data Center site selection risk), 45  
visiting construction sites, 29  

W - Y  
water  
chilled liquid cooling, 198  
sprinkler systems, 208–209  
Web cameras, remote monitoring, 323  
weight, 101  
bearing ability (raised floors), 123  
cabinets, 225  
Data Center site selection consideration, 50  
troubleshooting, 131  
whips (flexible), 142  
wiring. See also cabling  
configurations, 138  
design, 142  
management, 188–190, 219  
types of, 142  
work-in-progress tags, 284  

Z  
Zimbardo, Philip, 336  
zinc whiskers 346–347  
zonal cabinets, 163  
zoning for Data Centers, 34