

Index

A

Access layer, 5, 6–7, 236
ACE Device manager, 107, 230, 239
ACI. *See* Application Centric Infrastructure
active zone, 239
Adapter FEX, 155
Aggregation layer, 5–6, 236
APIC. *See* Application Policy Infrastructure Controller
Application Centric Infrastructure (ACI), 48
Application Control Engine (ACE), 60, 239.
See also ACE Device manager
global load balancing, 108, 239
high availability, 106–107, 237
load balancing features, 102–106, 110,
230, 240
virtual device contexts, 106
Application Policy Infrastructure Controller (APIC), 48
arbitrated loop topology, 78–79
association, 209

B

Baseboard Management Controller. *See* Cisco Integrated Management Controller
BiDi, 155
blade computing, 174–175
blade servers, 180, 182, 187
block and file storage, 71–72
block-based storage, 70, 239
B-series blade servers, 182

C

CCO account, 50
CEE-DCBX. *See* Converged Enhanced Ethernet DCBX
channel-group, 19
chassis, 174
server, 180
chassis management controller (CMC), 186

chassis management switch (CMS), 186
CIFS. *See* Common Internet File System
CIMC. *See* Cisco Integrated Management Controller
CIM-XML, 203, 243
CIN-DCBX. *See* Cisco, Intel, Nuova DCBX
Cisco, 2
Cisco, Intel, Nuova DCBX (CIN-DCBX), 153
Cisco ACE. *See* Application Control Engine; Cisco Application Control Engine
Cisco ACE Device Manager. *See* ACE Device manager
Cisco Application Control Engine (Cisco ACE), 60
Cisco Global Site Selector, 108
Cisco Integrated Management Controller (CIMC), 186, 232, 243
Cisco MDS line, 28, 58–60
Cisco Unified Computing Systems, 173
Class of Service (CoS), 150, 152, 241
cloud computing, 2
cluster setup, 197–203
cluster verification, 201–203
CMC. *See* chassis management controller
CMP. *See* connectivity management processor
CMS. *See* chassis management switch
CNAs. *See* converged network adapters
collapsed backbone topology, 236
collapsed core model, 7
commit, 202–203, 244
Common Internet File System (CIFS), 70, 238
configuration files, 203
connectivity management processor (CMP), 50
console port, 185, 232
control interface, 240
control plane, 30–31
Control Plane Policing (CoPP), 31, 237
Converged Enhanced Ethernet DCBX (CEE-DCBX), 153
converged fabric, of data centers, 73

converged network adapters (CNAs),
4, 147
Nexus 5000 connections, 154
UCS servers, 183
CPPO. *See* Control Plane Policing
Core layer, 5, 236
CoS. *See* Class of Service
C-series rack servers, 182–183
CSMA/CD, 149

D

DAS. *See* directly attached storage
data center bridging, 147, 150
Data Center Bridging Exchange (DCBX),
152–153
data center LANs, 2–3
 Access layer, 5, 6–7, 236
 Aggregation layer, 5–6, 236
 collapsed core model, 7
 Core layer, 5, 236
 unified, 4
data centers
 computing evolution, 174–175
 converged fabric of, 73
 interconnecting, 11
data plane, 29–30, 236
DCBX. *See* Data Center Bridging Exchange
DDoS attacks, 108
Dell Remote Access Console (DRAC), 186
denial-of-service (DoS), 31, 108
device virtualization, 2
directly attached storage (DAS), 70
distributed virtual switches (DVS), 122–124
Distribution layer, 5, 236
DNS. *See* domain name system
DNS servers, 198
domain name system (DNS), 103
DoS. *See* denial-of-service
DRAC. *See* Dell Remote Access Console
DVS. *See* distributed virtual switches

E

E port. *See* expansion port
EMC, 77
Emulex, 183

encapsulation, 148
end-of-row (EoR), 55–56, 238
Enhanced Transmission Selection (ETS),
152, 241, 242
ENodes, 153
EoR. *See* end-of-row
Equipment tab, 206
ESX, 173, 241
EtherChannels, 17, 18
Ethernet, 146. *See also* Fibre Channel over
 Ethernet; Virtual Ethernet Module
CEE-DBX, 153
flow control, 149
40 Gigabit, 148, 153, 155
lossy transport, 149
100 Gigabit, 153, 155
port personality, 187
10 Gigabit, 2, 28
ETS. *See* Enhanced Transmission Selection
exit, 202
expansion port (E port), 80
expert mode, 215
extended memory, 181–182
Extensible Markup Language (XML),
203, 243

F

F port. *See* fabric port
FA-AL. *See* Fibre Channel Arbitrated Loop
fabric extender (FEX), 56–58, 155, 242
 addressing for configuration, 161–162
 configuration, 156–164
 standby switch configuration, 163–164
fabric interconnects (FI), 232, 243
 cabling, 197–198
 console port, 185
 Ethernet interface port personality, 187
 I/O modules, 185–186
 management ports, 198
 setup dialog, 198–201
 UCS, 176, 177–180, 185–186, 242
fabric login (FLOGI), 84–85, 238, 239
fabric modules, 51, 236
fabric port (F port), 80, 238
fabric topology, 79–80
FabricPath, 2, 8–9, 50, 147, 237

FCNS. *See* Fibre Channel Name Server
FCoE. *See* Fibre Channel over Ethernet
FCoE Initialization Protocol (FIP), 153
fcoe mode on, 150
feature fcoe, 150
feature fex, 157
fex, 158
FEX. *See* fabric extender
fex associate, 57, 158
fex pinning redistribute, 163
FI. *See* fabric interconnects
Fibre Channel, 46–47, 53, 68, 70, 237, 238
configuring, 150
flow control, 149
frames, 69, 150
lossless transport, 149–150
PFC, 151–152
port types, 76, 80, 81
SAN components, 81, 82
switches, 74
Fibre Channel Arbitrated Loop (FC-AL), 78, 79
Fibre Channel Forwarder, 153
Fibre Channel ID, 238
Fibre Channel Name Server (FCNS), 85
Fibre Channel networks, 72–73
Fibre Channel over Ethernet (FCoE), 4, 70, 73, 146, 147, 237
CoS values, 152
data center bridging, 150
frame, 149, 241
lossless transport, 149–150
multihop, 242
protocol encapsulation, 148
QoS, 150
topology, 153
United Fabric, 148–150, 153
virtual expansion port, 241, 242
file-based storage, 70, 71
Finite State Machine (FSM), 187, 206–207, 243, 244
FIP. *See* FCoE Initialization Protocol
firewalls, 240
FLOGI. *See* fabric login
flow control, 149
priority-based, 151–152, 241, 242
40 Gbps Ethernet, 148, 153, 155
FSM. *See* Finite State Machine

G

generic expansion module (GEM), 53
Gigabit SFP interfaces, 154
global load balancing (GLB), 108, 239
global server load balancing (GSLB), 110, 230
Global Site Selector, 108, 240
grid configuration, 180
GSLB. *See* global server load balancing
guest OS, 173

H

HA. *See* high availability
hashing, 239
hashing predictor, 104, 230
HBA. *See* host bus adapter
health checks, 14, 105
heartbeat messages, 240
HFS+, 70
high availability (HA), 106–107, 237
host bus adapter (HBA), 72, 73, 147, 238
 SAN boot, 84
 vHBAs, 155
host channels, 237
HP Integrated Lights-Out Management (ILO), 186
Hyper-V, 120
hypervisors, 173

I

IBM System/360, 175
identity pools, 210–214, 243, 244
IEEE 802.1Q, 150, 152
IEEE 802.1Qbb, 151
IEEE 802.1Qbh, 155
ILO. *See* HP Integrated Lights-Out Management
initial setup
 MDS, 87–91, 238
 Nexus 1000v, 133–134
 Nexus family, 31–34
In-Service Software Upgrade (ISSU), 59
install license command, 50
Intelligent Platform Management Interface (IPMI), 186, 203
interface configuration, port channels, 19

interface port-channel, 158
 Intermediate System to Intermediate System (IS-IS), 8
 Internet Small Computer System Interface (iSCSI), 4, 70, 237, 238
 frames, 69
 over TCP/IP, 69, 238
 SAN initiation and, 73–74
 inter-switch links (ISLs), 76, 80
 I/O modules (IOMs)
 fabric interconnects, 185–186
 FSM tab, 187
 UCS, 181, 242, 243
 I/O multiplexer (mux), 186
 IOMs. *See* I/O modules
 IPMI. *See* Intelligent Platform Management Interface
 iSCSI. *See* Internet Small Computer System Interface
 IS-IS. *See* Intermediate System to Intermediate System
 ISLs. *See* inter-switch links
 ISSU. *See* In-Service Software Upgrade

J

JBOD enclosure, 77, 239

K

keepalive messages, 240
 keyboard, video and mouse (KVM), 186, 244
 KVM Manager, 204
 KVM over IP, 204

L

LACP. *See* Link Aggregation Control Protocol
 LAN. *See* local area network
 least-loaded predictor, 104, 230
 licensing, Nexus 7000 family, 50–51
 lights-out management, 186
 line cards, 8
 Nexus 1000V, 125
 Nexus 7000, 52

Link Aggregation Control Protocol (LACP), 18, 236
 link aggregation protocols, 18
 load balancer, 230, 240
 load balancing
 ACE features, 102–106, 110, 230, 240
 global, 108, 239
 GSLB, 110, 230
 management options, 107
 port channel metrics, 19–23
 virtual contexts, 106
 local area network (LAN), 3. *See also* data center LANs; VLANs
 serial over, 186
 logical unit numbers (LUNs), 74, 81
 lossless transport, 149–150
 lossy transport, 149
 LUNs. *See* logical unit numbers

M

management interfaces, 29, 237
 management network, 29
 management plane, 31
 management ports
 fabric interconnects, 198
 UCS, 185, 232, 243
 MDS, 4. *See also* Cisco MDS line; Multilayer Director Switch
 MDS 9100/9200, 60
 MDS 9500, 59, 241
 mezzanine card, 182
 mgmt0, 29
 Microsoft Hyper-V, 120
 MMF, 242
 modular approach to network design, 4, 237
 module vem X vemcmd show card info, 136–137
 MPLS. *See* Multiprotocol Label Switching
 Multilayer Director Switch (MDS), 58, 75, 238
 connecting, 76
 initial setup, 87–91, 238
 Multiprotocol Label Switching (MPLS), 11
 mux. *See* I/O multiplexer

N

N port. *See node port*
name server login, 84–85
NetApp, 77
network connectivity
 configuring and verifying, 29
 SAN basic, 75–76
 virtual machines, 118–120
network design, modular approach, 4, 237
Network File System (NFS), 70, 238
network interface cards (NICs), 147
network services, 102
network-centric computing, 175–177
 fabric interconnects, 177–180
 I/O modules, 181
 server chassis, 180
Nexus 1000V, 44–45, 116, 124, 231, 238,
 241. *See also* Virtual Ethernet Module;
 Virtual Supervisor Module
components, 125
distributed virtual switches with, 122
initial configuration, 133–134
installing, 129–137
line cards, 125
OVF template deployment, 130–133
port profiles, 129
software, 130
switch naming conventions, 130
vCenter management and, 128–129
verifying installation, 134–137
Nexus 2000 fabric extender, 45
 redundancy issues, 163
Nexus 2000 family, 55–58
Nexus 3000 series, 45–46
Nexus 3200 series, 46
Nexus 3500, 45
Nexus 4000, 46
Nexus 5000 family, 46–47, 53–55, 236,
 237, 241
 CNA connections, 154
 FEX configuration, 57
Nexus 5500UP, 155, 237
 FEX configuration, 156–164
Nexus 6000, 47
Nexus 7000 family, 7, 47, 48–53, 236,
 237, 241
 data plane, 30

fabric modules, 51
licensing, 50–51
line cards, 52
models, 49
power supplies, 52–53
supervisors, 50
Nexus 9000, 47–48, 238
Nexus family, 2, 4, 43
 EtherChannels, 17
Fibre Channel configuration, 150
initial setup, 31–34
overview, 44–48
storage networking, 28
NFS. *See* Network File System
NICs. *See* network interface cards
node loop port (NL port), 80, 238
node port (N port), 80, 238
non-virtualized adapters, 183, 243
NX-OS, 7, 8
 FabricPath and, 9
 FEX features, 167
 in Nexus 1000v, 241
 storage networking, 28
 vPC configuration, 13–14
 VSMs, 126

O

OM3 fiber, 155
100 Gbps Ethernet, 153, 155
OOB. *See* out-of-band network
Open Virtualization Format (OVF),
 130, 241
 deploying template, 130–133
OTV. *See* Overlay Transport Virtualization
out-of-band network (OOB), 29
Overlay Transport Virtualization (OTV),
 11, 236
oversubscription, 186
OVF. *See* Open Virtualization Format

P

PaGP. *See* Port Aggregation Protocol
PAK. *See* product activation key
parity, 77

PFC. *See Priority-based Flow Control*
pinning, 163, 243
pinning max-links, 163
point-to-point topology, 78
Port Aggregation Protocol (PaGP), 18, 236
port channeling, 17
port channels, 17–26
 dynamic negotiation, 236
 FEX configuration, 158
 interface configuration, 19
 load-balance metrics, 19–23
 statistics, 23–26
 virtual, 2, 12–17, 147, 236, 237
port personality, 187
port profiles, 129, 240
predictor, 103
 hashing, 104, 230
 least number of connections, 105
 least-loaded, 104, 230
 round-robin, 103, 230, 237
pre-provisioning, 164
primary peer, 198
priority grouping, 152
Priority-based Flow Control (PFC), 151–152,
 241, 242
priority-flow-control mode on, 151
probes, 105
product activation key (PAK), 50
protocol encapsulation, 148
provision model, 164

Q

QLogic, 183
QoS. *See quality of service*
quality of service (QoS), 73
 FCoE, 150
 marking, 8, 236

R

rackmount servers, 174, 182–183
Redundant Array of Independent Disks
(RAID), 77
replacing servers, 208–209
round-robin predictor, 104, 230, 237

S

SAN. *See storage area network*
SAN boot, 83–84
SAN switching, 74–75
SATA. *See Serial Advanced Technology*
 Attachment
scope, 202, 244
scope fabric-interconnect, 202
scope system, 202
SCSI. *See Small Computer System Interface*
SDN. *See software-defined networking*
secondary peer, 201
Serial Advanced Technology Attachment
(SATA), 70
Serial Over LAN (SOL), 186
server chassis, 180
Server Management Command Line
 Protocol (SMASH CLP), 203
server pool, 213
server virtualization, 117–118
Server Virtualization Switch (SVS), 128
servers. *See also UCS servers*
 blade, 180, 182, 187
 chassis, 180
 DNS, 198
 name, 84–85
 rackmount, 174, 182–183
 replacing and upgrading, 208–209
 service profile association, 209
 tower, 174
 upgrading or replacing, 208–209
 UUIDs, 208
service profile templates, 215–218
service profiles, 207–218
 address assignment, 210
 association, 209
 creating, 214–215
 expert mode, 215
 simple mode, 214
services modules, 239
set, 202
set out-of-band, 202
set virtual-ip, 202
setup, 87
SFPs. *See small form-factor pluggable modules*
show cluster extended-state,
201–202, 244

show configuration, 203
show diagnostic result fex, 161
show fex, 158
show fex detail, 159–160
show flogi database, 239
show interface fex-fabric, 161
show inventory fex, 160–161
show license host-id, 238
show license usage command, 50
show module, 127
show module vem mapping, 136
show modules, 134–135, 240
show run interface, 158, 162
show run vpc, 13–14
show svs connections, 135, 240, 241
show svs domain, 135
show vpc peer-keepalive, 14
show vpc role, 14
show vpc statistics peer-link, 15–16
simple mode, 214
Simple Network Management Protocol (SNMP), 31, 203
slot, 164
Small Computer System Interface (SCSI), 68–69, 70, 149, 237, 239
small form-factor pluggable modules (SFPs), 75–76, 154
SMASH CLP. *See* Server Management Command Line Protocol
SNMP. *See* Simple Network Management Protocol
software-defined networking (SDN), 48SOL.
See Serial Over LAN
solid-state drives (SSDs), 75
Spanning Tree Protocol, 8–9, 12
SPs. *See* storage processors
SSDs. *See* solid-state drives
SSO. *See* stateful switchover
standard virtual switches, 120–122
standby switches, FEX configuration, 163–164
state enabled, 240
stateful computing, 208
stateful switchover (SSO), 50
stateless computing, 209, 244
static pinning, 58
storage
 block and file, 71–72
 block-based, 70, 239
categories of, 69–72
 directly attached, 70
 file-based, 70, 71
 protection, 77
 topologies, 78–80
storage area network (SAN), 3, 4, 58–60, 68, 72
 basic connectivity, 75–76
 block-based storage and, 70
 components, 81, 82
 initiator, 73, 74
 target, 73
 virtual, 84, 91–93, 238
storage arrays, 72
 connectivity of, 76–77
storage controller, 77
storage networking, 238–239
 Nexus switches, 28
storage pools, 244
storage processors (SPs), 81
storage systems, 81, 82
stripes, 77
supervisor modules, 50. *See also* Virtual Supervisor Module
SVS. *See* Server Virtualization Switch
switched fabric topology, 79–80
switches. *See also* virtual switches
 chassis management, 186
 Fibre Channel, 74
 MDS, 58, 75, 76, 87–91, 238
 naming conventions, 130
 SAN, 74–75
 standby, 163–164
switchport mode fex-fabric, 57

T

TCP/IP, iSCSI over, 69, 238
templates
 OVF deployment, 130–133
 service profile, 215–218
10 Gigabit Ethernet, 2, 146
 cabling options, 154, 242
 storage networking, 28
TLVs. *See* type-length-values
top-of-the-rack switches, 6, 45, 55–56
tower servers, 174

traditional pause, 151
 Transparent Interconnection of Lots of Links (TRILL), 2, 8, 147
 trunk mode, 119
 25 Gbps Ethernet, 148
 Twinax, 155, 242
 type-length-values (TLVs), 152

U

UCS. *See* Unified Computing Systems

UCS 5108 blade server chassis, 180
 UCS 6100 series, 178
 UCS 6200 series, 179
 UCS 6248UP, 179
 UCS 6300 series, 180
 UCS command-line interface, 202
 UCS Manager, 203–207, 243

Equipment tab, 206
 FSM tab, 206–207
 GUI, 204, 243
 identity pools, 210–214
 navigating GUI, 205–206
 service profiles, 207–218

UCS Mini, 179
 UCS servers, 181–184
 B-series blade, 182
 C-series rack, 182–183
 extended memory, 181–182
 interface cards, 183–184
 non-virtualized adapters, 183, 243
 virtualized adapters, 184

Unified Computing Systems (UCS), 4, 173, 175, 232–233
 address assignment, 210–214
 cluster setup, 197–203
 cluster verification, 201–203
 connectivity, 184–188
 console port, 185, 232
 discovery process, 187–188, 243
 Ethernet interface port personality, 187
 fabric interconnects, 176, 177–180,
 185–186, 242
 identity pools, 210–214
 I/O modules, 181, 242, 243
 management port, 185, 232, 243
 server chassis, 180
 service profiles, 207–218

unified data center network, 4
 Unified Fabric, 146, 147, 231–232, 241–242
 connectivity hardware, 154–164
 data center bridging, 150
 DCBX, 152–153
 FCoE, 148–150
 FCoE topology, 153
 unified ports (UP), 179, 242
 Universal Port (UP), 54, 238
 Universally Unique Identifier (UUID),
 136, 244
 server, 208
 up, 202
 UP. *See* unified ports; Universal Port
 upgrading servers, 208–209
 UUID. *See* Universally Unique Identifier

V

vCenter, 122–123, 173

Nexus 1000v configuration, 134
 Nexus 1000v installation verification,
 135, 137
 Nexus 1000v management of, 128–129
 OVF template deployment, 130–133
 VSM communication with, 128–129

VDCs. *See* virtual device contexts

VEM. *See* Virtual Ethernet Module

vem status, 136

vemcmd show port, 136

vHBAs, 155

VIC. *See* Virtual Interface Card

VICs. *See* virtualized interface cards

VIF. *See* virtual interface

VIM. *See* Virtual Infrastructure

Methodology

virtual appliances, 44

VLANs, 119–120

virtual device contexts (VDCs), 26–28, 106,
 236, 239

Virtual Ethernet Module (VEM), 127,
 240, 241

installation verification, 136–137

Nexus 1000V installation

 preparation, 130

VSM communication with, 128

virtual expansion port, 241, 242
Virtual Infrastructure Methodology (VIM), 128
virtual interface (VIF), 156
Virtual Interface Card (VIC), 155, 242
virtual IP address, 198, 240
Virtual Machine FEX, 155
virtual machines, network connectivity, 118–120
virtual N port (VN port), 153
virtual networking, 44
virtual output queueing (VOQ), 51, 59
virtual PortChannels (vPCs), 2, 12, 147, 236, 237
configuration, 13–14
health checks and failover, 14
peer link, 15–16
roles, 14
statistics, 16–17
virtual routing and forwarding (VRF), 50
virtual server appliances, 126
virtual storage area network (VSAN), 84, 91–93, 238
Virtual Supervisor Module (VSM), 125–127, 240
Nexus 1000V installation preparation, 130
Nexus 1000V installation verification, 135
OVF template deployment, 132
vCenter communication with, 128–129
VEM communication with, 128
virtual switches, 44, 116–117, 236
distributed, 122–124
standard, 120–122
virtualization, 173
device, 2
server, 117–118
switch types, 125
virtualized adapters, 184
virtualized interface cards (VICs), 184
virtualized modular chassis switch, 155
VLAN trunking, 155–156
VLANs
in data center interconnection, 11
fabric interconnect management ports, 198
management traffic, 130
virtual machines, 119–120
virtual switches, 120–121

VMkernel, 120
vMotion, 121, 122
VMware, 44, 173
distributed virtual switch, 122–124, 241
Nexus 1000V installation preparation, 130
UUID, 136
VMware vSphere, 120
VN port. *See* virtual N port
vNICs, 155
VN-Tag, 155–156, 242
VOQ. *See* virtual output queueing
vPCs. *See* virtual PortChannels
VRF. *See* virtual routing and forwarding
VSAN. *See* virtual storage area network
VSM. *See* Virtual Supervisor Module
vSphere, 120, 206
vSwitches, 120–121

W

WAAS. *See* Wide Area Application Services
wave division multiplexing, 154
Wide Area Application Services (WAAS), 109, 230, 240
World Wide Names (WWNs), 82–83, 173, 208
World Wide Node Names (WWNNs), 82, 212, 238
World Wide Port Names (WWPNs), 82–83, 208, 212
WWNNs. *See* World Wide Node Names
WWNs. *See* World Wide Names
WWPNs. *See* World Wide Port Names

X

XML. *See* Extensible Markup Language

Z

zone set, 86, 238
zoning, 85–87, 238, 239