

Contents

Acknowledgments	xiii
Introduction	xv
About the Authors	xvii

CHAPTER 1	Next-Generation IT Trends	1
	Layers of function: the service-oriented infrastructure framework	3
	Blocks of function: the cloud modules	4
	Server module	5
	Storage module	5
	Fabric module	6
	WAN module	6
	End-user type I—branch office	7
	End-user type II—mobile	8
	Cloud computing characteristics	8
	Cloud computing taxonomy	9
	Deployment models	9
	Service models	10
	Tying it all together	10
	Summary	11

CHAPTER 2	Next-Generation Data Center Architectures and Technologies	13
	The data center consolidation and virtualization modus operandi	15
	Server consolidation drivers	16
	The Classic Server Sprawl Syndrome	16
	Application silos and stovepiped data	16
	Server virtualization	17
	Virtual machines and hypervisor	18
	VMware Networking Primer	19
	The Cisco Nexus 1000V Switch	22
	ESX Server storage networking overview	31
	Storage virtualization	35
	Block aggregation	36
	Symmetric and asymmetric storage virtualization	37
	Layer 2 evolution	40
	Virtual port channels: the STP makeover	42
	vPC design brief	45
	vPC and Nexus 1000V	48

Unified data center fabric	51
10-gigabit Ethernet	52
Ethernet reloaded	52
The FCoE solution	57
FCoE data plane	58
FCoE control plane	62
I/O Consolidation with FCoE	65
Summary	70
CHAPTER 3 Next-Generation WAN and Service Integration	73
Service integration in the data center	73
Firewall virtualization	75
Server load balancing and virtualization	76
Infrastructure segmentation	80
Layer 2 and layer 3 segmentations	80
The next-generation enterprise WAN	85
MPLS VPN prelude	85
Multi-VPN service from a service provider	87
MPLS over L2 circuits	88
DMVPN overview	90
DMVPN per VRF	93
MPLS VPN over DMVPN (hub and spoke only)	94
Summary	97
CHAPTER 4 Branch Consolidation and WAN Optimization	99
What is the WAN performance challenge?	100
First challenge: limited bandwidth	100
Second challenge: high latency in WAN connections	100
Solution: WAN optimization	103
WAN optimization benefits	104
Bandwidth savings through compression and deduplication	104
Speeding up the application layer	106
TCP acceleration	112
Requirements for WAN optimization deployment	114
Getting hold of traffic	115
Identifying an optimization partner	117
What does optimized traffic look like?	117
Implications of optimized traffic on monitoring and prioritization	122
Remote office virtualization designs	122
Summary	125

CHAPTER 5	Session Interception Design and Deployment	127
	Selecting an interception mechanism	127
	Placement decision	128
	Operational impact	128
	Manageability	128
	The WCCP deep dive	128
	WCCP definitions	129
	WCCP control plane messages	130
	WCCP service groups	133
	WCCP interception operation	135
	WCCP redirection schemes	136
	WCCP assignment methods	137
	WCCP return schemes	140
	WAN optimizer egress methods	140
	WCCP server platform considerations	142
	WCCP design examples	145
	WCCP configuration example	153
	In-path deployment in brief	160
	PBR deployment overview	161
	PBR failover	163
	Summary	165
CHAPTER 6	WAN Optimization in the Private Cloud	167
	WAN optimization requirements in the cloud	168
	Interception at the VM level	168
	Cloud interception with VRF-aware WCCP	169
	Cloud interception with non-VRF-aware WCCP	176
	VRF Select	176
	The WCCPv2 two-way connectivity challenge	177
	The Not-So-VRF solution	179
	The Not-So-VRF illustration	180
	Interception at the services aggregation layer	189
	Services chassis requirements	190
	Admin context	190
	User context	197
	ACESM interception: bridged mode	199
	ACESM interception: routed mode	209
	Health monitoring with probes	211
	WAN optimizer farm redundancy	213
	Summary	216

CHAPTER 7	SAN Extensions and IP Storage	219
	SAN extension overview	220
	Data recovery metrics	222
	Preliminary design considerations	222
	Optical networking solutions	229
	Dark fiber	229
	DWDM	230
	CWDM	234
	SONET/SDH services	236
	SONET/SDH topologies	237
	FCIP	238
	FCIP primer	239
	FCIP topologies	242
	FCIP HA	243
	FCIP performance tuning	245
	FCIP security	254
	iSCSI	254
	iSCSI protocol overview	255
	iSCSI deployments	261
	iSCSI HA	263
	iSCSI security	263
	Putting it all together	265
	Summary	266
CHAPTER 8	Cloud Infrastructure as a Service	267
	Cloud security	267
	Virtual switch security	270
	Endpoint security	277
	Virtual DMZ	277
	Unified computing system	278
	UCS Enabling Technologies	279
	UCS components	281
	Cloud management	285
	Hierarchical management	285
	Policy-based management	286
	Management mediation	287
	Automation	288
	User self-service	288
	XML-ization	289
	Cloud IaaS: the big picture	289
	Application software submodule	291

Virtual machine submodule	291
Virtual access-layer submodule	292
Compute submodule	292
Storage array submodule	293
SAN submodule	293
SAN extension submodule	293
Access-layer submodule	293
Aggregation-layer submodule	294
Core-layer submodule	294
Peering submodule	294
Next-generation WAN submodule	295
Cloud infrastructure management platform	295
End-user workloads and applications	296
The cloud IaaS overlay	296
Summary	297

CHAPTER 9 Case Studies	299
Virtual access-layer design study	299
Nexus 1000V components	300
Design examples	301
ERSPAN design study	307
ERSPAN source interfaces	307
ERSPAN design example	307
ERSPAN basic configurations	309
Deployment guidelines and restrictions	309
WAN optimization study	310
Unified fabric design study	311
FCoE access-layer design	311
Top-of-rack architecture design study	319
ToR design with Nexus 5000 and 2000	320
ToR design example: IGE-attached servers	321
FEX basic configurations	324
Basic vPC design study	329
Basic vPC configurations	330
SAN extension design study	339
Simple FCIP design example	339
Service-oriented infrastructure design study	353
Virtual access-layer high-level design	354
Compute submodule high-level design	355
Storage module high-level design	358
Fabric module high-level design	359

Services aggregation layer high-level design.....	363
WAN module high-level design	366
Design comments	368
Summary	369
Appendix A Acronyms and Abbreviations.....	371
References	381
Index.....	389