

1	A Short History of Cloud Computing	1
1.1	From Big Iron to Commodity	1
1.2	The Internet Area	3
1.3	Performance and Address Space	4
1.4	Virtualization Is Back Again	4
1.5	The Flavors of Cloud Computing	6
1.5.1	Public Cloud	6
1.6	Anything as a Service	7
1.6.1	Public Cloud Platforms for SAP	8
1.7	Cloud Applications	9
1.8	Private Clouds	10
1.9	Summary	12
2	From R/3 to HANA	15
2.1	SAP Business Suite	18
2.1.1	SAP ERP/SAP ECC	19
2.1.2	SAP CRM	20
2.1.3	SAP SCM	20
2.1.4	SAP SRM	21
2.1.5	SAP PLM	22
2.1.6	SAP CPM	22
2.1.7	SAP GRC	23
2.1.8	SAP Solution Manager	23
2.2	SAP NetWeaver	24
2.2.1	SAP NetWeaver BW	24
2.2.2	SAP NetWeaver Portal	25
2.2.3	SAP Knowledge Warehouse	26
2.2.4	SAP NetWeaver Mobile	27
2.2.5	SAP NetWeaver Master Data Management	27
2.2.6	SAP NetWeaver Process Integration	27
2.3	Business Objects	28
2.4	SAP Solutions for Small and Medium Companies	28
2.4.1	SAP All-in-One	28

2.4.2	SAP Business One	28
2.4.3	SAP Business ByDesign	29
2.5	SAP Appliances	29
2.5.1	Duet and Alloy	29
2.5.2	SAP Business Warehouse Accelerator	30
2.5.3	SAP High Performance Analytical Appliance	31
2.6	Summary	37
3	Service Levels for SAP on Cloud	39
3.1	IT Service Management Reference Model	41
3.2	Service Level Management	42
3.3	Performance Management	43
3.3.1	Response Time	43
3.4	Units of Measure for SAP Applications	47
3.4.1	Predicting the System Load	48
3.4.2	Can the Performance Be Guaranteed?	51
3.4.3	Measurement Based Sizing	52
3.4.4	SAPS-Meter	54
3.5	Load Profiles	58
3.5.1	Load Profiles of Transactional Solutions	58
3.5.2	Load Profiles of Analytical Systems	60
3.5.3	Load Profiles of Other SAP-Solutions	60
3.6	Availability Management	61
3.6.1	How to Define Availability?	62
3.6.2	How Many Resources Are Needed in Case of a Disaster?	63
3.6.3	How Much Stability Is Required?	64
3.7	Summary	64
4	Security Aspects for SAP on Cloud	65
4.1	The Threat Landscape	66
4.1.1	External Threats	67
4.1.2	Internal Threats	68
4.1.3	Technical Attacks: Viruses, Worms, Trojan Horses, etc.	69
4.1.4	Non-Technical Threats	70
4.2	Legal Aspects	70
4.3	Classical IT Security and the Cloud	71
4.4	Security on Public Clouds: Who Is Responsible?	73
4.4.1	Security Concept of Amazon AWS	73
4.5	Public Cloud Security Automation and Management	75
4.5.1	Hardening Red Hat Linux as Guest Operating System	75
4.5.2	Hardening Windows as Guest OS	76
4.5.3	Hardening the Hypervisors	81
4.6	SAP on Private Cloud: A Practical Example	81
4.7	Summary	82

5	Change and Configuration Management	83
5.1	Introduction to Change and Configuration Management	84
5.1.1	Elements of the CCMS	84
5.1.2	Change and Configuration Data Types	85
5.1.3	Integrating Change and Configuration Management with SAP	85
5.2	Managing SAP Business Changes	86
5.2.1	Change Management Drives the Business and IT Lifecycle	87
5.2.2	IT and Business Accountability and Alignment	87
5.3	Managing Technology Changes	87
5.3.1	Understand the Configuration Management Process	88
5.3.2	Manage Service Templates and Profiles	89
5.3.3	Use a Technical Sandbox	90
5.3.4	Protect the Development System	90
5.3.5	Review the SAP Technology Stack and Tools	91
5.3.6	Leverage Regression Testing Tools and Capabilities	91
5.3.7	Maintain Technical Change and Configuration Management Rigor	91
5.4	Managing Organizational Change	92
5.4.1	Understand the Four Technology Perspectives	94
5.4.2	Minimize Human Involvement	95
5.4.3	Optimize Organizational Change Processes	96
5.4.4	Plan for SAP Staffing Backup Before Disaster Strikes	96
5.4.5	Leverage Help Desk and Operations Support Teams	97
5.4.6	Thoughtfully Outsource and Augment	98
5.4.7	Mitigate Risk by Open Exchange of Real Life Experience	98
5.4.8	Increase IT's Process Discipline	99
5.5	Summary	100
6	How Private and Public Clouds Work	101
6.1	Cloud Services Principles	101
6.2	Technologies for Public Clouds	103
6.3	Windows Azure Cloud Fabric	103
6.3.1	Provisioning a New Node in Azure	105
6.3.2	Deploying a Service into Windows Azure	106
6.3.3	Roles and Instances in Azure	107
6.3.4	Fault Domains and Upgrade Domains	107
6.3.5	Azure Storage	108
6.4	Amazon Web Services	110
6.4.1	Amazon EC2 Availability	111
6.4.2	Storage in AWS	111
6.5	Technologies for Private Clouds	113
6.6	Microsoft Private Cloud	114

6.7	VMware vCloud	115
6.8	Summary	116
7	SAP Solutions on Public Clouds	117
7.1	Public Clouds: A Short Overview	118
7.1.1	Cloud Standards	119
7.1.2	Cloud APIs	121
7.2	Can Public Clouds Meet SAP Application Requirements?	122
7.3	Amazon Web Service for SAP	125
7.3.1	Instance Types for SAP (Server Building Blocks)	126
7.3.2	AWS Storage for SAP	127
7.3.3	Network: Amazon Virtual Private Cloud	128
7.3.4	Backup/Restore of SAP Applications on EC2 Instances . .	129
7.3.5	SAP High-Availability in AWS	130
7.3.6	Monitoring with Amazon CloudWatch	131
7.3.7	Other Aspects of SAP on AWS	131
7.3.8	AWS Service Levels	132
7.4	Outlook: Public Clouds and SAP	132
7.4.1	Beyond the Physical Boundaries	133
7.4.2	SAP NetWeaver Cloud	134
7.4.3	Project Titanium	135
7.5	Summary	136
8	Private Cloud Infrastructures for SAP	137
8.1	SAP Landscapes	138
8.1.1	SAP System Architecture	139
8.1.2	2-tier versus 3-tier	140
8.2	Server Architectures: Nifty Details?	141
8.2.1	Multi-core and Multi-thread	142
8.2.2	Inter Core Communication and Access to Main Memory	144
8.2.3	Scale-up Versus Scale-out	146
8.2.4	Rack Mount Versus Blade	146
8.2.5	Memory: Fast but Volatile	148
8.3	Storage: Hard and Other Disks	149
8.3.1	Sizing for Throughput	149
8.3.2	The Disk Is Dead: But Is SSD Already King?	152
8.4	Network	153
8.4.1	User Network	153
8.4.2	Server Network	156
8.4.3	Storage Network	156
8.4.4	Fibre Channel over Ethernet (FCoE)	157
8.4.5	iSCSI	159

8.5	Unified Computing	160
8.5.1	Converged Network Adapters	161
8.5.2	Port Extenders	162
8.5.3	Fabric Extender	162
8.5.4	Fabric Interconnects	163
8.5.5	Unification and Virtualization	163
8.5.6	Software Based Fabric Extender	164
8.5.7	Hardware Based Fabric Extender	165
8.6	Summary	165
9	Stateless Computing	167
9.1	Service Profile Definition	169
9.1.1	Unified Computing and VMware's vCenter	171
9.2	Cloud Operation with Stateless Computing	173
9.2.1	IDPools	173
9.2.2	Server Pools	175
9.2.3	Administrative Organization for SAP on Cloud	176
9.3	Cloud Data Center Facilities	177
9.3.1	How Green Clouds Can Be?	178
9.4	Summary	180
10	Economic and Legal Aspects of Cloud Computing	181
10.1	Trial and Error-Fast and Cheap	182
10.1.1	Economic Risks and Other Considerations	182
10.1.2	Legal Implications	183
10.2	Economic Myths, Realities, and Other Observations	183
10.2.1	Innovative Cloud Platforms Do Not Necessarily Cost Less	184
10.2.2	Volume Discounts Rarely Drive Economies of Scale	184
10.2.3	The Cloud May Not Yield Greener IT for Some Time	185
10.2.4	Cloud Software Licensing Models Remain Unchanged	185
10.2.5	CapEx Versus OpEx May Myths	186
10.3	Business Economics of the Cloud for SAP	186
10.3.1	Macroeconomics and Other Market Drivers	187
10.3.2	Business Risks, Functionality, Data Sensitivity, and Role	188
10.3.3	Developing Cloud Business Cases for SAP	189
10.4	Technology Economics and Considerations	190
10.4.1	Demand, Supply, and the Buying Hierarchy	190
10.4.2	Technology Attributes and Challenges	191
10.4.3	Public Cloud Opportunities and Challenges	191

10.4.4	Private Cloud Opportunities and Challenges	192
10.4.5	Hybrid Cloud Opportunities and Challenges	192
10.5	Organizational Economics and Considerations	193
10.5.1	The Business End-User Community	193
10.5.2	Reinventing the Internal SAP IT Organization	194
10.5.3	Organizational Process Discipline or Hardening	194
10.5.4	Cloud Service Providers and Hosters	195
10.5.5	Evaluating Organizational Readiness for Change	195
10.5.6	An Effective Model for SAP IT Organizational Change	196
10.5.7	Organizational Skills and Staffing	197
10.6	The Legal Landscape for SAP Cloud Computing	198
10.6.1	Governance, Risk, Compliance, and Geographic Constraints	198
10.6.2	Internal GRC Considerations	199
10.6.3	Data and Security Considerations	199
10.6.4	People Considerations	200
10.6.5	Developing a Legally-Informed Cloud Economics Plan	201
10.7	Summary	201
About the Authors		203
Index		207