

Contents

1	Introduction	1
2	Making Metrics a Success – The Business Perspective	9
2.1	The Business Need for Measurement	9
2.2	Managing by the Numbers	13
2.2.1	Extraction	13
2.2.2	Evaluation.....	17
2.2.3	Execution.....	20
2.3	Metrics for Management Guidance	22
2.3.1	Portfolio Management	22
2.3.2	Technology Management	24
2.3.3	Product and Release Planning	26
2.3.4	Making the Business Case	27
2.4	Hints for the Practitioner	29
2.5	Summary	32
3	Planning the Measurement Process	35
3.1	Software Measurement Needs Planning	35
3.2	Goal-Oriented Approaches	36
3.2.1	The GQM Methodology	36
3.2.2	The CAME Approach.....	38
3.3	Measurement Choice	40
3.4	Measurement Adjustment.....	42
3.5	Measurement Migration	43
3.6	Measurement Efficiency.....	45
3.7	Hints for the Practitioner	45
3.8	Summary	47
4	Performing the Measurement Process.....	49
4.1	Measurement Tools and Software e-Measurement.....	49
4.2	Applications and Strategies of Metrics Tools.....	50
4.2.1	Software process measurement and evaluation	50
4.2.2	Software Product Measurement and Evaluation	51
4.2.3	Software Process Resource Measurement and Evaluation	54
4.2.4	Software Measurement Presentation and Statistical Analysis	54
4.2.5	Software Measurement Training	55

4.3	Solutions and Directions in Software e-Measurement	56
4.4	Hints for the Practitioner	61
4.5	Summary	62
5	Introducing a Measurement Program.....	63
5.1	Making the Measurement Program Useful	63
5.2	Metrics Selection and Definition	63
5.3	Roles and Responsibilities in a Measurement Program	66
5.4	Building History Data	68
5.5	Positive and Negative Aspects of Software Measurement	69
5.6	It is People not Numbers!	72
5.7	Counter the Counterarguments	74
5.8	Information and Participation	75
5.9	Hints for the Practitioner	76
5.10	Summary	79
6	Measurement Infrastructures	81
6.1	Access to Measurement Results	81
6.2	Introduction and Requirements	81
6.2.1	Motivation: Using Measurements for Benchmarking	81
6.2.2	Source of Metrics	82
6.2.3	Dimensions of a Metrics Database	83
6.2.4	Requirements of a Metrics Database	84
6.3	Case Study: Metrics Database for Object-Oriented Metrics	86
6.3.1	Prerequisites for the Effective Use of Metrics	86
6.3.2	Architecture and Design of the Application	87
6.3.3	Details of the Implementation	88
6.3.4	Functionality of the Metrics Database (Users' View)	90
6.4	Hints for the Practitioner	93
6.5	Summary	94
7	Size and Effort Estimation	95
7.1	The Importance of Size and Cost Estimation	95
7.2	A Short Overview of Functional Size Measurement Methods	96
7.3	The COSMIC Full Function Point Method	100
7.4	Case Study: Using the COSMIC Full Function Point Method	103
7.5	Estimations Can Be Political	106
7.6	Establishing Buy-In: The Estimation Conference	107
7.7	Estimation Honesty	108
7.8	Estimation Culture	108
7.9	The Implementation of Estimation	109
7.10	Estimation Competence Center	111
7.11	Training for Estimation	113
7.12	Hints for the Practitioner	113
7.13	Summary	114

8	Project Control	115
8.1	Project Control and Software Measurement	115
8.2	Applications of Project Control	118
8.2.1	Monitoring and Control	118
8.2.2	Forecasting	124
8.2.3	Cost Control	126
8.3	Hints for the Practitioner	130
8.4	Summary	131
9	Defect Detection and Quality Improvement	133
9.1	Improving Quality of Software Systems	133
9.2	Fundamental Concepts	135
9.2.1	Defect Estimation	135
9.2.3	Defect Detection, Quality Gates and Reporting	137
9.3	Early Defect Detection	138
9.3.1	Reducing Cost of Non-Quality	138
9.3.2	Planning Early Defect Detection Activities	140
9.4	Criticality Prediction – Applying Empirical Software Engineering	142
9.4.1	Identifying Critical Components	142
9.4.2	Practical Criticality Prediction	144
9.5	Software Reliability Prediction	146
9.5.1	Practical Software Reliability Engineering	146
9.5.2	Applying Reliability Growth Models	148
9.6	Calculating ROI of Quality Initiatives	150
9.7	Hints for the Practitioner	154
9.8	Summary	155
10	Software Process Improvement	157
10.1	Process Management and Process Improvement	157
10.2	Software Process Improvement	160
10.2.1	Making Change Happen	160
10.2.2	Setting Reachable Targets	163
10.2.3	Providing Feedback	166
10.2.4	Practically Speaking: Implementing Change	168
10.2.5	Critical Success Factors	169
10.3	Process Management	170
10.3.1	Process Definition and Workflow Management	170
10.3.2	Quantitative Process Management	173
10.3.3	Process Change Management	174
10.4	Measuring the Results of Process Improvements	175
10.5	Hints for the Practitioner	177
10.6	Summary	179
11	Software Performance Engineering	181
11.1	The Method of Software Performance Engineering	181
11.2	Motivation, Requirements and Goals	183

11.2.1	Performance-related Risk of Software Systems	183
11.2.2	Requirements and Aims.....	184
11.3	A Practical Approach of Software Performance Engineering	185
11.3.1	Overview of an Integrated Approach	185
11.3.2	Establishing and Resolving Performance Models	185
11.3.3	Generalization of the Need for Model Variables.....	187
11.3.4	Sources of Model Variables	189
11.3.5	Performance and Software Metrics	190
11.3.6	Persistence of Software and Performance Metrics	192
11.4	Case Study: EAI	193
11.4.1	Introduction of a EAI Solution	193
11.4.2	Available Studies.....	194
11.4.3	Developing EAI to Meet Performance Needs	195
11.5	Costs of Software Performance Engineering.....	198
11.5.1	Performance Risk Model (PRM).....	198
11.6	Hints for the Practitioner.....	199
11.7	Summary.....	201
12	Service Level Management.....	203
12.1	Measuring Service Level Management	203
12.2	Web Services and Service Management	204
12.2.1	Web Services at a Glance	204
12.2.2	Overview of SLAs.....	206
12.2.3	Service Agreement and Service Provision	207
12.3	Web Service Level Agreements	209
12.3.1	WSLA Schema Specification	209
12.3.2	Web Services Run-Time Environment.....	210
12.3.3	Guaranteeing Web Service Level Agreements.....	211
12.3.4	Monitoring the SLA Parameters.....	212
12.3.5	Use of a Measurement Service	213
12.4	Hints for the Practitioner	214
12.5	Summary	216
13	Case Study: Building an Intranet Measurement Application	217
13.1	Applying Measurement Tools	217
13.2	The White-Box Software Estimation Approach.....	218
13.3	First Web-Based Approach	221
13.4	Second Web-Based Approach.....	222
13.5	Hints for the Practitioner	223
13.6	Summary	223
14	Case Study: Measurements in IT Projects.....	225
14.1	Estimations: A Start for a Measurement Program	225
14.2	Environment	226
14.2.1	The IT Organization	226
14.2.2	Function Point Project Baseline	226

14.3	Function Point Prognosis	229
14.4	Conclusions from Case Study	230
14.4.1	Counting and Accounting	230
14.4.2	ISO 8402 Quality Measures and IFPUG GSCs	231
14.4.3	Distribution of Estimated Effort to Project Phases	233
14.4.4	Estimation of Maintenance Tasks	234
14.4.5	The UKSMA and NESMA Standard	235
14.4.6	Enhancement Projects	236
14.4.7	Software Metrics for Maintenance	237
14.4.8	Estimation of Maintenance Effort After Delivery	238
14.4.9	Estimation for (Single) Maintenance Tasks	239
14.4.10	Simulations for Estimations	239
14.4.11	Sensitivity analysis	241
14.5	Hints for the Practitioner	241
14.6	Summary	242
15	Case Study: Metrics in Maintenance	243
15.1	Motivation for a Tool-based Approach	243
15.2	The Software System under Investigation	244
15.3	Quality Evaluation with Logiscope	245
15.4	Application of Static Source Code Analysis	251
15.5	Hints for the Practitioner	254
15.6	Summary	256
16	Metrics Communities and Resources	259
16.1	Benefits of Networking	259
16.2	CMG	259
16.4	COSMIC	260
16.6	German GI Interest Group on Software Metrics	261
16.7	IFPUG	261
16.8	ISBSG	262
16.9	ISO	265
16.10	SPEC	266
16.11	The MAIN Network	266
16.12	TPC	267
16.13	Internet URLs of Measurement Communities	267
16.14	Hints for the Practitioner and Summary	268
	Glossary	269
	Literature	279
	Index	291