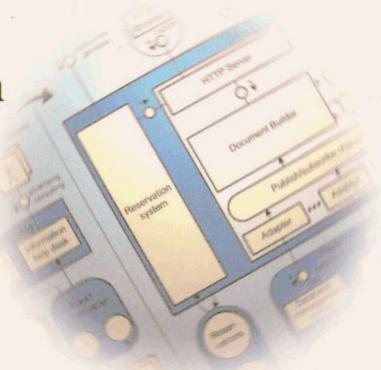


## Fundamental Modeling Concepts

Effective Communication of IT Systems

Andreas Knöpfel Bernhard Gröne Peter Tabeling

with foreword by Siegfried Wendt



## **Contents**

foreword				
Preface				
Intr	oductio	on	1	
1.1	The ne	eed for communication	. 1	
	1.1.1	Software and people	. 1	
	1.1.2	Structure information to prepare communication		
	1.1.3	Retrieve system information from people	. 4	
	1.1.4	Communicate system information to people		
	1.1.5			
	1.1.6	Structure teamwork		
1.2	The Fl	MC Idea	. 8	
	1.2.1	Requirements for a modeling technique supporting		
		communication	. 8	
	1.2.2	FMC		
	1.2.3	Three aspects – Three diagram types	. 9	
1.3	Outlir			
Con	positie	onal Structures	13	
2.1	An ex	ample: The travel agency	. 13	
	2.1.1	The scenario		
	2.1.2	A dynamic system	. 13	
	2.1.3	An information-processing system	. 15	
	2.1.4			
	2.1.5	A refined model	. 17	
2.2	Mode			
2.3				
	2.3.1	Read access		
	2.3.2	Write access		
	1.1 1.2 1.3 Com 2.1	Introduction 1.1 The norm 1.1.1 1.1.2 1.1.3 1.1.4 1.1.5 1.1.6 1.2 The Final Fi	Introduction  1.1 The need for communication  1.1.1 Software and people  1.1.2 Structure information to prepare communication  1.1.3 Retrieve system information from people  1.1.4 Communicate system information to people  1.1.5 Support communication  1.1.6 Structure teamwork  1.2 The FMC Idea  1.2.1 Requirements for a modeling technique supporting communication  1.2.2 FMC  1.2.3 Three aspects – Three diagram types  1.3 Outline of this book  Compositional Structures  2.1 An example: The travel agency  2.1.1 The scenario  2.1.2 A dynamic system  2.1.3 An information-processing system  2.1.4 A block diagram showing the system  2.1.5 A refined model  2.2 Modeling the structure of a system  2.3 Agents accessing storages  2.3.1 Read access	

viii CONTENTS

			21 22				
	2.4		23				
	۷.٦		23				
			23				
			25				
			26				
	2.5		27				
	2.6		28				
3	Dyn	namic Structures	29				
	3.1	Petri nets: Basic principles	29				
	3.2		33				
	3.3	Basic patterns	34				
	3.4		36				
	3.5		38				
	3.6		<b>4</b> 0				
4	Val	alue Structures and Mind Maps 41					
	4.1		42				
	4.2	Cardinalities	45				
	4.3	Predicates and roles	46				
	4.4	Partitions	48				
	4.5	Reification	49				
	4.6	Summary	50				
	4.7	Exercises	52				
5	FM	C Basics: Summary	53				
6	Rei	· · · · · · · · · · · · · · · · · · ·	57				
	6.1	1	57				
	6.2	- I	59				
			59				
			60				
			61				
		1	69				
		J	71				
	6.3	0	72				
		<b>y</b>	72				
		6.3.2 From conceptual to implementation structures	75				

CONTENTS ix

		6.3.3	Syntax and meaning of refinement	77
		6.3.4	Structure variant systems	80
	6.4	Petri r	nets: Advanced concepts	85
		6.4.1	Transition—bordered and transition—like sub-nets	85
		6.4.2	Safe Petri nets	86
		6.4.3	Multitoken places	89
		6.4.4	Recursive Petri nets	90
		6.4.5	Timing constraints	95
	6.5	Non-h	nierarchical transformations and semantic layers	97
		6.5.1	Encoding of values	98
		6.5.2	Implementation of channels and storages	100
		6.5.3	Relevance of non-hierarchical transformations	101
	6.6	Exerci	ises	104
7	Tow	ards Ir	mplementation Structures	107
	7.1		m structure versus software structure	
	7.2		Processor to processes	
		7.2.1	Role and processor view	
		7.2.2	Role piggyback	
		7.2.3	Role multiplex, interrupt handling and context switch	
	7.3	Distril	bution, concurrency and synchronization	
		7.3.1	Physical versus conceptual distribution	
		7.3.2	Concurrency versus distribution	
		7.3.3	Inter-task communication	
		7.3.4	Modeling task and memory management activities	
		7.3.5	Mapping concurrent behavior to tasks	
		7.3.6	Synchronized access to shared data	
		7.3.7	Deriving transactions from FMC models	
	7.4	From	FMC to objects and classes	
		7.4.1	Common views	143
		7.4.2	Low-level mappings	147
		7.4.3	High-level mappings	
		7.4.4	Additional views	
		7.4.5	Guidelines for choosing a view	
	7.5	Conce	eptual patterns versus software patterns	
8	Apr	olying l	FMC in Your Daily Work	157
			ning comfortable with FMC	
		8.1.1		
			The next stens	158

X\_\_\_\_\_ CONTENTS

		8.1.3	Things to consider	. 159
	8.2	Descr	ibing existing systems with FMC	
		8.2.1	How to get information	. 161
		8.2.2	Documenting systems	. 162
		8.2.3	Preparing integration	. 163
		8.2.4	Preparing migration and re-engineering	
	8.3	Using	FMC in construction	
		8.3.1	Supporting requirements engineering with 'Mental	
			Prototyping'	. 165
		8.3.2	Architecture-based design: The System Map	. 167
		8.3.3	Integrate new team members	. 171
		8.3.4	Evolution and migration of systems	
	8.4	Using	FMC diagrams to support communication	. 173
		8.4.1	Using FMC in interviews, meetings and discussions	. 174
		8.4.2	Presentations	. 176
		8.4.3	Using FMC in documentation and reports	
		8.4.4	Technical training and teaching	. 179
	8.5	Guide	elines for didactical modeling	. 182
		8.5.1	What is the purpose of the models?	. 182
		8.5.2	Who is my audience?	. 183
		8.5.3	Which aspects do I want to show?	. 183
		8.5.4	Which granularity and level of abstraction should	
			I choose?	. 184
	8.6	Cost a	and benefit of modeling	
9	Mod	deling :	and Visualization Guidelines	189
	9.1	-	luction	
	9.2		sing the reader's perception	
		9.2.1	Linestyles	. 191
		9.2.2	Arcs and arc trees	. 192
		9.2.3	Shape and arrangement of nodes	
		9.2.4	Colors and shading	
		9.2.5	Fonts	
	9.3		ssing comprehension	
	,	9.3.1	Labeling	
		9.3.2	Checking plausibility	. 201
		9.3.3	Component hierarchies versus semantic layers	201
		9.3.4	From naive models to abstractions	204
	9.4		dary notation, patterns and pitfalls	208

CONTENTS xi

		9.4.1	Block diagrams	209
		9.4.2	Petri nets	
		9.4.3	E/R diagrams	217
		9.4.4	Annotations	217
10	Rela	tionshi	p with Other Modeling Approaches	221
			aring FMC with Structured Analysis	
			Background of Structured Analysis	
			Modeling and description concepts	
			Document management and data dictionary	
		10.1.4	Development process	227
		10.1.5	Comparing FMC and SA	227
	10.2		nd the Unified Modeling Language	
			Differences in focus	
			Differences in notation	
			Differences in concept	
			Complementary usage of FMC and UML	
			Model Driven Architecture	
11	A S	zstem o	f Server Patterns	247
			ration domain	
			The system	
			Requests and sessions	
			Forces	
			Conceptual focus of the pattern language	
	11.2		ern language for request processing servers	
			Overview	
			Guideline for choosing an architecture	
			Patterns for request processing servers in the literature	
			The Listener / Worker pattern	
			The Forking Server pattern	
		11.2.6	The Worker Pool pattern	262
			The Worker Pool Manager pattern	
			The Job Queue pattern	
			The Leader / Followers pattern	
		11.2.10	The Session Context Manager pattern	275
	11.3		ple applications	
			Internet Daemon	
			Apache HTTP server	
		11.3.3	SAP R/3	283

(1)	CONTI	ENTS
	11.3.4 Related applications at object level	284 284
Εŗ	pilogue	287
4	Solutions	289
3	Reference Sheets	299
2	Glossary	309

323

331

References

Index