



McGraw-Hill INTERNATIONAL EDITION



Contents

Preface *iv*

PART ONE

The Context of Systems Development
Projects 3

1 THE CONTEXT OF SYSTEMS ANALYSIS AND DESIGN METHODS 4

Introduction	5
The Product—Information System	5
The People—System Stakeholders	7
<i>Systems Owners</i>	7
<i>Systems Users</i>	7
<i>Systems Designers</i>	9
<i>Systems Builders</i>	9
<i>Systems Analysts</i>	10
<i>External Service Providers</i>	10
<i>The Project Manager</i>	10
Business Drivers for Today's Information Systems	11
<i>Globalization of the Economy</i>	11
<i>Electronic Commerce and Business</i>	11
<i>Security and Privacy</i>	14
<i>Collaboration and Partnership</i>	14
<i>Knowledge Asset Management</i>	15
<i>Continuous Improvement and Total Quality Management</i>	15
<i>Business Process Redesign</i>	16
Technology Drivers for Today's Information Systems	16
<i>Networks and the Internet</i>	16
<i>Mobile and Wireless Technologies</i>	18
<i>Object Technologies</i>	18
<i>Collaborative Technologies</i>	19
<i>Enterprise Applications</i>	19
The Process—System Development Process	23
<i>System Initiation</i>	25
<i>System Analysis</i>	25
<i>System Design</i>	26
<i>System Implementation</i>	26
<i>System Support and Continuous Improvement</i>	27

2 INFORMATION SYSTEMS DEVELOPMENT 00

Introduction	35
The Process of Systems Development	35
<i>The Capability Maturity Model</i>	35
<i>Life Cycle versus Methodology</i>	37
<i>Underlying Principles for Systems Development</i>	38
A Systems Development Process	41
<i>Where Do Systems Development Projects Come From?</i>	41
<i>The Systems Development Phases</i>	43
<i>Cross Life-Cycle Activities</i>	52
<i>Sequential versus Iterative Development</i>	54
Alternative Routes and Strategies	54
<i>The Model-Driven Development Strategy</i>	57
<i>The Rapid Application Development Strategy</i>	60
<i>The Commercial Application Package Implementation Strategy</i>	62
<i>Hybrid Strategies</i>	65
<i>System Maintenance</i>	65
Automated Tools and Technology	68
<i>Computer-Assisted Systems Engineering</i>	68
<i>Application Development Environments</i>	71
<i>Process and Project Managers</i>	71

3 PROJECT MANAGEMENT 78

Introduction	79
What Is Project Management?	79
<i>The Causes of Failed Projects</i>	80
<i>The Project Management Body of Knowledge</i>	83
The Project Management Life Cycle	87
<i>Activity 1—Negotiate Scope</i>	89
<i>Activity 2—Identify Tasks</i>	89
<i>Activity 3—Estimate Task Durations</i>	91
<i>Activity 4—Specify Intertask Dependencies</i>	93

- Activity 5—Assign Resources* 94
- Activity 6—Direct the Team Effort* 98
- Activity 7—Monitor and Control Progress* 99
- Activity 8—Assess Project Results and Experiences* 107

PART TWO

Systems Analysis Methods 115

4 SYSTEMS ANALYSIS 116

Introduction 117

What Is Systems Analysis? 117

Systems Analysis Approaches 118

- Model-Driven Analysis Approaches* 118
- Accelerated Systems Analysis Approaches* 120
- Requirements Discovery Methods* 122
- Business Process Redesign Methods* 123
- Systems Analysis Strategies* 123

The Scope Definition Phase 123

- Task 1.1—Identify Baseline Problems and Opportunities* 124
- Task 1.2—Negotiate Baseline Scope* 127
- Task 1.3—Assess Baseline Project Worthiness* 127
- Task 1.4—Develop Baseline Schedule and Budget* 128
- Task 1.5—Communicate the Project Plan* 128

The Problem Analysis Phase 129

- Task 2.1—Understand the Problem Domain* 129
- Task 2.2—Analyze Problems and Opportunities* 133
- Task 2.3—Analyze Business Processes* 133
- Task 2.4—Establish System Improvement Objectives* 135
- Task 2.5—Update or Refine the Project Plan* 135
- Task 2.6—Communicate Findings and Recommendations* 136

The Requirements Analysis Phase 137

- Task 3.1—Identify and Express System Requirements* 138
- Task 3.2—Prioritize System Requirements* 139
- Task 3.3—Update or Refine the Project Plan* 140
- Task 3.4—Communicate the Requirements Statement* 140
- Ongoing Requirements Management* 140

The Logical Design Phase 140

- Task 4.1a—Structure Functional Requirements* 141
- Task 4.1b—Prototype Functional Requirements (alternative)* 142
- Task 4.2—Validate Functional Requirements* 142
- Task 4.3—Define Acceptance Test Cases* 142

The Decision Analysis Phase 143

- Task 5.1—Identify Candidate Solutions* 143
- Task 5.2—Analyze Candidate Solutions* 144
- Task 5.3—Compare Candidate Solutions* 146
- Task 5.4—Update the Project Plan* 146
- Task 5.5—Recommend a System Solution* 147

5 FACT-FINDING TECHNIQUES FOR REQUIREMENTS DISCOVERY 154

Introduction 155

An Introduction to Requirements Discovery 155

The Process of Requirements Discovery 157

- Problem Discovery and Analysis* 157
- Requirements Discovery* 158
- Documenting and Analyzing Requirements* 158
- Requirements Management* 159

Fact-Finding Techniques 160

- Sampling of Existing Documentation, Forms, and Files* 160
- Research and Site Visits* 162
- Observation of the Work Environment* 163
- Questionnaires* 164
- Interviews* 166
- How to Conduct an Interview* 167
- Discovery Prototyping* 171
- Joint Requirements Planning* 172

A Fact-Finding Strategy 176

6 MODELING SYSTEM REQUIREMENTS WITH USE CASES 183

Introduction 184

An Introduction to Use-Case Modeling 184

System Concepts for Use-Case Modeling 185

- Use Cases* 186
- Actors* 186
- Relationships* 187

The Process of Requirements Use-Case Modeling	190
<i>Step 1: Identify Business Actors</i>	190
<i>Step 2: Identify Business Requirements Use Cases</i>	190
<i>Step 3: Construct Use-Case Model Diagram</i>	194
<i>Step 4: Document Business Requirements Use-Case Narratives</i>	195
Use Cases and Project Management	199
<i>Ranking and Evaluating Use Cases</i>	199
<i>Identifying Use-Case Dependencies</i>	200

7 DATA MODELING AND ANALYSIS 206

Introduction	207
What Is Data Modeling?	207
System Concepts for Data Modeling	208
<i>Entities</i>	208
<i>Attributes</i>	209
<i>Relationships</i>	212
The Process of Logical Data Modeling	220
<i>Strategic Data Modeling</i>	220
<i>Data Modeling during Systems Analysis</i>	222
<i>Looking Ahead to Systems Design</i>	222
<i>Automated Tools for Data Modeling</i>	223
How to Construct Data Models	225
<i>Entity Discovery</i>	225
<i>The Context Data Model</i>	226
<i>The Key-Based Data Model</i>	228
<i>Generalized Hierarchies</i>	231
<i>The Fully Attributed Data Model</i>	231
Analyzing the Data Model	234
<i>What Is a Good Data Model?</i>	234
<i>Data Analysis</i>	235
<i>Normalization Example</i>	235
Mapping Data Requirements to Locations	243

8 PROCESS MODELING 249

Introduction	250
An Introduction to Process Modeling	250
System Concepts for Process Modeling	252
<i>External Agents</i>	252

<i>Data Stores</i>	253
<i>Process Concepts</i>	253
<i>Data Flows</i>	258

The Process of Logical Process Modeling	266
How to Construct Process Models	269
<i>The Context Data Flow Diagram</i>	270
<i>The Functional Decomposition Diagram</i>	271
<i>The Event-Response or Use-Case List</i>	272
<i>Event Decomposition Diagrams</i>	275
<i>Event Diagrams</i>	276
<i>The System Diagram(s)</i>	278
<i>Primitive Diagrams</i>	279
<i>Completing the Specification</i>	279

9 OBJECT-ORIENTED ANALYSIS AND MODELING USING THE UML 293

An Introduction to Object-Oriented Modeling	294
System Concepts for Object Modeling	294
<i>Objects, Attributes, Methods, and Encapsulation</i>	294
<i>Classes, Generalization, and Specialization</i>	296
<i>Object Class Relationships</i>	299
<i>Messages and Message Sending</i>	300
<i>Polymorphism</i>	303
The UML Diagrams	304
The Process of Object Modeling	306
<i>Modeling the Functional Description of the System</i>	306
<i>Constructing the Analysis Use-Case Model</i>	306
<i>Modeling the Use-Case Activities</i>	309
<i>Guidelines for Constructing Activity Diagrams</i>	314
<i>Drawing System Sequence Diagrams</i>	317
<i>Guidelines for Constructing System Sequence Diagrams</i>	319
<i>Finding and Identifying the Business Objects</i>	319
<i>Organizing the Objects and Identifying Their Relationships</i>	324

10 FEASIBILITY ANALYSIS AND THE SYSTEM PROPOSAL 334

- Introduction 335
- Feasibility Analysis and the System Proposal 335
 - Feasibility Analysis—A Creeping Commitment Approach* 335
 - Systems Analysis—Scope Definition Checkpoint* 337
 - Systems Analysis—Problem Analysis Checkpoint* 337
 - Systems Design—Decision Analysis Checkpoint* 337
- Six Tests for Feasibility 338
 - Operational Feasibility* 338
 - Technical Feasibility* 338
 - Schedule Feasibility* 339
 - Economic Feasibility* 339
- Cost-Benefit Analysis Techniques 339
 - How Much Will the System Cost?* 339
 - What Benefits Will the System Provide?* 340
 - Is the Proposed System Cost-Effective?* 342
- Feasibility Analysis of Candidate Systems 346
 - Candidate Systems Matrix* 346
 - Feasibility Analysis Matrix* 349
- The System Proposal 351
 - Written Report* 351
 - Formal Presentation* 352

PART THREE

Systems Design Methods 363

11 SYSTEMS DESIGN 364

- Introduction 365
- What Is Systems Design? 365
- Systems Design Approaches 365
 - Model-Driven Approaches* 366
 - Rapid Application Development* 370
 - Systems Design Strategies* 370
- Systems Design for In-House Development—The “Build” Solution 372
 - Task 5.1—Design the Application Architecture* 372

- Task 5.2—Design the System Database(s)* 372
- Task 5.3—Design the System Interface* 376
- Task 5.4—Package Design Specifications* 377
- Task 5.5—Update the Project Plan* 378

Systems Design for Integrating Commercial Software—The “Buy” Solution 378

- Task 4.1—Research Technical Criteria and Options* 381
- Task 4.2—Solicit Proposals or Quotes from Vendors* 382
- Task 5A.1—Validate Vendor Claims and Performances* 382
- Task 5A.2—Evaluate and Rank Vendor Proposals* 384
- Task 5A.3—Award (or Let) Contract and Debrief Vendors* 384
- Impact of Buy Decision on Remaining Life-Cycle Phases* 385

12 APPLICATION ARCHITECTURE AND MODELING 391

- Introduction 392
- Application Architecture 392
- Physical Data Flow Diagrams 393
 - Physical Processes* 393
 - Physical Data Flows* 396
 - Physical External Agents* 398
 - Physical Data Stores* 398
- Information Technology Architecture 399
 - Distributed Systems* 399
 - Data Architectures—Distributed Relational Databases* 407
 - Interface Architectures—Inputs, Outputs, and Middleware* 409
 - Process Architectures—The Software Development Environment* 414
- Modeling the Application Architecture of an Information System 416
 - Drawing Physical Data Flow Diagrams* 416
 - The Network Architecture* 417
 - Data Distribution and Technology Assignments* 418
 - Process Distribution and Technology Assignments* 420
 - The Person/Machine Boundaries* 420

13 DATABASE DESIGN 429

- Introduction 430
- Database Concepts for the Systems Analyst 430
 - Fields* 430
 - Records* 431
 - Files and Tables* 432
 - Databases* 432
- Prerequisite for Database Design—
 - Normalization 438
- Modern Database Design 438
 - Goals and Prerequisites to Database Design* 439
 - The Database Schema* 439
 - Data and Referential Integrity* 444
 - Roles* 447
 - Database Distribution and Replication* 447
 - Database Prototypes* 448
 - Database Capacity Planning* 448
 - Database Structure Generation* 448

14 OUTPUT DESIGN AND PROTOTYPING 454

- Introduction 455
- Output Design Concepts and Guidelines 455
 - Distribution and Audience of Outputs* 455
 - Implementation Methods for Outputs* 458
- How to Design and Prototype Outputs 463
 - Automated Tools for Output Design and Prototyping* 463
 - Output Design Guidelines* 466
 - The Output Design Process* 466
 - Web-Based Outputs and E-Business* 474

15 INPUT DESIGN AND PROTOTYPING 483

- Introduction 484
- Input Design Concepts and Guidelines 484
 - Data Capture, Data Entry, and Data Processing* 484
 - Input Methods and Implementation* 487
 - System User Issues for Input Design* 489
 - Internal Controls—Data Editing for Inputs* 491

- GUI Controls for Input Design 492
 - Common GUI Controls for Inputs* 494
 - Advanced Input Controls* 498
- How to Design and Prototype Inputs 500
 - Automated Tools for Input Design and Prototyping* 500
 - The Input Design Process* 501
 - Web-Based Inputs and E-Business* 507

16 USER INTERFACE DESIGN 513

- Introduction 514
- User Interface Design Concepts and Guidelines 514
 - Types of Computer Users* 514
 - Human Factors* 515
 - Human Engineering Guidelines* 516
 - Dialogue Tone and Terminology* 517
- User Interface Technology 517
 - Operating Systems and Web Browsers* 517
 - Display Monitor* 518
 - Keyboards and Pointers* 518
- Graphical User Interface Styles and Considerations 519
 - Windows and Frames* 519
 - Menu-Driven Interfaces* 520
 - Instruction-Driven Interfaces* 526
 - Question-Answer Dialogues* 527
 - Special Considerations for User Interface Design* 529
- How to Design and Prototype a User Interface 533
 - Automated Tools for User Interface Design and Prototyping* 533
 - The User Interface Design Process* 533

17 OBJECT-ORIENTED DESIGN AND MODELING USING THE UML 544

- Introduction 545
- The Design of an Object-Oriented System 545
 - Entity Classes* 545
 - Interface Classes* 545
 - Control Classes* 546

Persistence Classes 546
System Classes 546
Design Relationships 547
Attribute and Method Visibility 547
Object Responsibilities 548

The Process of Object-Oriented Design 549

Refining the Use-Case Model 549
*Modeling Class Interactions, Behaviors,
and States That Support the Use-Case
Scenario* 551
*Updating the Object Model to Reflect the
Implementation Environment* 560

PART FOUR

Beyond Systems Analysis and Design 567

18 SYSTEMS CONSTRUCTION AND IMPLEMENTATION 568

Introduction 569
What Is Systems Construction and
Implementation? 569

The Construction Phase 569

*Task 6.1—Build and Test Networks
(if Necessary)* 569
Task 6.2—Build and Test Databases 572
*Task 6.3—Install and Test New Software
Packages (if Necessary)* 572
Task 6.4—Write and Test New Programs 573

The Implementation Phase 574

Task 7.1—Conduct System Test 574
Task 7.2—Prepare Conversion Plan 574
Task 7.3—Install Databases 577
Task 7.4—Train Users 577
Task 7.5—Convert to New System 578

Photo Credits 584

Glossary/Index 585