

Contents

1	Provisioning and Maintenance.....	1
1.1	History of Software Maintenance.....	1
1.1.1	Maintenance in Software Engineering	1
1.1.2	Dynamic Maintenance.....	3
1.2	Maintenance Provisioning.....	4
1.2.1	Server Provisioning.....	4
1.2.2	User Provisioning	5
1.3	Characteristics and Challenges.....	6
1.3.1	Provisioning Characteristics.....	6
1.3.2	Challenges	7
1.4	Distributed and Service-Oriented Dynamic Provisioning	10
1.4.1	Target System	10
1.4.2	Related Products.....	12
1.4.3	Related Standards	15
1.5	Summary	15
	References	16
2	Grid and Distributed Systems	21
2.1	Fundamental Concepts	21
2.2	The Principles of Grids	22
2.2.1	Service-Oriented Architecture	22
2.2.2	Open Grid Service Architecture	23
2.3	Grid Middleware	24
2.3.1	Globus Toolkit.....	24
2.3.2	CGSP.....	26
2.3.3	gLite	28
2.3.4	UNICORE	30
2.3.5	ProActive.....	31
2.4	Dynamic Provisioning in Middleware	33
2.4.1	Provisioning of Middleware.....	33

2.4.2	Provisioning Using Middleware.....	34
2.5	ChinaGrid and Related Projects	34
2.5.1	CGSV	34
2.5.2	GPE4CGSP	36
2.5.3	Application Grids	38
2.6	Summary	39
	References	40
3	Highly Available Dynamic Deployment Infrastructure.....	41
3.1	Motivation	41
3.2	Principle of Dynamic Deployment Infrastructure	45
3.2.1	Dynamic Deployer Core	47
3.2.2	Deploy Approach Manager	47
3.2.3	Service Package Manager	48
3.3	Service-Level vs. Container-Level.....	49
3.3.1	HAND-C: Container-Level Deployment.....	49
3.3.2	HAND-S: Service-Level Deployment.....	51
3.3.3	Service Dependency	52
3.3.4	Avoid Deadlock.....	53
3.3.5	Time Cost Analysis	53
3.4	Performance Analysis.....	56
3.4.1	Dynamic Deployment Experiments	56
3.4.2	Capability and Availability in Dynamic Environment.....	61
3.4.3	GAR File Transfer Performance.....	63
3.5	Summary	64
	References	64
4	Service-Oriented Dependency-Aware Maintenance	67
4.1	Dependency-Aware Maintenance.....	67
4.2	Motivations	70
4.2.1	Concepts	70
4.2.2	Dependencies in a Grid	72
4.2.3	Maintaining Solution and Dependencies.....	73
4.2.4	Objectives.....	74
4.3	Definitions.....	75
4.4	Design of Cobweb Guardian	78
4.4.1	Architecture.....	78
4.4.2	Environment Dependency-Aware Maintenance in Three Granularities.....	79
4.4.3	Deployment Dependency-Aware Propagating Maintenance... ..	80
4.4.4	Invocation Dependency-Aware Grouping Maintenance.....	81
4.4.5	Grouping Maintenance with Feedback.....	83

4.5	Evaluations	84
4.5.1	Test Environment	84
4.5.2	Deployment Dependency-Aware Propagation.....	85
4.5.3	Invocation Dependency-Aware Grouping	86
4.5.4	Environment Dependency-Aware Maintenance in Different Granularities	89
4.5.5	Evaluation for Dynamicity	90
4.6	Summary	91
	References	91
5	Asynchronous Provisioning Strategy for Heterogeneous Grids.....	93
5.1	Motivation.....	93
5.2	Asynchronous Provisioning Model.....	94
5.2.1	Traditional Maintaining Solutions.....	94
5.2.2	Definitions for Asynchronous Maintenance	95
5.2.3	Specification.....	97
5.3	Maintenance Algorithms	98
5.3.1	The Virtual Maintainer	98
5.3.2	HAND Handler	100
5.4	Time Sequence Analysis	102
5.5	Characteristics Discussion.....	103
5.5.1	Transient Fault Tolerance	103
5.5.2	Archive Pending Tasks	104
5.5.3	Applicability.....	105
5.6	Correctness Proof.....	105
5.7	Evaluations.....	108
5.7.1	Environment Settings	108
5.7.2	Metrics.....	109
5.7.3	Applications	109
5.7.4	Overheads.....	110
5.7.5	Evaluations in Cluster and Grid	110
5.8	Summary	113
	References	113
6	Orchestrating Provisioning among Heterogeneous Middleware	115
6.1	Introduction.....	115
6.2	Related Works	118
6.2.1	Interoperability.....	118
6.2.2	Dynamic Provisioning.....	119
6.2.3	Scheduling in a Distributed System	119
6.3	Orchestrating Model.....	120
6.3.1	Definitions.....	120

6.3.2	Optional Solutions for Resourceless Execution	121
6.3.3	Classic Formulation.....	122
6.4	Problem Formulation for Resourceless Orchestration.....	124
6.4.1	Constraints for Provisioning.....	125
6.4.2	Optimization Goal	126
6.5	Implementation of Orchestrator	126
6.6	Evaluations.....	126
6.6.1	Environment Setup.....	127
6.6.2	Application GridBean.....	129
6.6.3	Abbreviation.....	129
6.6.4	Running Applications Separately on Specific Middleware ...	129
6.6.5	Orchestration with Specific Demands	132
6.7	Summary	133
	References.....	134
7	Implementation of Dynamic Provisioning with Community Services.	137
7.1	Introduction	137
7.2	Implementation of Essential Components.....	139
7.2.1	Service Repository	139
7.2.2	Administration Console Client	140
7.2.3	Virtual Maintainer	142
7.2.4	Maintenance Workers	142
7.2.5	Dependency Probes	143
7.2.6	Working Flow.....	144
7.2.7	Lessons	147
7.3	Community Services that Apply the Dynamic Provisioning System	148
7.3.1	Bioinformatic Services	148
7.3.2	Image Processing Services	148
7.3.3	Massive Data Processing Services	150
7.3.4	CFD Grid.....	150
7.4	Summary	151
	References	151
8	Conclusions and Future Challenges	153
8.1	Conclusions	153
8.2	Future Challenges.....	154
	References	155
	Glossary.....	157
	Index.....	169