

# Table of Contents

<b>Chapter 1. Introduction . . . . .</b>	<b>1</b>
Bénédicte BUCHER and Florence LE BER	
1.1. Geomatics software . . . . .	2
1.1.1. Digital geographical data . . . . .	2
1.1.2. GIS-tools . . . . .	5
1.1.3. Software innovation and geomatics research . . . . .	9
1.2. Pooling . . . . .	12
1.2.1. The need for pooling and its relevance . . .	12
1.2.2. Reflection opportunity on geomatics pooling . . . . .	13
1.2.3. Pooling within the MAGIS research group	15
1.3. Book outline . . . . .	17
1.4. Bibliography . . . . .	18
<b>PART 1. SOFTWARE PRESENTATION . . . . .</b>	<b>23</b>
<b>Chapter 2. ORBISGIS: Geographical Information System Designed by and for Research . . . . .</b>	<b>25</b>
Erwan BOCHER and Gwendall PETIT	
2.1. Introduction . . . . .	25
2.2. Background history . . . . .	26
2.3. Major functionalities . . . . .	30

2.3.1. Language and spatial analysis . . . . .	30
2.3.2. Representation: style and cartography . .	35
2.3.3. Other functionalities . . . . .	36
2.3.3.1. Visualization . . . . .	36
2.3.3.2. Editing . . . . .	37
2.3.3.3. OGC flux . . . . .	38
2.4. Architecture and graphical interface . . . . .	39
2.4.1. Architecture and models . . . . .	39
2.4.1.1. Creating a plugin . . . . .	40
2.4.1.2. Manipulating data . . . . .	41
2.4.2. Graphical interface . . . . .	47
2.4.2.1. The GeoCatalog . . . . .	47
2.4.2.2. The GeoCognition . . . . .	47
2.4.2.3. The Map and the TOC . . . . .	48
2.5. Examples of use . . . . .	48
2.5.1. Spatial diachronic analysis of urban sprawl . . . . .	48
2.5.2. Spatial hydrologic analysis . . . . .	51
2.5.3. Geolocation . . . . .	56
2.5.3.1. Geocoding . . . . .	57
2.5.3.2. Geographical rectification . . . . .	57
2.6. Community . . . . .	61
2.7. Conclusion and perspectives . . . . .	63
2.8. Acknowledgments . . . . .	64
2.9. Bibliography . . . . .	64
 <b>Chapter 3. GEOXYGENE: an Interoperable Platform for Geographical Application Development . . . . .</b>	 67
Éric GROSSE, Julien PERRET and Mickaël BRASEBIN	
3.1. Introduction . . . . .	67
3.2. Background history . . . . .	68
3.3. Major functionalities and examples of use . .	69
3.3.1. Generic functionalities . . . . .	70
3.3.2. Use case: building data manipulation . .	70
3.3.2.1. Data . . . . .	70

3.3.2.2. The data schema: the Building class . . . . .	72
3.3.2.3. Object-relational mapping with OJB . . . . .	73
3.3.2.4. A processing example: building urban areas . . . . .	73
3.4. Architecture . . . . .	75
3.4.1. The core . . . . .	76
3.4.2. First applicative layer: the basic applications . . . . .	77
3.4.3. Second applicative layer: the expert applications . . . . .	78
3.4.3.1. Semiology modules . . . . .	80
3.4.3.2. GEOXYGENE 3D module . . . . .	80
3.4.3.3. GEOXYGENE spatiotemporal module . . . . .	82
3.5. Communities . . . . .	84
3.6. Conclusion . . . . .	86
3.7. Bibliography . . . . .	88
<b>Chapter 4. Spatiotemporal Knowledge Representation in AROM-ST . . . . .</b>	<b>91</b>
Bogdan MOISUC, Alina MIRON, Marlène VILLANOVA-OLIVIER and Jérôme GENSEL	
4.1. Introduction . . . . .	91
4.2. From AROM to AROM-ST . . . . .	93
4.2.1. AROM in context: a knowledge representation tool . . . . .	93
4.2.2. Originalities . . . . .	95
4.2.3. Why a spatiotemporal extension? . . . . .	96
4.2.3.1. Existence . . . . .	96
4.2.3.2. AROM's contribution . . . . .	97
4.3. AROM-ST . . . . .	100
4.3.1. Metamodel . . . . .	100
4.3.2. Objects and time relationships . . . . .	102
4.3.3. Space and time types . . . . .	107
4.3.4. Spatial modeling example with AROM . . . . .	108

4.4. From AROM-OWL to ONTOAST . . . . .	112
4.5. Architecture . . . . .	113
4.6. Community . . . . .	115
4.7. Conclusions and prospects . . . . .	116
4.8. Bibliography . . . . .	117
<b>Chapter 5. GENGHIS: an Environment for the Generation of Spatiotemporal Visualization Interfaces . . . . .</b>	<b>121</b>
Paule-Annick DAVOINE, Bogdan MOISUC and Jérôme GENSEL	
5.1. Introduction . . . . .	121
5.2. Context . . . . .	122
5.2.1. The SPHERE and SIDIRA applications: two applications devoted to visualizing data linked to natural risks . . . . .	123
5.2.2. GENGHIS: a generator of geovisualization applications devoted to multi-dimensional environmental data . . . . .	125
5.3. Functionalities linked to the generation of geovisualization applications . . . . .	127
5.3.1. Use cases for GENGHIS . . . . .	127
5.3.2. Instancing the data model and the knowledge base . . . . .	128
5.3.3. Editing the presentation model . . . . .	130
5.3.4. Generating the geovisualization interface . . . . .	132
5.4. Functionalities of the geovisualization application generated by GENGHIS . . . . .	133
5.4.1. Spatial frame functionalities . . . . .	135
5.4.2. Temporal frame functionalities . . . . .	135
5.4.3. Informational frame functionalities . . . . .	137
5.4.4. Interactivity and synchronization principles . . . . .	138
5.5. Architecture . . . . .	140
5.6. Scope and user communities . . . . .	141

5.6.1.	Natural risks: a privileged scope . . . . .	141
5.6.1.1.	The SIHREN application . . . . .	142
5.6.1.2.	The MOVISS application . . . . .	144
5.6.2.	User community . . . . .	146
5.7.	Conclusion and perspectives . . . . .	147
5.8.	Acknowledgments . . . . .	148
5.9.	Bibliography . . . . .	149
<b>Chapter 6. GEOLIS: a Logical Information System to Organize and Search Geo-Located Data . . . . .</b>		151
Olivier BEDEL, Sébastien FERRÉ and Olivier RIDOUX		
6.1.	Introduction . . . . .	151
6.2.	Background history . . . . .	152
6.3.	Main functionalities and use cases . . . . .	153
6.3.1.	Geographical data visualization and exploration . . . . .	156
6.3.1.1.	Virtual layers: queries and extensions . . . . .	157
6.3.1.2.	Visualizing a virtual layer: map and navigation index . . . . .	158
6.3.1.3.	Building and transforming virtual layers: navigation links . . . . .	163
6.3.2.	Representation of geographical data and spatial reasoning . . . . .	168
6.3.2.1.	Representing spatial properties . . . . .	169
6.3.2.2.	Representing spatial relations . . . . .	172
6.3.3.	Use cases . . . . .	174
6.3.3.1.	Direct search . . . . .	175
6.3.3.2.	Targeted search . . . . .	176
6.3.3.3.	Exploratory search . . . . .	177
6.3.3.4.	Knowledge search . . . . .	180
6.4.	Architecture . . . . .	182
6.5.	Users and developers . . . . .	184
6.6.	Conclusion . . . . .	186
6.7.	Bibliography . . . . .	186

<b>Chapter 7. GENEXP-LANDSiTES: a 2D Agricultural Landscape Generating Piece of Software . . . . .</b>	189
Florence LE BER and Jean-François MARI	
7.1. Introduction . . . . .	189
7.2. Context . . . . .	190
7.3. Major functionalities . . . . .	193
7.3.1. Point generation . . . . .	194
7.3.2. Field pattern simulation . . . . .	194
7.3.2.1. Voronoï diagrams . . . . .	195
7.3.2.2. Random rectangular tessellation . . . . .	196
7.3.3. Cropping pattern simulation . . . . .	198
7.3.3.1. Stationary method . . . . .	198
7.3.3.2. Taking into account succession changes . . . . .	199
7.3.3.3. Future changes . . . . .	199
7.3.4. Post-production, spatial analysis, and formats . . . . .	200
7.3.4.1. Post-production . . . . .	200
7.3.4.2. Spatial analysis . . . . .	200
7.3.4.3. Formats, import, and export . . . . .	201
7.4. Case uses . . . . .	201
7.5. Architecture . . . . .	204
7.5.1. The application Core . . . . .	205
7.5.2. Separating graphical classes from business classes . . . . .	205
7.5.3. The plugin system . . . . .	206
7.5.4. Interface . . . . .	206
7.6. Communities . . . . .	207
7.7. Conclusion . . . . .	209
7.8. Acknowledgments . . . . .	209
7.9. Bibliography . . . . .	210

<b>Chapter 8. MDWEB: Cataloging and Locating Environmental Resources . . . . .</b>	215
Jean-Christophe DESCONNETS and Thérèse LIBOUREL	
8.1. Introduction . . . . .	215
8.2. Context . . . . .	216
8.2.1. Origins . . . . .	216
8.2.2. Positioning . . . . .	218
8.3. Major functionalities and case uses . . . . .	220
8.3.1. Matching roles and functionalities . . . . .	221
8.4. Cataloging functionality . . . . .	224
8.4.1. Notion of metadata . . . . .	225
8.4.2. Notion of metadata profile . . . . .	226
8.4.3. A simplified view of cataloging . . . . .	228
8.4.4. Cataloging in a multiuser context . . . . .	232
8.4.5. Cataloging extensions . . . . .	234
8.4.5.1. Help for metadata input . . . . .	234
8.4.5.2. Metadata exchange . . . . .	236
8.5. Locating functionality . . . . .	238
8.5.1. Local and distant metadata querying . . . . .	241
8.5.2. Monolingual or multilingual querying . . . . .	241
8.6. Administration functionality . . . . .	244
8.7. Architecture . . . . .	247
8.8. User community . . . . .	249
8.9. Conclusion . . . . .	251
8.10. Bibliography . . . . .	253
<b>Chapter 9. WEBGEN: Web Services to Share Cartographic Generalization Tools . . . . .</b>	257
Moritz NEUN, Nicolas REGNAULD and Robert WEIBEL	
9.1. Introduction . . . . .	257
9.2. Historical background . . . . .	258
9.3. Major functionalities . . . . .	262
9.3.1. Uploading software tools . . . . .	262
9.3.2. Requesting a service . . . . .	263
9.3.3. Cataloging and discovering services . . . . .	264

9.4. Area of use . . . . .	265
9.4.1. Usage . . . . .	265
9.4.1.1. Interactive mode . . . . .	265
9.4.1.2. Automatic mode . . . . .	266
9.4.2. User types . . . . .	267
9.4.2.1. Researchers . . . . .	267
9.4.2.2. Cartographic institutions (Institut Géographique National - IGN and others) . . . . .	271
9.4.2.3. GIS providers . . . . .	271
9.5. Architecture . . . . .	273
9.5.1. WEBGEN services access . . . . .	273
9.5.2. A standard data model for generalization services . . . . .	274
9.6. Associated communities . . . . .	276
9.6.1. Distribution . . . . .	276
9.6.2. Uses . . . . .	276
9.6.3. Contributors . . . . .	276
9.7. Conclusion and outlook . . . . .	277
9.8. Acknowledgments . . . . .	279
9.9. Bibliography . . . . .	279
<b>PART 2. SUMMARY AND SUGGESTIONS . . . . .</b>	<b>283</b>
<b>Chapter 10. Analysis of the Specificities of Software Development in Geomatics Research . . . . .</b>	<b>285</b>
Florence LE BER and Bénédicte BUCHER	
10.1. Origin and motivations . . . . .	286
10.1.1. Targeted users and uses . . . . .	286
10.1.2. Motivations and foundations . . . . .	287
10.2. Major functionalities, fields, and reusability . . . . .	288
10.2.1. Functionalities . . . . .	288
10.2.2. Fields . . . . .	289
10.2.3. Reusability . . . . .	291

<b>Chapter 11. Challenges and Proposals for Software Development Pooling in Geomatics . . . . .</b>	293
Bénédicte BUCHER, Julien GAFFURI, Florence LE BER and Thérèse LIBOUREL	
11.1. Requirements and challenges . . . . .	294
11.1.1. Pooling function implementations . . . . .	294
11.1.1.1. Reusing functions implemented in geomatics . . . . .	294
11.1.1.2. The challenge of defining interoperable interfaces . . . . .	297
11.1.1.3. The challenge of modular development . . . . .	299
11.1.2. Pooling models and expertise . . . . .	301
11.1.2.1. The need for it . . . . .	301
11.1.2.2. A challenge: the diversity and gaps in the existing expertise . . . . .	302
11.2. Solutions . . . . .	303
11.2.1. Reference frameworks and metadata . . .	304
11.2.2. Test cases to improve description of implemented functions and progress within a community . . . . .	307
11.3. Conclusion . . . . .	311
11.4. Bibliography . . . . .	313
<b>Glossary . . . . .</b>	317
<b>List of Authors . . . . .</b>	325
<b>Index . . . . .</b>	329