

Contents

1	Communicating NASA's Science to the Public	
by	France Cordova	1
1.1	Introduction	1
2	The Library of Congress's National Digital Library Program	
by	James H. Billington	17
2.1	Introduction	17
3	The Universal Library: Intelligent Agents and Information on Demand	
by	Raj Reddy	27
3.1	Introduction	27
3.2	A Future Scenario	27
3.3	Conventional vs. Digital Libraries	29
3.4	The Economic Model	30
3.5	The Content and Infrastructure Model	31
3.6	The Home Information System Model	32
3.7	The Operating System Model	32
3.8	The Human Computer Interaction Model	33
3.9	Conclusion	33
4	Building a Scalable America	
by	Larry Smarr	35
4.1	Introduction	35
I	Visualization	
5	Video as Scholarly Material in the Digital Library	
by	Wayne Wolf, Bede Liu, Andrew Wolfe, Minerva Yeung, Boon-Lock Yeo, and Daniel Markham	45
5.1	Moving images as scholarly material	45
5.2	Digital Video Libraries	46
5.3	Methodologies and algorithms for digital video libraries	46
5.4	Conclusions	53

6 Digital Libraries for Electronic News	
by Michael A. Shepherd, C.R. Watters, and F.J. Burkowski	55
6.1 Introduction	55
6.2 Newspaper Databases	57
6.3 Electronic News	57
6.4 Features of an Electronic News System	58
6.5 Electronic News as a Digital Library	58
6.5.1 Attributes of News Items	58
6.5.2 Integration of News Delivery and a Digital Library	59
6.6 Summary	62
7 WebJournal: Visualization of a Web Journey	
by Bipin C. Desai and Stan Swiercz	63
7.1 Introduction	63
7.2 Journaling a Web Journey	64
7.2.1 Layout and Semantics of WebJournal	64
7.2.2 Semantics of Nodes	67
7.2.3 Semantics of Edges	67
7.2.4 Handling Multiple Browser Windows	69
7.3 Managing the WebJournal Real Estate	69
7.4 Marking Nodes, Saving, Reloading and Printing	72
7.4.1 Exploding a Node	73
7.4.2 Marked Nodes and Printing	75
7.5 WebJournal Internals, communications.	79
7.6 Conclusions	79
7.7 Acknowledgment	80
II Document Handling and Information Retrieval	
8 Uniform Structured Document Handling using a Constraint-based Object Approach	
by Anisoara Nica, Elke Angelika Rundensteiner	83
8.1 Introduction	84
8.1.1 Structured Document Management	84
8.1.2 The Constraint-based Approach	85
8.1.3 Overview	86
8.2 Project Background	86
8.3 The Constraint-Based Object Model	88
8.4 Mapping SGML Model Groups into the Constraint Based Model	90
8.5 Schema Merging Using the Constraint Model	97
8.6 Related Work	99
8.7 Conclusions	100

9 Digital Software and Data Repositories for Support of Scientific Computing

by Ronald Boisvert, Shirley Browne, Jack Dongarra, and Eric Grosse

9.1	Introduction	103
9.2	Characteristics of Some Existing Software Repositories	104
9.2.1	Netlib	104
9.2.2	The National HPCC Software Exchange (NHSE)	105
9.2.3	GAMS Virtual Repository	106
9.3	Indexing and Searching of Software Objects	107
9.3.1	Data Models	107
9.3.2	Software Classification	107
9.3.3	Search Interfaces	108
9.4	Retrieval of Software Objects	109
9.4.1	Downloading Files	109
9.4.2	Templates and Archetypes	110
9.4.3	Remote Execution	111
9.4.4	Change Notification	111
9.5	Access to Scientific Data	112
9.6	Integration with Document Digital Libraries	113

10 Semantic Hypermedia Retrieval in Digital Libraries

by Stephan Wiesener, Wolfgang Kowarschick, Pavel Vogel, and Rudolf Bayer

10.1	Introduction	115
10.2	The OMNIS Digital Library System	118
10.2.1	OMNIS System Architecture	118
10.2.2	Archiving and Retrieval	120
10.2.3	OMNIS in Practice	121
10.3	Towards Knowledge-based Navigation in Digital Libraries	121
10.3.1	System Architecture	123
10.3.2	Documents and Semantic Knowledge Bases	125
10.3.3	Queries and Navigation	127
10.4	Summary and Outlook	128

11 Fuzzy Full-Text Searches in OCR Databases

by Andreas Myka and Ulrich Güntzer

11.1	Introduction	131
11.2	Search mechanisms	133
11.2.1	Exact match	133
11.2.2	Canonical forms	134
11.2.3	N-grams	137
11.2.4	Linear scanning	137
11.3	Experiments	140
11.3.1	Environment	140

11.3.2 Methodology	140
11.3.3 Results	141
11.4 Summary and outlook	145
 III Network-Based Information and Resource Discovery	
 12 Data Discovery in Large Scale Heterogeneous and Autonomous Databases	
by Athman Bouguettaya and Stephen Milliner	149
12.1 Background	149
12.1.1 Motivation	149
12.2 Related Work	151
12.3 The FINDIT Database Discovery System	153
12.3.1 The FINDIT Architecture Level	155
12.3.2 The FINDIT Interaction/Negotiation Level	157
12.3.3 The FINDIT Interoperability Level	159
12.3.4 The FINDIT Exploration Level	160
12.4 Implementation Overview	163
12.5 Discussion and Future Directions	166
 13 An Intelligent Agent for the K-12 Educational Community	
by Mark E. Rorvig, Mark W. Hutchison, Robert O. Shelton, Stephanie L. Smith and Marwan E. Yazbeck	167
13.1 Introduction	167
13.2 The Agent	168
13.3 Acknowledgements	176
13.4 Appendix A - Example of Question and Answer Responses from November and April	176
 14 Interface Issues for Interactive Multimedia Documents	
by Robert B. Allen	179
14.1 Introduction	179
14.1.1 Multimedia Documents	179
14.1.2 Multimedia Browsers	180
14.1.3 Internal Representations	180
14.2 Presentation Issues For Multimedia Documents	180
14.2.1 Tables of Contents (TOCs)	181
14.2.2 Linking	181
14.2.3 Searching	181
14.2.4 Supporting Partially Guided Tours	182
14.2.5 Locking Concurrent Multimedia Streams	182
14.3 TOC Interface Implementations	183
14.3.1 Corpora	183
14.3.2 Timeline-based Audio-Slideshow Browser	184

14.3.3 TOC-based View-graph and Audio Browser	185
14.3.4 TOC-based Video Browser	185
14.3.5 Visual TOC Browser	186
14.4 Discussion	187
14.4.1 Other Media, Other Structures, and Other Widgets	187
14.4.2 Possible Social Impact of Multimedia Lectures	188
14.4.3 Envoi	188
14.5 Acknowledgements	189
15 Searching and Discovery of Resources in Digital Libraries	
by Nahum Gershon, William Ruh, Joshua LeVasseur, Joel Win-	
stead, and Adrienne Kleiboemer	191
15.1 Introduction	191
15.2 Browsing Through Hyperspace Without Being Lost	193
15.3 Overcoming the Rigidity of the WWW- Building One Owns	
Information Hyperspace	193
15.4 Finding New Information in Retrieved Documents- Aggregating	
Relevant Information	196
15.5 Classification of Information and Metadata Extraction	197
15.6 In Conclusion	198
15.7 Acknowledgments	198

IV Design Issues and Prototyping

16 The Almaden Distributed Digital Library System

by David M. Choy, Richard Dievendorff, Cynthia Dwork, Jeffrey	
B. Lotspiech, Robert J. T. Morris, Norman J. Pass, Laura C.	
Anderson, Alan E. Bell, Stephen K. Boyer, Thomas D. Griffin,	
Bruce A. Hoenig, James M. McCrossin, Alex M. Miller, Florian	
Pestoni and Deidra S. Picciano	203
16.1 Introduction	203
16.2 The Library Principals and their Needs	207
16.2.1 The consumer	207
16.2.2 The librarian	207
16.2.3 The primary publisher	208
16.2.4 The secondary publisher	208
16.3 Architecture of the Almaden Distributed Digital Library System	209
16.3.1 The Source Server	212
16.3.2 The Customer Server	213
16.3.3 The Client	215
16.4 Security and Rights Management	215
16.5 Summary and Future Work	218

17 Alexandria Digital Library: Rapid Prototype and Metadata Schema	
by Christoph Fischer, James Frew, Mary Larsgaard, Terence R. Smith and Qi Zheng	221
17.1 Introduction	221
17.2 Goals, Strategy, and General Architecture of ADL	222
17.2.1 The Strategy and General Architecture of ADL	223
17.3 The Rapid Prototype System for the ADL	225
17.3.1 Classes of Queries and the Functional Architecture of the RPS	226
17.4 The Interfaces to the ADL Rapid Prototype	227
17.4.1 The User Interface to the RPS	228
17.5 The Catalog and Metadata for the ADL Rapid Prototype	231
17.5.1 A Comparison of the USMARC and FGDC Metadata standards	231
17.5.2 General Issues in Implementing USMARC and FGDC Standards	233
17.5.3 Combining the FGDC and USMARC Standards in the RPS	234
17.6 The Ingest and Storage Components of the Rapid Prototype . .	237
17.7 Software and Hardware Components of the ADL Rapid Prototype	238
17.8 Unique Features of the RPS, Lessons Learned, and Next Steps .	239
17.8.1 The Next Stage in constructing ADL	239
17.9 Summary	240
18 The ELINOR Electronic Library	
by Dian G. Zhao and A. Ramsden	243
18.1 Introduction	243
18.2 Using ELINOR	245
18.2.1 The Database	245
18.2.2 Browsing and Reading Documents	246
18.2.3 Searching for Documents	246
18.2.4 Printing Documents	249
18.3 User Study	250
18.4 The Systems Aspect of ELINOR	250
18.4.1 The System Architecture	250
18.4.2 Usage Statistics Collection	252
18.4.3 Usage Statistics Management	252
18.4.4 Usage Statistics Reporting	255
19 Dienst: Building a Production Technical Report Server	
by James R. Davis, Carl Lagoze, and Dean B. Krafft	259
19.1 Introduction	259
19.2 Overview of Dienst	259
19.3 Experience Gained	260
19.3.1 Dienst and the World Wide Web	260
19.3.2 Copyright Issues	262

19.3.3 Document Submission and Management	264
19.3.4 Providing Documents in Multiple Formats	265
19.4 Ongoing Issues	266
19.4.1 Interoperability Among Heterogeneous Search Engines . .	266
19.4.2 Heterogeneous Servers and the Dynamic User Interface .	267
19.4.3 Reliability	267
19.4.4 Document Structure	268
19.4.5 Technology Transfer	268
19.5 Future Plans	269
19.6 Acknowledgements	270
Bibliography	273