Conclusion

Digital technology has advanced remarkably in the last several years, and the future holds the possibility of even more startling developments. The Semantic Web could transform the World Wide Web into a global database whose content is meaningful to both people and computers. Autonomic computers could learn to run themselves. Holographic storage could allow laser beams to be used to store computer-generated data in three dimensions and exponentially increase storage capacity. Automated policy-based management algorithms could make the administration of digital image collections, and indeed of almost all aspects of life, less arduous and more efficient.

However, these and many other possibilities will not come into being unless they are able to handle heterogeneity and change: the diverse platforms, operating systems, devices, software, formats, and schemas that exist in today's networked environment. Perhaps paradoxically, the best way of achieving this is through the application of open standards, not so much to remove heterogeneity—though there will certainly be an element of that—but to navigate intelligently through it, or perhaps to provide intelligent translation between heterogeneous elements. The consistent application of standards will be an essential component of advances in integration technology that might bring into being some form of the "information fusion" that the more romantic among us expect from scientific advance. At the very least, we can hope for assimilation of the functions of the myriad management systems offered today (document management, image management, digital asset management, media asset management, content management, library management, and so on) into more unified systems. More immediately, documentation standards for images must be refined and consensus built around such issues as the range of data elements that constitute a minimal image description, the most effective data structure, and so forth.

There are a number of other issues that also require further research, such as the development and adoption of accepted strategies for preservation repositories. Technologies affecting Web accessibility, such as bandwidth and wireless transmission, will continue to be an issue if the Web is to become truly global. Delivery technology that is sensitive to the client environment (display capabilities, decompression software/ hardware, etc.) might only send images with a dynamic range within a client workstation's display capability or might only send compressed images in formats the client workstation is capable of decompressing. To achieve this, image servers would need to receive descriptions of client workstations in a standard way so that only meaningful information would be transferred to a user's workstation. Issues of intellectual property on the Web are also being constantly contested, and generally accepted standards of what is and what is not permissible have yet to emerge.

Digital imaging has already provided wider access to the world's cultural heritage than ever before: images and metadata can be distributed over worldwide or local networks and can be used for many different purposes, from enhancement of scholarship and teaching to personal exploration and enjoyment. The potential for developing new audiences and broadening cultural appreciation is far-reaching. In order to take full advantage of these opportunities, however, digital image collections must be constructed to remain relevant and accessible beyond a single, short-term project. Careful choices in technology and the use of shared technical and descriptive standards will make it possible to exchange information among databases and across networks and promote collaboration and resource sharing. Standards-driven approaches will ensure that all cultural heritage institutions can participate fully in the creation of the universal virtual museum.

Notes

1. The Digital Library Forum, *A Framework of Guidance for Building Good Digital Collections* (Institute of Museum and Library Services, 2001). Available only on the World Wide Web at <http://www.imls.gov/pubs/forumframework.htm>.

2. See Murtha Baca, ed., *Introduction to Metadata: Pathways to Digital Information* (Los Angeles: Getty Research Institute, 1998). Also available in Spanish. Version 2.0 available only on the World Wide Web at <http://getty.edu/research/conducting_research/standards/>.

3. Of particular interest is the FRBR (Functional Requirements for Bibliographic Records) model, which addresses the problem of linking hierarchic metadata records by allowing FRBR records to contain information on "works" and related "expressions," "manifestations," and "items," so that it is not necessary to recatalogue each instance. More information is available on the World Wide Web at <http://www.ifla.org>.

4. *Handbook of Standards: Documenting African Collections*, AFRICOM, 1996. Available on the World Wide Web in English and French versions at <http://icom.museum/afridoc/>. An Arabic version is under development, under the auspices of the ICOM Regional Organization for the Arab Countries.

5. Tim Berners-Lee, James Hendler, and Ora Lassila, "The Semantic Web," *Scientific American* 284, no. 5 (May 2001): 34-43.

6. For an extended discussion of these perils, see Howard Besser, "Digital Longevity," in Maxine K. Sitts, ed., *Handbook for Digital Projects: A Management Tool for Preservation and Access* (Andover, MA: Northeast Document Conservation Center, 2000): 155-66. Also available on the World Wide Web at <http://www.nedcc.org/digital/ix.htm>.

7. Oya Y. Rieger, "Project to Programs: Developing a Digital Preservation Policy," in Anne R. Kenney and Oya Y. Rieger, eds., *Moving Theory into Practice: Digital Imaging for Libraries and Archives* (Mountain View, CA: Research Libraries Group, 2000).

8. Additional information on the Rosetta Project is available on the World Wide Web at <http://www.rosettaproject.org>.

9. Additional information on OAIS is available from the NASA/Science Office of Standards and Technology (NOST) on the World Wide Web at <http://ssdoo.gsfc.nasa.gov/nost/isoas/>.