Building a Digital Library of the Middle East

Report of the Workshop

Bibliotheca Alexandrina
Alexandria, Egypt

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Building a Digital Library of the Middle East

Workshop Report

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Executive Summary

In January 2006 the Bibliotheca Alexandrina hosted a workshop to lay the foundation for a digital library of resources relating to the Middle East, with an initial focus on cultural heritage but with the goal of establishing advanced networks to support future research and education in the sciences, social sciences, arts and humanities. The meeting was supported by funding from the US-Egypt Joint Science and Technology Fund and the National Science Foundation. The US Institute of Museum and Library Services served as project partner, and a coordinating committee provided organizational guidance.

The workshop objectives were to agree on a long-term vision; assess the current information infrastructure in the Middle East and examine the potential for establishing advanced research networks; identify a model for content aggregation, management and preservation; identify content scope and services; and document requirements as a roadmap for future actions. This report contains the conclusions and recommendations of the participants.

Participants agreed that the digital library should provide:

- worldwide resources from and about the cultures and societies of the Middle Eastern and Arab worlds;
- a framework for incorporating resources of many types, including multilingual and multimedia materials, from many sources and subject areas;
- content that has public value, is easily navigable, unrestricted for use, and that can be adapted for different audiences;
- wide-scale access and exchange of information through multiple regional and international networks;
- preservation of resources in a trusted repository with redundancy to ensure long-term continuity;
- an architecture that is distributed, open, interoperable, and that is integrated into the global knowledge infrastructure;
- a working structure that is collaborative and receptive to new partners, contributors, and users; and,
- long-term sustainability as a dynamic, growing, and secure resource

Workshop participants identified a number of action items to help build the necessary content, infrastructure, and partnerships to ensure successful deployment of the digital library. While the full report contains many specific recommendations, on a broad level these include:

- strategies for identifying potential partners, content, and user communities;
- analysis of the existing and emerging advanced research networks in the Middle East, development of a how-to guide for establishing new networks, and a plan for interconnecting advanced research networks worldwide; and,
- formation of an initial partnership of a small number of lead organizations to jump-start the initiative and to promulgate standards-based activity, initially using the Open Archives Initiative Protocol for Metadata Harvesting as an organizing framework but also incorporating additional agreements and flexibility for future enhancements.

A successful Digital Library of the Middle East will create new resources for education and study; new scholarly collaborations; new relationships among scientific and cultural heritage organizations; and, ultimately, a fuller, shared understanding of the human experience.

The Alexandria workshop shows promise as a model for similar efforts. The Fulbright Academy of Science and Technology, with funding from UNESCO and NSF, has announced a workshop in Rabat, Morocco, in January 2007 for the nations of the ancient Maghreb region of North Africa, based on the Alexandria meeting (http://www.fulbrightacademy.org/page/86607/). Through deployment of this model and subsequent investments in networks, infrastructure, and content, a global digital library can become a reality within the next decade.

Overview

With funding from the US-Egypt Joint Science and Technology Fund, the Bibliotheca Alexandrina (BA) and the US Institute of Museum and Library Services (IMLS) partnered to organize a workshop to lay the foundation for a digital library of resources relating to the Middle East (MEDL). The workshop was held at the BA in Alexandria, Egypt, January 15-17, 2006. The agenda included definition of the mission and scope; identification of the network, system and organizational infrastructure required to support a robust and sustainable digital library; consideration of requirements for the creation of initial content; and discussion of potential users of the digital library.

A workshop web site is being maintained at the University of Pittsburgh School of Information Sciences (http://www.sis.pitt.edu/~egyptdlw/). Relevant background documents and other information are posted on this site. Bibliotheca Alexandrina maintains a mirror website at www.bibalex.org/EgyptDLW/.

The workshop objectives were to:

- agree on a long-term vision;
- assess the current information infrastructure in the Middle East and examine the potential for establishing advanced research networks;
- identify a model for content aggregation, management and preservation;
- identify content scope and services; and,
- document requirements as a roadmap for future actions.

Background

The workshop grew out of a series of inter-agency meetings convened by the US State Department in 2003 focusing on restoring and preserving the cultural heritage of Iraq. Both IMLS and National Science Foundation (NSF) representatives noted the potential for the development of a digital library as a means of collecting, preserving, and sharing cultural heritage resources across institutional and geographic boundaries. Digital surrogates of museum artifacts,

manuscripts, books, and related information such as archival resources and even archeological sites could be useful as documentation in the event of loss of originals through destruction, damage or theft. In addition, aggregation of digital content would bring together in a virtual environment information that is currently scattered throughout the world and make it readily available to scholars and students worldwide. The network that would be created to provide wide access to these resources could be used to stimulate and support research not only in cultural heritage but in the arts, sciences and humanities.

It was also recognized that a larger scope beyond the geographic and political boundaries of present-day Iraq would be desirable given the long and rich cultural heritage of the entire Middle East, the long-standing relationships and interactions among various Middle Eastern cultures, and the potential for a collaborative project to promote shared understanding.

As a result of these discussions, the BA and IMLS agreed to apply in partnership to the US-Egypt Joint Science and Technology Fund for seed money to organize a workshop on the topic. The application was approved in June 2005; subsequently, NSF added funds to allow for additional US-invited participants. Additional sponsors included the Egyptian Ministry of Communications and Information Technology and the Egyptian Academy of Scientific Research and Technology.

A planning meeting for the workshop was held in Washington on August 4, 2005, attended by representatives of a number of US Federal agencies that had been involved in the initial State Department meetings as well as the following members of the workshop coordinating committee: Noha Adly, BA; Stephen Griffin, NSF; Kenneth Hamma, J. Paul Getty Trust; Ron Larsen, University of Pittsburgh School of Information Sciences; and Joyce Ray, IMLS (see planning meeting report on the workshop web site).

The coordinating committee identified the following topics to be addressed at the workshop:

- Vision, Mission and Scope
- Content, Collections and Users

- Network Infrastructure
- Interoperability and Standards

Workshop participants were invited who could provide expertise in one or more of these areas. Participants were invited from the US, UK, and Taiwan, as well as Egypt and other Middle Eastern countries.

The presentations provided high-level perspectives on the value of digital libraries and technology to promote research, education, literacy, and democracy. Other presenters addressed current technology and digital library initiatives and projects in Egypt and the US, as well as current and emerging protocols for aggregating and managing digital content and metadata. The full agenda and list of participants is posted on the workshop web site.

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Introduction

Technological, social and economic forces suggest that in the near future there will be a common, shared, global communications and knowledge environment of unprecedented size, capability, scope and value. National and multinational digital libraries are growing in number and size at a rapid pace [see Appendix 1 for a partial list]. National Research and Education Networks (NRENs) are being established and enhanced around the globe, linking universities, research establishments, schools and libraries with high-speed connectivity to support use of digital content in many formats, including sound and images as well as text. Many countries in Europe and North America have high bandwidth NRENs. More recently, major network infrastructure programs are being implemented in less-developed countries in North and South Africa, South America, Asia and Oceania. Individual networks and digital libraries link with each other and join to create a larger whole, bringing massive amounts of digital content and new applications into worldwide use. These resources draw new users, creating a self-reinforcing cycle of development and driving demand for additional resources.

A key attribute for new large-scale resources is to connect seamlessly to and become part of the rapidly expanding global information environment and human knowledge commons. Although bandwidth availability varies greatly by country and region, it promises to increase steadily over the next few years. It is not far-fetched to envision a universal digital library that preserves the human record and ensures access to this accumulated knowledge to all people for the foreseeable future. At the same time, much needs to be done at the local level to properly create and manage individual resources to ensure they link seamlessly and yield maximum value while maintaining their authenticity and identity.

The Digital Library of the Middle East (MEDL) is a starting point for collecting and organizing digital materials related to the history and cultural heritage of the Middle East and Arab worlds. It will be both a digital resource of great value and a new social and organizational network of international partnerships involving universities, libraries, museums and other providers and users of digital content and technology. The Bibliotheca Alexandrina, in reviving the vision of the

ancient Library of Alexandria as a preserver of all human knowledge, has the technological and organizational capacity to provide a center about which the effort can grow. It is thus an appropriate organization to serve as the hub of this creative effort. This can mean, in the near term, establishing at the BA an organized, managed digital repository for Middle East cultural heritage materials currently held in widely scattered individual institutions around the world and a center for regional networking infrastructure activities. In the intermediate term, the MEDL can create a regional network of partners for additional content and collection creation. In the long term, the MEDL can host and manage a self-sustaining distributed resource supporting a wide range of intellectual activities over a broad geographical area. The Bibliotheca Alexandrina has demonstrated the commitment and vision, and has assembled the human and technical resources to manage and preserve a vast treasury of human memory on digital media.

Digital collections of cultural heritage materials are invaluable to those seeking a fuller, shared understanding of the historic human experience and its bearing on the present. The MEDL will add to the current global knowledge commons resources covering many centuries, languages, and forms of human expression, both tangible and intangible. With dedicated high-bandwidth linkages to global networks and proper technical attributes, the MEDL can attract and collaborate with the appropriate partners to assemble the necessary technological infrastructure and assure access to a rich body of digital content by researchers throughout the Middle East and the world. It can also serve the needs and interests of the general public and others who lack high-speed access. The creation, organization and sharing of digital content relating to the cultural heritage of the Middle East will serve to advance understanding, research, education, community development and the preservation and appreciation of Middle Eastern culture.

Cultural and Technological Context

The present-day Middle East consists of nation states whose political boundaries do not reflect the region's long and rich history. National identity and individual allegiance is often subordinate or secondary to

that of ethnic group, region, and religion. Historic cultural, linguistic and religious borders do not coincide with national borders. Multiple nations now govern and have jurisdiction over the ancient land of Mesopotamia—the geographical area centered between the Euphrates and Tigris rivers—where some of mankind's great civilizations began, prospered and spread. Three of the world's great religions have roots there: Judaism, Christianity, and Islam.

The Middle East has undergone a multi-millennium cultural diffusion of peoples, ideas, languages, and of material and non-material cultural artifacts. To more fully understand the history of the Middle East and its influence in shaping societies and events in other regions of the world, it is necessary to begin to collect and reassemble the dispersed knowledge fragments of Middle East culture and history. These remnants and evidence of long-term historic change and cultural development can be found, in part, in the artifacts that remain in archeological sites or have been removed from the region for many reasons. Valuable artifacts and documents essential to creating a comprehensive record of the Middle East are found in museums, university libraries and departmental collections, and in private hands, far removed from the location and context of their creation. In the past several centuries, sites have been discovered and artifacts recovered, collected and moved to other locations around the globe, primarily for the purpose of protecting, preserving and studying them for a multitude of scholarly purposes. Artifacts in museums, university departments and cultural memory institutions are for the most part carefully cataloged and curated. In other cases, artifacts have been looted from sites to be sold for profit, ignoring valuable contextual information and ravaging the sites of origin. Reconstructing cultural and historic records requires assembling and linking the remnants of material and intangible culture into coherent collections. This is a formidable task, often impossible to accomplish with physical artifactual materials, but achievable in many cases using digital representation and networking resources. These provide the means for linking and tools for interpreting digital cultural assets as well as of safeguarding cultural memory through preservation of digital representations of artifacts and their associated documentation.

It is now feasible to create extremely accurate digital surrogates of a wide variety of cultural heritage materials which, in many cases,

increase the scholarly value of the originals while leaving them intact and unaltered. Artifacts for which digital representations have been successfully made include fragile manuscripts and inscriptions on a variety of media, images, sounds, three-dimensional objects, ancient buildings and culturally significant sites. Inscriptions on clay tablets can be enhanced and made legible; ancient codex can be read without opening the manuscript; even the contents of tightly wound scrolls that cannot be physically unrolled can be rendered readable by creating and unrolling a digital model of the original. Once in digital form, the extracted information gains all the benefits of entry into the digital and networking realms - it can be easily stored, copied, transferred, transformed and shared, allowing students and scholars around the world to collaborate on the analysis of artifacts that are invaluable in their physical form and for which direct access is tightly restricted or prohibited. It is possible to imagine a process in which thousands of organizations and individuals will collectively create a digital library of Middle East cultural heritage containing digital objects of all forms, which will be of unprecedented size and scope, open and accessible to all, and serving as a model for new efforts of this kind around the globe.

In the course of history, it has been exceptionally rare that opportunities to exponentially increase human knowledge have arisen. Information and communications technologies, combined with vast quantities of digital content and human expertise, present unparalleled potential for the task at hand. Collections of digital surrogates of artifacts can enable analysis at levels of accuracy and sophistication far beyond that possible through examination of the artifact itself. Collections of these surrogates can enable altogether new forms of study, offering new insights through information integration, filling knowledge gaps, comparative analysis and establishing new relationships via linking along numerous new dimensions. In this way, new digital collections can be created which faithfully represent complex processes and situations. The size, scope and complexity of possible collections are essentially unbounded. Computing and storage resources are now inexpensive enough to be within the means of many organizations and individuals, and they are becoming increasingly cheaper. The Internet allows digital content from many collections to be linked and treated as a single resource (which is already happening with popular use of

digital music files). This new resource will reveal new phenomena for study and will dramatically reduce the barriers for access, sharing and collaborative activities, enabling people around the globe to participate in the new knowledge society regardless of their age, level of education or geographic location.

Workshop Structure

Four working groups were organized at the Alexandria workshop: Vision, Mission and Scope; Content, Collections and Users; Network Infrastructure; and Interoperability and Standards. All groups began with a discussion of vision and mission for the MEDL, with input provided to the working group on Vision, Mission and Scope. The other working groups also addressed a range of topics related to:

- current status and information infrastructure needs in the Middle East;
- potential for advanced research network connections to the Middle East countries;
- technologies and methodologies for addressing content creation, management and preservation needs; and,
- disciplinary and interdisciplinary research needs to be addressed as the information infrastructure is developed, and that will be generated by the development of the infrastructure.

Plenary discussions established a framework for dialogue among participants, presented current state-of-the-art capabilities, and challenged participants to imagine as-yet-unknown developments. The workshop report is envisioned as a document to inform and engage grant-making agencies and other potential investors to sustain the overall effort over the long-term; to identify key opportunities for immediate collaboration between the U.S., Egypt, and other countries in the Middle East and neighboring regions; and to stimulate creative contributions by others with the capacity and will to join the effort.

Vision, Mission and Scope

The Digital Library of the Middle East will exist within a global knowledge infrastructure supporting the free flow of information, capturing many forms of human expression, maximizing use of distributed resources, and serving research, education and information needs of all people. Specifically, the MEDL will promote the preservation and understanding of the cultural heritage of the Middle East through the collection, curation and dissemination of a sustainable digital record of worldwide resources from and about the cultures and societies of the Middle Eastern and Arab worlds. Achievement of this vision will require extensive cooperation, new technological resources and dedicated efforts by people and organizations located in the Middle East and in lands far beyond that region where societies have been shaped, in part, by Middle East cultures. The result will be new relationships between cultural heritage organizations, new scholarly collaborations, new resources for education and study at all levels and the establishment of long-term processes that promote the collection and preservation of the cultural heritage of the Middle East while simultaneously encouraging a fuller, shared understanding of the historic human experience and its bearing on the present day.

Essential Features

The MEDL should provide:

- worldwide resources from and about the cultures and societies of the Middle Eastern and Arab worlds;
- a framework for incorporating resources of many types, including multilingual and multimedia materials, from many sources and subject areas;
- content that has public value, is easily navigable, unrestricted for use, and that can be adapted for different audiences;
- wide-scale access and exchange of information through multiple regional and international networks; and,
- preservation of resources in a trusted repository with redundancy to ensure long-term continuity;

- an architecture that is distributed, open & interoperable, and that is integrated into the global knowledge infrastructure;
- a working structure that is collaborative and receptive to new partners, contributors, and users; and,
- long-term sustainability as a dynamic, growing, and secure resource.

Anticipated Results

A successful Digital Library of the Middle East will create:

- new relationships among cultural heritage organizations;
- new scholarly collaborations;
- new resources for education and study; and,
- a fuller, shared understanding of the historic human experience and its bearing on the present.

Content, Collections and Users

A dynamic and intimate relationship exists between content and users. Digital library developers will need to maintain a balance between amassing content and responding to the interests of particular audiences. A content-driven focus would give precedence to resources that are readily available (e.g., that are in the possession of participating partners, or that can be obtained at low cost). A user-driven focus would begin from the perspective of the audience—known, likely, and potential users—and build content based on known or perceived user needs. For example, a research and higher education audience is likely to value comprehensive, developed collections, accompanied by secondary literature and other research resources, while a general user or primary education audience might prefer broad but selective representations of knowledge domains, accompanied by well-shaped interpretations and lesson plans. Because a critical mass of both content and users will be necessary to support a robust MEDL, both approaches should be pursued at the outset.

The success of the MEDL will ultimately depend on demonstrated value to users, so it will be important to develop objective measures and targeted outcomes for identified audiences. This can be done by developing descriptive user scenarios with targeted outcomes, such as skills and knowledge acquisition.

Issues relating to content, users and user services should be identified and, if not resolved up front, at least acknowledged for consideration as the library evolves.

Content Issues:

- Scope should be addressed and further defined, including subject parameters (e.g., natural history, sciences, inclusive vs. exclusive definitions of cultural heritage) as well as geographic parameters.

- Priority for acquisition should be given to:
  - content that is unrestricted for use;
  - aggregation projects that bring together dispersed but related resources;
  - collections that are less accessible because they are unprocessed and uncataloged, fragile, stored in unsuitable conditions or otherwise at risk, etc.;
  - content contributed by active partners who will help to build and promote the MEDL; and,
  - born-digital resources, especially when the creators or owners are unlikely to preserve and provide continuing access to this content.

- Linguistic diversity of content, users and services should be assumed and encouraged.
- Content should be presented in a balance of library-like, stand-alone collections and museum-like collections, which are generally more deeply curated and interpreted (e.g., “library of libraries,” “virtual museums”).
- Content should be presented in appropriate ways for the intended audiences (e.g., scholars, children, teachers).

- A preservation strategy should be developed that identifies needs and priorities and provides for both centralized and distributed preservation, with the latter accompanied by preservation guidelines and tutorials.

User Issues:

- A research/evaluation agenda should be built into planning, based on continuing usability studies, user needs assessment, use analysis, and outcomes appraisal.
- Assessment should include outcomes such as changes in educational opportunities or in technology training opportunities.
- Technology readiness of user groups should be assessed as input for development of project infrastructure (for example, will primary use be at computer terminals or on mobile phones or via interactive television delivered by satellite?)
- The project should develop a broad definition of the entire user community, with attention to nuanced identification of specific groups including scholars, school children, teachers and illiterate communities.
- The needs of potential user communities should help shape the priorities for knowledge areas and subjects to be included in the library; some subjects will have global interest while others will serve limited local interests.
- Users should be considered as potential creators and producers of content, not just as consumers; a project goal should include the development and support of user communities as well as the delivery of content and services.

Services:

Specific services, such as those identified below, would add value to the library:

- the provision of information literacy training to teach users to become effective users of the library;
- community building services such as listservs, blogs, and other means to support dialog and social interaction;

- opportunities for participation in a user community and in the larger library, such as contributing images of local cultural heritage, and training for users to enable them to create and contribute content; and,
- the provision of learning objects for illiterate communities.

Action Items:

- Identify content already catalogued and digitized, as well as projects that intend to digitize and catalog relevant content (potential partners).
- Identify potential partners and their interests, such as museums, libraries, cultural and educational agencies, and community development organizations.
- Conduct a preliminary needs assessment of potential user communities that may be identified largely through partners.
- Identify the needs of likely user groups with regard to connectivity, access, infrastructure, and availability of technology.
- Organize a future workshop to:
  - develop an action agenda, based on the first workshop report, with specific proposals for next steps to be considered (secure commitments from participants to act as content or service providers and/or collection managers);
  - create a conceptual framework; and,
  - identify pilot and demonstration projects as “proof of concepts” to market the project to funders and attract potential partners, and that can be scaled up if successful.

Network Infrastructure

The importance of connecting the MEDL and its potential users to national research and education networks (NRENs) cannot be overemphasized. NRENs link universities and research institutes as well as many national and international libraries such as the British Library, the Library of Congress, and the Bibliotheca Alexandrina.

These connections make digitized collections from those libraries accessible via a high-speed NREN infrastructure. NRENs provide backbone architecture, regional network access and international connections to other high-speed networks, and services such as advice and guidance to member organizations and videoconferencing. Network infrastructure is critical to the success of the MEDL.

Most countries in Europe, North America and Australasia have well-established NRENs. NRENs are also emerging in North Africa, South Africa, South America, and along the historic “Silk Road” from Europe to Asia. There are currently existing or developing NREN efforts in Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, the Palestinian Authority, Qatar, Syria and Tunisia, though the range of development and capabilities varies greatly across these countries, and in other North African and Middle Eastern countries no known effort currently exists.

In addition to NREN connectivity within a country, connectivity between countries will also be important to the MEDL. The European Commission-supported EUMEDCONNECT project is underway, providing 10 million euros in an 80/20 funding scheme for a dedicated network infrastructure interconnecting NRENs in Algeria, Morocco, Cyprus, Egypt, Syria, Israel, Jordan, Tunisia, Lebanon, Palestinian Authority, Turkey, and Malta with the European research and education network GEANT, and beyond Europe to the global research and education network infrastructure.

Representatives of the key NRENs in Egypt—EUN, the Egyptian Universities Network and ENSTINET, the network of Egyptian research centers—as well as the Ministry of Communication and Information Technology (MCIT) participated actively in the conference and in all working group discussions. The Egyptian NREN community includes 124 research centers and institutes representing 32 ministries, 16 governmental universities, a number of private universities and research centers, and the Bibliotheca Alexandrina. With such an active NREN initiative, Egypt is well-positioned to take a leadership role in encouraging the development of NRENs in neighboring countries. Egypt, through EUN, is already a participant in the EUMEDCONNECT project and MCIT has provided funding for

EUN and ENSTINET to connect to the higher education and research network in the US. The Egyptian NREN organizations also have the benefit of working closely with the Bibliotheca Alexandrina.

The group urged MEDL supporters to actively explore opportunities to work with these regional projects—particularly through the participant countries in the region—to identify potential partners in development of the intra- and inter-regional network infrastructure and to gain support for development and use of the MEDL.

In countries where no current NREN exists or where one is just emerging, a handbook, or "cookbook," could assist by addressing such issues as:

- connection and usage policy;
- recommendations for a regulatory environment that supports development of NRENs;
- long-term funding and sustainability;
- requirements for human resources and strategies for building expertise;
- performance and capability targets typically expected of NRENs to support digital libraries; and,
- guidance on good network management and performance.

The TERENA compendium, a comprehensive annual survey and database of NREN organizational, funding and technical information could be a key tool in providing new NRENs with information on how other NRENs are organization and operated.

While NRENs could provide access to the MEDL for a very broad set of users, the vision for the MEDL also requires rich connectivity for the public through commercial Internet sites. Development of the commercial Internet is crucial to providing access to the MEDL for citizens and residents at home, business users, elementary and secondary school teachers and students, and others who do not have high-speed access through an education or research institution. As access for all citizens to the public Internet is improved, it will be important for the MEDL to have good connectivity with the commercial Internet, configured in a way that keeps traffic local.

Each institution participating in the MEDL should have good access to a local Internet exchange point that will provide users accessing the resources at that institution a more direct path over the Internet.

Action Items:

- Commission a white paper that analyzes existing and emerging NREN efforts in countries with institutions involved or likely to be involved in the MEDL. This would highlight the importance of network infrastructure as a critical building block for a successful project. This assessment should also identify current capabilities and areas where investments should be made.
- Commission an NREN "cookbook" to aid in the development of new NRENs and the further build-out of emerging NREN infrastructure.
- Align the MEDL with related initiatives such as Egypt's E-content and E-Access initiatives to promote use of the MEDL by the general public. These initiatives promote better network access for the public and the development of local content; the MEDL would provide important content and would in turn benefit from increased use.

In the longer term, substantial investment should be sought to interconnect the Middle East with the US through programs such as the National Science Foundation's International Research Network Connections in the Office of Cyber Infrastructure. Additional effort should be made to collaborate with the EUMEDCONNECT project to expand international connections between NRENs in the Middle East.

Interoperability and Standards

The MEDL will likely involve a federation of as-yet unidentified participating institutions in varying states of readiness. While it is anticipated that the MEDL will be capable of incorporating a variety of media formats, the initial content and format scope is also unidentified at this time. With these uncertainties, it is not fruitful to articulate a full suite of applicable standards at all levels at this stage. However, the value of standard-compliant procedures is recognized and should be a guiding principle. For a basic guide to standards and

recommended practices see *A Framework of Guidance for Building Good Digital Collections, maintained by the National Information Standards Organization* (http://www.niso.org/standards/std_resources.html).

Standards for interoperability at the repository level should receive the most specific attention and should initially focus on the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) as the best means currently available to aggregate large quantities of digital content and metadata from a number of dispersed sources (for more information see http://www.openarchives.org/). The OAI-PMH protocol and associated standards would provide the main basis for broad participation in MEDL. The OAI-PMH would help to support:

- deposit and ingest of materials;
- transmission of materials to mirror sites;
- digital preservation; and,
- return of value-added information to original data providers (language translation, OCR of page images, and other enrichment) as an incentive to continuing contributions.

Additional protocols and infrastructure would eventually be needed, especially to handle more complex digital objects. An initial partnership of a small number of lead organizations would provide a practical means to jump-start development and to promulgate standards-based activity. A lead US institution, in partnership with a lead Middle East institution such as the Bibliotheca Alexandrina, could establish initial agreements, standards and protocols, including appropriate application of standards for file formats, metadata schemes, vocabulary, language representation, and end-user interfaces as needed. Additional agreements, such as memoranda of understanding, would be needed to establish consensus and shared understanding among participating institutions. Agreements should provide for:

- mutual organizational and technical support;
- content development;
- mirror sites and dissemination plans;
- a structure for participation by other institutions; and,

- development of standards-based services, including digitization, OCR, cataloging, translation, deposit and preservation.

All standards and agreements should support and promote the essential digital library features articulated in the Vision, Mission and Scope statements.

Conclusion

The Middle East has been a crossroad of cultures for more than five thousand years. No other region on earth can claim such a diversity of cultures and complexity of interactions among them as this ancient land. Change, both creative and disruptive, has been a constant characteristic. The cultural legacy of this region provides a key to better understanding of the past and insight into present conditions that are shaping the future not only of the Middle East but of the world.

Due to circumstances of climate and human effort, there is, fortuitously, an unusually complete record of human presence and experience here. Each historical period has left a record of its time. Although traces of the past are often fragmented and dispersed, collectively they depict the complexities of harmony and strife, productivity and destruction, creativity and repression, abundance and privation - universal themes in the history of mankind. The record of these times exists primarily in the form of manuscripts and written records as well as historical sites and artifacts, but there is also a rich body of non-material culture in the intangible aspects of social activities: language, symbols, myths, music, beliefs, values, norms, and attitudes. In short, the history and cultural heritage of the Middle East offers perspectives into the events and beliefs that continue to shape individual lives, social constructs and collective national behaviors.

Recent advances in digital technologies and related applications now make it feasible to begin to collect and assemble the historical and cultural record of the Middle East and make it readily accessible to all through a large-scale, collaborative process. In this process,

individual parts of the record will be brought together into a coherent collection, and a structure will be created for continued growth with the participation of many contributing partners. The result will be a coherent and uniform documentary resource that will support a wide variety of research and educational activities. This record will also reveal significant knowledge gaps and will suggest new directions for scholarship.

The network infrastructure created for the MEDL will simultaneously support collaborative scientific research and development in multiple disciplinary domains throughout the Middle East and beyond. All scientific inquiry that benefits from collaboration—that is to say, virtually all scientific domains, from astronomy to zoology—will be advanced by the ability to transport data across high-speed research networks and the facilitation of communication among colleagues in dispersed locations.

In addition, new research in computing science will be required at each stage of development on topics such as repository interoperability, multilingual and cross-language retrieval, network services, and management of mixed-media, semi-structured digital collections. This will necessarily need to proceed in highly collaborative, international research arrangements and illuminate new network infrastructure features necessary to support research and development.

This workshop began the process of identifying the technologies, resources and organizational processes through which the vision of a self-sustaining, dynamic Digital Library of the Middle East can be realized. The discussions confirmed that it is in the interests of many to reach for this vision. The process can be initiated with modest investments and collective resolution. The result will be a public good of immense scholarly and social value. A suggested process and timetable are set out below.

> Stage 1: 2006 -… Establish social and organizational consortia of regional content providers; BA builds and maintains MEDL central repository with regional and international mirror sites.

Stage 2: 2007 - … Create high bandwidth links between consortia members and BA; begin building high bandwidth links EU, USA, and other National Research and Education Networks.

Stage 3: 2008 - … Establish major access points across region in libraries, universities, museums and research centers with high bandwidth links, enabling these institutions to contribute content and applications.

Stage 4: 2010 - … Fully integrate MEDL into the global knowledge environment; encourage international collaboration and participation; promote robust access to the world community.