



The Evolutionary Development of the Digital Library in the Central Bank of the Islamic Republic of Iran: From Simple Digital Imaging to the Use of Web-based Databases

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Abstract:

Purpose: *The main purpose of this paper is to show how different approaches were adopted to facilitate usage of the digital library to fulfill user information needs. During this process a range of technologies in different evolving stages were chosen and implemented.*

Findings: *To deal with the realities of the information age, the Central Bank of the Islamic Republic of Iran Library tested and adopted different procedures and technologies which allow users better and easier access to web-based databases and documents digitized from printed formats.*

Limitations\Implications: *In recent years users have increasingly considered the internet as the digital library as distinct from the physical library where they normally visit and perform research in person. The concept of using the Library through digital access to web based information databases and to digital electronic library documents from their desktops was at first quite perplexing and foreign.*

Originality: *Despite difficulties, the trial and error method to progress towards building a digital government library can be a very telling and interesting experience.*

Keywords: Users, Usability, Information Systems, Information technology

Introduction:

Fran Berman defined cyber infrastructure as "the coordinated aggregate of software, hardware and other technologies as well as human expertise required to support

current and future discoveries in science and engineering"¹. It is on this basis that we can affirm that choosing appropriate technologies in order to meet the users' needs is a priority in building up a digital library. Digital libraries must be willing and prepared to adapt themselves to the pace and scope of technical advances to progress towards digitization of data with optimum usability and user satisfaction. The object of this paper is to show the evolving role of the library of the Central Bank of the Islamic Republic of Iran (CBI) in applying certain technologies in order to best respond to user needs.

Present Information Services in the CBI Library

The development of the digital library of CBI has pursued a "two pronged strategy, one being to digitize current local content and the other to devise options for accessing external sources."² Most of the external sources were available in CD-ROM electronic formats which were made accessible on a server through the Markazi Bank intranet. The advent of internet presented the possibility for the transition of some CD-ROM databases to access via internet. One example is the very useful ECONLIT database which has essays and documents in economic and banking fields and to which the CBI library now subscribes for general internet access.

The library sites (lib.cbi.net and lib.cbi.ir) now contain a menu bar with certain very useful items for all levels of user needs. For example, the item called 'SERVICES' covers such sub items as selective dissemination of information (SDI) for researchers or expert users with a high degree of specialization needing very specific resources. These particular users may also click on the SDI sub item in the menu to access the library information services email and place a request for needed documents. The information system in the library is always updated to ensure such services as SDI are optimized for compatibility with semantic web technologies.

The menu bar includes other icons for searching the catalogues and for access to databases and an icon called digital library directs the users to such sub-items as the databases and foreign and Persian CDs existing in the library. It is also worth mentioning that the library of the CBI has been selected as a World Bank depositary library and there is the possibility for the users and researchers to click on the icon and search the World Bank electronic library to benefit from the information presented there.

A monthly electronic bulletin, Noavar, introduces all the newly purchased books (foreign and Persian) and provides a list of journals along with the cataloguing call number, allowing the user to acquire the required document via the intranet. Abstracts are presented for selected titles of Persian and English books and each issue also features some new websites relevant to the economic or banking sectors. The printed versions of Noavar are also available and are sent to different Departments in the bank to inform them of the latest publications in the library. The researchers and experts

¹ Chris Greer. 2008. "The Fifth Dimension". In *Legal Framework for e-Research: Realising the potential*, p.5. Sydney University Press, 2008.

² "Digital Library Development: Identifying sources of content for developing Countries...", The International Information & Library Review 36 (2004): 185-197. www.scribd.com.

from the different departments of the bank are given priority but University professors and students and others come from outside as well.

Other services are of course available, such as the library search system allowing users to search the subject indexes and to retrieve documents relevant to their information needs. The focus is on efforts for efficient information management, user satisfaction, a high degree of ease in usability and adoption of different approaches to meet the information requirements of the users efficiently. In the coming sections, the technical efforts to achieve a proficient special digital library are outlined.

It is also necessary to raise the matter of information literacy for both users and the librarians as it contributes much to the subject of usability. Continuing education for librarians is programmed by the Human Resources and Personnel Training Department of the CBI each season. Almost all the librarians at different levels have completed the Microsoft courses and those pertinent to initial familiarization with internet and databases and they are ready to handle the information needs of on-site users act as an information instructor. CBI personnel in different Departments have also found it necessary to complete specific courses to allow them to use information resources efficiently.

What is Usability?

Usability has some attributes. The International Standards Organization defines usability as, "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.... Brinck, Gergle and Wood (2002) share a similar perspective that usability is functionally correct, efficient to use, easy to learn and remember, error tolerant, and subjectively pleasing."³

Every digital library is evaluated on the basis of certain components. The axis of evaluation has been postulated as follows:

- 'Usability' defines the quality of interaction between the "user" and the "system". This helps the user to manipulate a system effectively, in an efficient and enjoyable way and to exploit all the available functionalities. A usable system is easy to learn, is flexible and adapts to user preferences and skills.
- 'Usefulness' concerns the "user" and "context" components. The usefulness of the content and its relevance to the use tasks and needs are the reasons behind the selection and usage of a digital library.
- 'Performance' is placed between the "content" and the "system". ... The performance of the system depends strongly on the formats, structures and representations of the context.

Considering the above points, the interaction of the user and the system is of great importance. A usable system needs to be attractive to the user but above all be learnable, safe and reliable."⁴

³ Jundy Jeng, "What is usability in the context of the Digital Library and how can it be measured?" Information Technology and Libraries, June 2005.

⁴ "Evaluation of Digital Libraries", International Journal of Digital Libraries, Springer-Verlag 2007, pp.6-7.

Different Information Technologies and their Suitability for Organizational Knowledge

In today's world, knowledge has increasingly been acknowledged as a significant resource for organizations, therefore it is no surprise that senior managers place a priority upon the optimum use of facilities and organizational capitals for augmenting levels of personnel capabilities and awareness. Developing the scientific level of personnel has a great role in fulfilling the aims, aspirations and macro-strategies of the organizations. Technological progress together with the increase in the number of information sources has made information technology use an empirical must. Building on information technology as an instrument, we can save time and decrease the costs of strategies. Library resources comprise part of the organization's investment allocated for purchase, maintenance and capital costs. Using information technology can optimize their usage. At the same time we should not forget that knowledge management in organizations has never been an easy task. It often happens that the "knowledge management approaches, in many cases with information technology have not produced the intended outcomes"⁵. Uncertainties surround the extent to which organizations and institutions are prepared to benefit from novel technological systems.⁶ Therefore, user friendliness of the systems and the extent to which users are able to access their needed information without much technical knowledge are clearly quite important.

It is in the light of daily growth and expansion of the role of information in recent years that libraries and information centers have of necessity been forced to pursue new information technologies for efficient operations and use. Information technology has been very effective in all branches of human knowledge especially that held in libraries and the result has been the making of digital or virtual libraries, where the users are not limited by the physical aspects and where regardless of location, there is the possibility for full text information access. These digital entities are inclusive of journals, electronic books and different databases. As a result, government libraries, along with the high speed of change in the information world are moving towards digitizing that is suitable and proper for their own societies.

Along with other governmental organizations in Iran, the banking sector has been very responsive to change and the high speed of information development and learning. The CBI library has voluminous and valuable information sources and has taken action to optimize their use. Now these information materials largely fall into two formats, paper and electronic. To convert the paper resources, the library made repeated requests to obtain a book scanner and other relevant facilities to form the backbone of the digital library.

Studies and investigations were made with the important libraries of the country so as to gain some idea or find a proper model for tackling the offline database. The

⁵ Yoo, Y. and Ginzberg M., 2003. *One Size Doesn't fit All: Knowledge Management Systems and Knowledge Sharing Practices in Global Learning Organizations*. Case Western Reserve University, USA, p.84.

⁶ Paul David and Michael Spence, "Designing Institutions Infrastructure for e-Science", *In Legal Framework for e-Research: Realizing the potential*, Sydney University Press, 2008, p. 59.

findings showed that the databases (in a CD or DVD format) are used in the following manner:

1. Traditional usage of the CD-ROM or CD tower
2. Imaging, that is making images of the CDs and loading them on the data server.

In both cases, there was little possibility for easy use of the database without technical and network complexities. Therefore, the library of the Central Bank of the Islamic Republic of Iran, having experience with both methods, of necessity, chose and actually devised a third approach so as to meet the users needs in an easier way while avoiding the requirement for sophisticated technical and network knowledge at the user end. Such a system enjoys the following characteristics:

1. Centralized supervision over all database with a view of their different structures
2. Centralized administration and supervision over all the users of the database
3. Including security issues and considerations relevant to the databases and the users
4. Little or no requirement for specialized, technical and network information at the user end
5. Possibility for prompt updating of the databases
6. Online use of off-line databases
7. Possibility for the use of the electronic information in a web-based format
8. Removing the physical (time and place) limitations of information services.
9. Flexibility for the production of different reports (e.g.Number of users, Databases most used, characteristics of user queries...)

Following a session held between the hardware engineering experts and CBI Library staff, it was decided that to develop the level of knowledge of personnel and their use of present resources in the library, the database project must be designed in such a way that no extra installation of software should be necessary for accessing the needed resources. Also the physical surroundings should be arranged in such a way to optimize and facilitate user access.

After some months of research, relevant studies and the testing of some probable systems, a system was identified as quite capable of meeting the CBI library's information needs and it was customized and implemented. In this system, the user is able to enter the domain with his user name and password and accesses the content by clicking his required database.

The Process of System Renovation and Relevant Studies

The CBI Library acquires a large number of compact disks from both foreign and domestic resources which initially were placed in a server file of high capacity and made accessible through the use of VCS 500 virtual drive software. Users had to install relevant software on their personal computers which caused several problems.

First of all, for the users to install the software on their computers which were linked to the network, they had to hand in a written request to the microcomputer section. There were increasing numbers of compact disks and ever-increasing requests for permissions to be issued by the Microcomputer section. It was not possible for this section to handle the matter easily and offer good service, as much time and personnel for the task were needed. Also this duplication and the installation of too many compact disks mitigated the speed and efficiency of user computers and it caused considerable slowdowns in the system. Given these problems, there had to be another alternative for the users to use the resources and databases without any need for installation.

Adopting a New Approach for Presenting Services

Considering the points mentioned, a new approach with greater efficiencies was considered justified. After many relevant studies and investigations of the technology and innovations, a software server for the compact disks was chosen and implemented. The designated system is a web-based format based on a Citrix Remote Server, where the images of compact disks are reflected in the existing file server. The necessary connection via TCP/IP and Citrix protocol becomes available by starting an application server. The user connects to the library website and through his web browser is able to effect automatic implementation of the Citrix Metaframe Client program on his or her own computer to choose and run the needed application software. This method obviates the need for much technical literacy and for applying complex adjustments to the network's context. Using any kind of compact disks, the user is also enabled to have comprehensive access to the needed graphic environment and multimedia software and can also print his targeted document. The development of the schematic design of the system is further elaborated in Attachment A.

Briefly, the said system has the following merits:

1. Current usage by numerous users with potential incremental capability.
2. Possible capacity augmentation and adjustment for new databases.
3. Capacity for controlling and accessing the databases.
4. Capacity to control of different categories of users for the full scope of user access.
5. Sufficient security between users and server connection.
6. Processing and installation complexities on server (not user) end.
7. Use of different network contexts for connections.
8. Capacity for using different databases simultaneously.

Hardware and Software Systems

As for the hardware, at least two servers were required: a file server for the storage of the compact disks imaging and a server for starting the Citrix server. The present file server had the capacity to store the compact disks but considering the hardware capacities, the Citrix server could give services for a limited number of users. Therefore, for the purpose of load balancing, it was essential to use several servers. Because all the processing and servicing of the users would be carried out on the server, the server's response to user queries had to be done at high speed and the hardware units of the server had to be tolerant of such work burdens. The

background tables and rationale are detailed in Attachment A and the minimum requirement calculated for:

1. A suitable motherboard for a server
2. Internal memory (RAM) on the basis of the number of the connected users
3. A margin memory (HDD) of high capacity and speed
4. A network card of high speed
5. Suitable band width.

As for the software, the necessary components for such as project are as follows:

1. A suitable operating system
2. Proper software for managing the databases
3. The software for presenting services according to the network

Since a high capacity operating system with the capability of installing and starting different software was needed, the two operating systems considered suitable for the servers were Windows and Linux. Due to the present conditions of this country, the operational system Linux was a more suitable one but certain technical difficulties arose. (Many compact disks were designed only for the Windows operating system. Changing the CDs and imaging to be compatible with Linux was a much harder and at times even impossible task.) It was therefore decided to use the updated Windows as a more flexible malleable operating system with a variety of updated software. This version of Windows enjoys a good capacity and capability for establishing network and security connections as well as a suitability for users control, resources managing and a working flexibility with different software.

For connecting the user to the server, different services such as FTP and TELNET are available. A service by the name of Terminal server was used because it had the capacity for establishing graphical connection with the server. This service has several advantages and some deficiencies.

Advantages: 1) quick and easy connection 2) possibility for setting users limitations 3) easy installation of the software in the server

Deficiencies: 1) observation of the server's working environment by the user 2) the users access to the drives present in the server 3) lack of a suitable graphical environment for easy user access.

Considering the above advantages and deficiencies, it was necessary to choose software that could work with this service and be capable of removing the said deficiencies in the first place and in the second possessing sophisticated user presentation facilities. For this purpose, considering the studies carried out and the tests of different software, Citrix was chosen as the best option for the project.

Other project requirements involved the administration of information resources.

In the beginning, carrying out such a project was done for the present compact disks which had a lot of usage hindrances, among which was users distress of not being able to study the information without having officially obtained permission. Therefore, after research, a CD simulating software was chosen with the following strengths:

1. The possibility of using at least 2600 CDs
2. The possibility of simultaneous implementation of all CDs in a REAL format
3. The possibility of updating the CDs in a much facilitated way
4. The possibility of presenting definitions for different categories for accessing the CDs through indexes
5. The possibility of setting security levels for the access to the CDs

Generally Citrix has been designed to present services at the Server end with all the processing done on the server itself. The contextual purpose of this project is the user and he/she being enabled to easily click to use the variety of software in the compact disks.. This was not possible with one software package and interoperability was needed to allow several users each performing a particular task within a secure environment. User authentication allows display of applications permitted for specific users as validated at the beginning of each session by Citrix which has the following capacities and capabilities:

1. The possibility for several users to connect simultaneously
2. The simultaneous implementation of several application software packages on the server
3. The possibility for optimum administration of the software as follows:
 - i) The administrator is enabled to limit the range of software application for some users
 - ii) The possibility of making special adjustments on the page received by the user (page, quality or sound adjustments)
 - iii) The possibility of presenting definitions for different illustration models on the user's side
 - iv) The possibility of using other existing software on different servers
 - v) The possibility of setting limitations for using server resources
4. Impromptu services for printing by the printers present on the user's or server's side
5. The possibility for using management software of *Password Managers*
6. The possibility of setting Web Conferencing
7. Administration of the present resources in the system (Load Balancing)
8. The possibility for the installation of a variety of software packages directly in the users system
9. Extracting constant various reports of resources and users
10. Presenting definitions for different operating profiles of different contexts

Finally, it is necessary to mention that the above system for determining the users identification is connected to the Active Directory domain (Cbi.gov.ir or Cbiran) and the users with the user name and password have been enabled to connect to the system.

The trial of the new system and user response

The above system was launched in a trial format and in order to familiarize the CBI colleagues, a short course of few hours in five stages was arranged and implemented. Most CBI personnel welcomed the idea and gave very encouraging views of reinforcing the digital library as well as the updating of the existing databases. They also emphasized the necessity of more such courses with longer hours. The courses were convened with the participation of about 120 personnel with different educational backgrounds: 20 percent had Iranian diplomas, about 35 percent had BA or associate of arts certificates and 45 percent were graduates with MS or PHD degrees. Full-fledged launch of the system requires some preliminary steps such as the supply of additional servers. At present these are being acquired.

Conclusion

The most important point central to the concept of digital libraries is about information access. Therefore, systems are assessed on the basis of optimization of information retrieval efficiencies. "Users are the first component of any interaction process and their characteristics are complex and constantly evolving."⁷ This process of evolution is also applicable in the domain of system or software choice. It is important to note that the CBI library has no intention of advocating one system or one software over another. What this library has aimed at is choosing and implementing the best technology capable of responding to users' information needs in an optimum manner. Because of this, it has undergone and may again undergo such an evolutionary process.

⁷ "Evaluation of Digital Libraries", International Journal of Digital Libraries, Springer-Verlag 2007, p. 5.

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Method of Calculation of Hardware Requirements

On the basis of existing characteristics of the initial server (mentioned below), a maximum of 15 users could connect to the server simultaneously:

1. Mainboard GiGa 8I945
2. RAM 2G
3. Hard 80 SATA
4. LAN CARD 100MB

In order to acquire the particular specifications of a suitable hardware, it was necessary to calculate the percentage of individual use of the resources . On the basis of the resulting report, then it would be possible to purchase the required hardware. In the following report obtained from the Citrix program, the percentage of resource usage by a single user is shown.

Type	Version	Start Time	% Active	User
0	1.0.0.1	2007/04/28 03:17:28 P.Û	0 %	CBIRAN\mohammadi
0	9.0.32649.0	2007/04/28 03:17:27 P.Û	0 %	CBIRAN\mohammadi
0	4.0.2198.1	2007/04/28 03:17:27 P.Û	0 %	CBIRAN\mohammadi

Name	Path	Product Date
BOOKWORK.EXE	C:\Program Files\WTO\	2001/12/03 06:27:48 È.Û
ssonsvr.exe	C:\Program Files\Citrix\ICA Client\	2005/04/04 06:38:10 P.Û
wfshell.exe	C:\Program Files\Citrix\System32\	2005/04/12 03:14:46 P.Û

The Implemented processes to connect the user to the server (1-3)

	Average	Minimum	Maximum	Std. Dev.	Variance
Overall CPU utilization:	0.4 %	0 %	0.9 %	0.5 %	0.3
Kernel mode:	0.3 %	0 %	0.7 %	0.4 %	0.2
User mode:	0.1 %	0 %	0.2 %	0.1 %	0
CPU utilization while active:	0 %	0 %	0 %	0 %	0
Kernel mode:	0 %	0 %	0 %	0 %	0
User mode:	0 %	0 %	0 %	0 %	0

The Percentage of CPU Use (2-3)

	Average	Minimum	Maximum	Std. Dev.	Variance
Working set while active:	MB	MB	MB	MB	
Nominal working set:	6.9 MB	2.5 MB	12.8 MB	5.3 MB	27.7
Peak working set:	7.5 MB	2.7 MB	13.7 MB	5.6 MB	31.8
Peak paged pool:	0 MB	0 MB	0.1 MB	0 MB	0
Peak non-paged pool:	0 MB	0 MB	0 MB	0 MB	0
Peak page file usage:	3.3 MB	0.8 MB	6.6 MB	3 MB	8.8
Page faults/sec:	96.7	17	234.6	119.9	14375.2

The Percentage of Memory Use(3-4)

	Average	Minimum	Maximum	Std. Dev.
Time loaded:	00:00:43	00:00:43	00:00:44	00:00:00
Time active:	00:00:00	00:00:00	00:00:00	00:00:00
Active/loaded ratio:	0 %	0 %	0 %	0 %

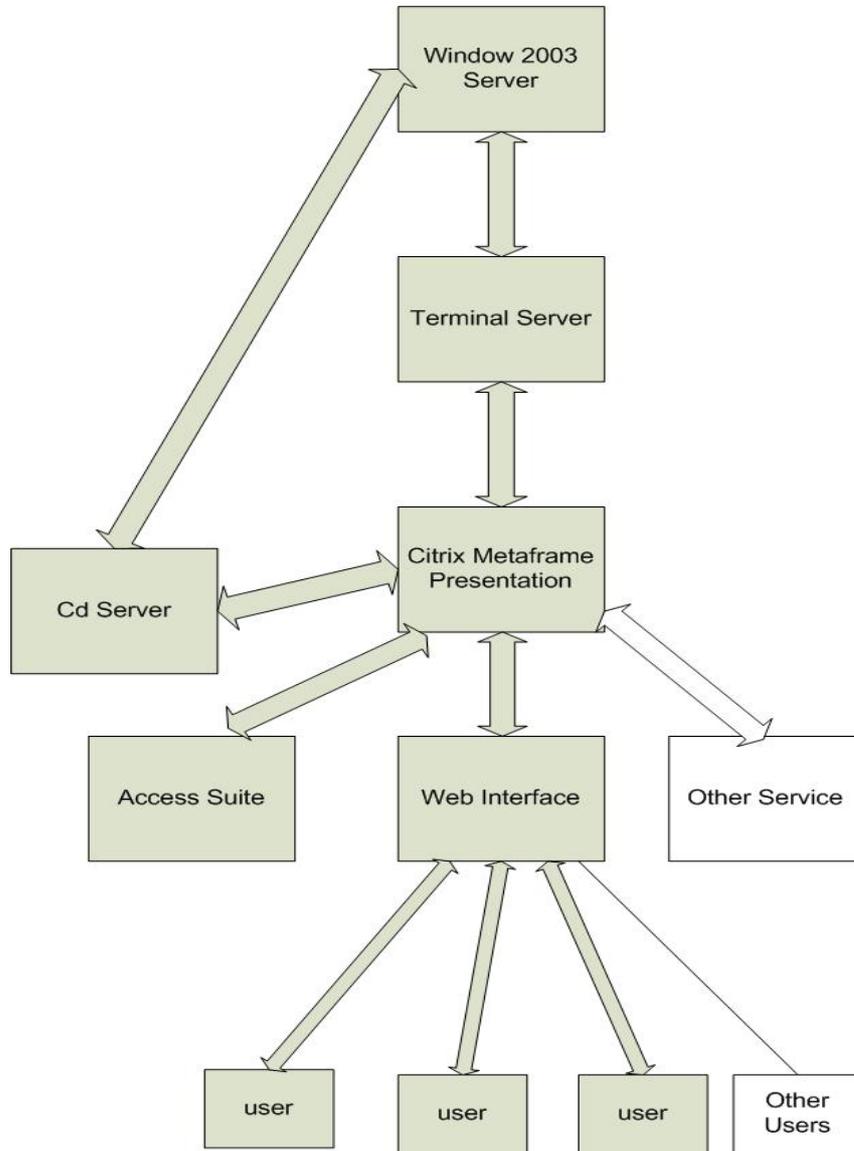
Total time loaded:	00:02:10	First recorded use:	2007/04/28 03:17:27 P.Û
Total time active:	00:00:00	Last recorded use:	2007/04/28 03:18:11 P.Û

Therefore, the least parts necessary and suitable for responding to a limited number of users are as follows:

- A suitable motherboard for a server
- Internal memory (RAM) on the basis of the number of the connected users
- A margin memory (HDD) of high capacity and speed
- A Network card of high speed
- Suitable Band Width.

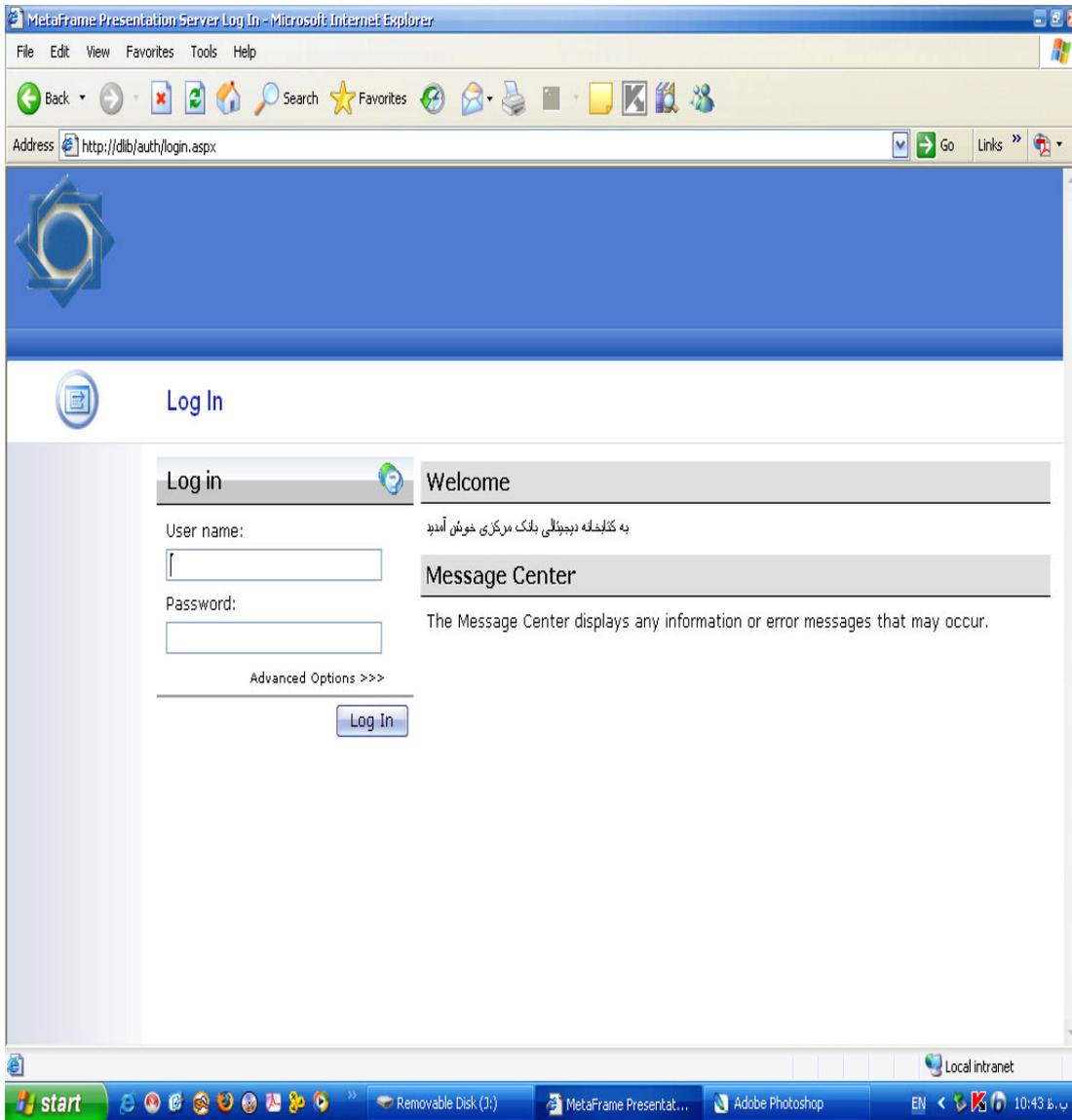
Annexation

The Schematic Illustration of the present connections in the Server.



The System Designed is available at <http://Dlib>

The Page for entering the User Name and Pass word



The page for Selecting the intended type of compact Disks, Persian or Foreign

Latin's CDs - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites Refresh Print Stop Back Forward Links

Address <http://dlib/site/default.aspx> Go Links

LIBRARY
Central Bank Of
The Islamic Republic Of IRAN

کتابخانه
بانک مرکزی جمهوری اسلامی ایران

لیست لوحهای فشرده

- تمام لوحهای زیر از طریق شبکه داخلی بانک قابل استفاده می باشد.

- [لیست لوحهای فشرده فارسی](#)
- [لیست لوحهای فشرده لاتین](#)

Done Local intranet

start Removable Disk (J:) Latin's CDs - Microsof... Adobe Photoshop EN 10:46

Persian's CDs - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites Refresh Print Stop

Address http://dlib/site/Persian's%20CDs.htm Go Links

لیست لوحهای فشرده فارسی

تمام لوحهای زیر از طریق شبکه داخلی بانک قابل استفاده می باشد.

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 - Am1y-2o1y-0x0b-1q6f-4f0i-7x8w-8a6e-8h1l
 - سده هفتم میلادی تا عصر حاضر
 - Au3i-6f5f-3s3a-6s0n-3t6v-6i3b-7f7i-6s3s
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- ...

Done Local intranet

start Removable Disk (J:) Persian's CDs - Micros... Adobe Photoshop EN 10:47

Latin's CDs - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites Refresh Print W Links

Address <http://dlib/site/Latin's%20CDs.htm> Go



لیست لوحهای فشرده لاتین

تمام لوحهای زیر از طریق شبکه داخلی بانک قابل استفاده می باشد.

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Dictionaries, Encyclopedias & Directories

- American Heritage Dictionary
- Longman: Advanced American Dictionary
- IMF Glossary
- Webster's Interactive Encyclopedia 1996
- [Microsoft Encarta World Atlas 1998](#)
- [Microsoft Encarta Dictionary 2004](#)
- [Microsoft Encarta Reference Library 2004](#)
- Encyclopaedia Britannica 2002
 - o Vol 1
 - o Vol 2

Done Local intranet

start Removable Disk (J:) Latin's CDs - Microsof... Adobe Photoshop EN 10:47