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2.1 Introduction

Academic libraries have various sections like acquisition, processing, circulation, reference, periodicals / journals, computer and internet, reprography, etc. All these sections are important and out of which reference has been one of the popular and main section and function of library. In past, reference function was largely based on print materials. But as technology and ICT have impacts on every filed, reference function is also changed. Reference section now uses print as well as electronic, digital resources to provide reference service. Major revolutionary change came in libraries especially in reference services are due to impact of computer, ICT and internet. The information can be obtained in any format like print or digital and also text to multimedia.

Information and reference services are continuously developing as is the library itself. The earliest concept of modern reference work is usually traced to Samuel Swett Green’s 1876 paper entitled “personal relation between libraries and readers” in which he advocates the importance of personal service and guidance to the library users (Han, Lifeng and Goulding, Anne, 2003: p. 251). Till now the concepts and practices of reference work have been increased and evolved significantly. Based on Green’s ideas, Bopp and Bunge categorize the practices of reference services into three groups (Han, Lifeng and Goulding, Anne, 2003: p.251)

1) Information services that take the forms of ready reference questions, bibliographic verification, interlibrary loan and document delivery, information and referral services and information brokering.

2) Guidance including readers’ advisory services, bibliotherapy, term-paper counseling, selective dissemination of information.

3) One to one or group instruction.

As the library is changing to modern library, library professionals are adjusting services according to changing environment and user needs. Various services have changed while some new have been added. If we search related literature, we find that a digital reference service has become more important over recent years.
2.2 Evolution of digital libraries

Traditional libraries changed to automation, then electronic resources and then digital resources. But this process does not complete in short time period. It has long time history and slowly changing process. Today also it is not stopped at any point, although it is going on gradually. Thus digital libraries become the term to notify the digital counterpart of the traditional libraries. The evolution of digital libraries is not linear process, but it is contribution of many disciplines. In this era, digital libraries have become complex networked systems, which support communication as well as collaboration among different world wide spread communities containing “digital objects” and digital counterpart of printed documents, images, videos, programs, multimedia objects, etc.

Digital libraries are significantly different from traditional libraries because they permit patrons to get an on-line access to and work with electronic edition of full text documents and related images. These digital libraries have heterogeneous systems which does not follow single path. According to Smith (2001) digital library is an organized and focused collection of digital objects, including text, images, audio, video with the methods of access and retrieval and for the selection, creation, organization, maintenance and sharing of collection.

Digital libraries offer numerous benefits in terms of accessibility and search. In most library applications, digitization normally results in documents that are accessible from the website of a library on the internet. Digital library is later stage of electronic library. In digital library high speed optical fiber are used for LAN and the access is over the WAN and provide wide range of internet based services. Easily available digital information is worship of internet. All this development gives birth to new range of reference services. In this trend digital reference is the latest one. Reference services at digital libraries are most important aspects. They play vital role in fulfilling library’s aims and objectives. They act as key to library’s four primary service roles; to serve as a centre for information, formal education, research and independent learning. (Magamma, M., 2013: p. 2)
### Technological Bases of Library Operations and Materials:

<table>
<thead>
<tr>
<th>Type</th>
<th>Technical Operations</th>
<th>Library Materials</th>
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<tbody>
<tr>
<td>Traditional Library</td>
<td>Paper</td>
<td>Paper</td>
</tr>
<tr>
<td>Automated Library</td>
<td>Computer</td>
<td>Paper</td>
</tr>
<tr>
<td>Electronic Library</td>
<td>Computer</td>
<td>Electronic Media</td>
</tr>
<tr>
<td>Digital Library</td>
<td>Computer</td>
<td>Digitized Material</td>
</tr>
</tbody>
</table>

(Source: based on Pomerantz, J., 2003: p.3, also added new type)

Buckland (1992) makes difference between types of libraries: the paper, the automated and electronic, now we can add digital library in this. The differentiation of these libraries is based on the materials collected by libraries and way by which technical functions are done. The paper library consists of paper collection and technical operation through paper; the automated library contains paper but technical operation electronically; electronic library is related to both collection and technical operation electronic, while digital library contains digitized material and technical operation electronic.

Buckland’s (1992) differentiation between types of libraries is according to the technology utilized and the purpose of it. But Greenstein and Thorin (2002) differentiate types of digital libraries according to the age and sophistication of the digital library project. They further state that digital libraries can be divided as young, mature and adult digital library. The digital library which is just launched is young and it is in planning and experimentation phase which deploy some innovative technology but caters very traditional library services. The mature digital library is that which has acquired core competencies and technical understanding and focuses on integrating digital materials into library’s collections and on developing the policies, technical capabilities and professional skills required to sustain it. Greenstein and Thorin say that all digital libraries now in existence are of one of these two types. They claim that the adult digital library has yet to arrive. But this assumption has been made by Greenstein and Thorin in 2002, now situation has changed. Many libraries are turned to digital library. This is due to advancement in technology, availability of World Wide Web, etc. (Pomerantz, J., 2003: p.3-6)
2.3 Overview Concept of Digital Reference Services

The primary aim of library is to provide various services to users to meet their information needs. Various techniques used in library like classification, cataloguing, open access, OPAC, shelf-list, guides, etc. are indirect form of assistance to users to find required document in library. Every library works according five laws of library science and tries to save time of users by providing specific information as quickly as possible. This gives rise to personal efforts to bring together user and his document. This method of providing personal attention to users refers to ‘Reference Service’.

According to the American Library Association’s Glossary of Literary Terms, ‘Reference Service is that phase of library work which is directly concerned with assistance to readers in securing information and in using resources of the library in study and research.’

Dr. S.R. Ranganathan defines Reference Service as, ‘personal service to each reader in helping him to find the documents answering his interest at the moment pinpointedly, exhaustively and expeditiously.’ According to Dr. S.R. Ranganathan, in the present electronic and communication environment reference service is not only confined to the library service but also to remote users. Sometimes it is termed as e-reference service, digital reference service and virtual reference service.

New information technologies are drastically influencing every field of our life. We are living in technology era. New concepts are introduced and changing according to advanced technology. The library and information science profession is also facing these challenges. New information technologies have an impact on every aspect of library services. Information technology plays important role in every section of library. Now internet has become more popular source among new generation users and libraries. Internet enables them to find, search, receive and download required information from sources scattered all over the world. Easily available digital information has become most important part of user and librarians. It has also become cost effective and cost efficient alternative to traditional methods. Advances in computer technology result in digital revolution with digital information. All these changes give birth to new range of reference services in which digital reference is latest trend.
2.4 Evolution of Virtual Reference Services

The provision of reference services by libraries dates back to the late 19th century. In 1876, a paper by Samuel Swett Green of the Worcester Public Library identifies four components of reference services: 1) Instruct the reader in how to use the library and its resources 2) Answer readers questions 3) Aide the reader in the selection of good works and 4) Promote the library within the community (Luini, Christina, 2012: p.2).

In 2008, the Reference and User Services Association (RUSA), a division of the American Library Association (ALA) defines reference work as, “Reference transactions and other activities that involve the creation, management and assessment of information or research resources, tools and services”.

RUSA also defines reference transactions as, “Information consultation in which library staff recommends, interpret, evaluate and / or use information resources to help others to meet particular information needs.”

If we compare the Green’s 1876 definition with RUSA’s 2008 definition, we can see that reference service has same component of helping users to get needed information. Since a long time ago, the physical reference desk is serving as the central point between reference service and users. Reference librarians meet and conduct reference interview with users, to understand user’s exact information needs and correlate that need with the reference sources available in library.

Fast moving technology has changed the way of thinking of librarians as well as users, regarding reference services. Information explosion and information available on World Wide Web has made information finding easier for users. Many users try to satisfy their information needs through internet. They find it more convenient. Due to this, today’s reference librarians are providing guidance to users in choosing available resources weather digital or print instead of serving as an intermediary between users and information. Accordingly changes are taking place in user needs, behavior, expectations which has a great impact on libraries and librarians. They are also pulling their services toward virtual or digital. Ask-a-services, Web OPAC, Web Forms, E-mail, Social Media, Instant Messaging Services (IM), Twitter, Video Conferencing, Chat reference etc. are becoming very much popular. Traditional reference desk is changing towards virtual one. Reference services are being provided virtually or digitally.
RUSA defines virtual reference as “It is reference service initiated electronically where patrons employ computers or other technology to communicate with public services staff without being physically present. Communication channels used frequently in virtual reference includes chat, video-conferencing, and voice over IP, co-browsing, e-mail, and instant messaging”.

RUSA’s definition of virtual reference is broad and includes both asynchronous and synchronous forms of reference.

2.5 Definitions of Digital Reference Service

The foundations of modern reference work are laid by Samuel Swett Green in 1876. From that, the practices engaged in reference service have been changed, but central aim of reference service is as it is i.e. to answer and provide exact resources to users for their query. The terms “Digital Reference”, “Internet Information Services”, “E-reference”, “Virtual Reference”, “Real Time Reference”, “Live Reference” and “Chat Reference” are used to describe reference services that utilize computer technology in some way. All share the central objective, use of software and internet to facilitate human intermediation at distance.

Many experts have defined digital reference service as follows:

According to James, “Digital reference service is provision of direct, professional assistance to people who are seeking information, at the time and point of need.”

Smith defines, “Emphasis on use of print as well as digital reference services – provided over the internet and can involve the use of both print and digital resources.”

Hirko defines, “A library service that provides answers to computer questions via electronic means such as e-mails, web forms, interactive chat and application sharing” (Digital Reference Services, accessed through Google)

According to Lankes, “Digital Reference Service refers to the position of human intermediated service over digital network.”

Digital Reference Service may be defined as, “The provision of reference services involving collaboration between library user and librarian, in a computer based medium. These services can utilize various media, including e-mail, web forms,
chat, video, web customer call centre software, voice over internet protocol (VoIP), etc.”

Hence we can conclude that digital reference service requires computer communication with digital network, should have connection between user and the librarian. (Chandwani, Anita, 2006: p. 2)

According to Whitlatch (2003) “Digital Reference Services are internet based services that employ human experts or intermediaries to provide information to users”.

Also known as virtual reference service, digital reference service (DRS) is “reference service initiated electronically, often in real-time, where patrons employ computers or other internet technology to communicate with reference staff, without being physically present.” (RUSA, 2004) (Ramos, Marian S., 2011: p. 2)

Linda Berube (2003) defines that digital reference refers to a network of expertise, intermediation and resources placed at the disposal of someone seeking answers in an online environment.

John M. Wasik (2003) defines, “Digital Reference and ask-a-services are internet based question and answer services that connect users with experts in a variety of subject areas. In addition, experts may also provide users with referrals to other online and print source of information”. (Maharana, Bulu and Panda, K.C., p. 2)

2.6 Elements of Reference Service

A reference service incorporates the following three basic elements:

1) Information or Knowledge base.
2) User or client now likely to be a member of the new cyber-community in which the library operates.
3) Information professional or librarians, who play the role of intermediary assisting and advising the user in their information seeking (Sharma, Sumati; Kumar, Ashok and Singh, Mohinder, 2004: p. 11)

First element is information or knowledge base, which is important part of reference service and includes Encyclopedias, Yearbooks, Dictionaries, Directories, Bibliographies, Indexes, Atlas, Almanacs, etc. This was traditional knowledge base which is completely changed with impact of technological advancements.
Second important element of reference service is the user. According to five laws of library science, user and his information needs are prime important in reference services. User is centre point in reference service. With the advanced technology, computer, and internet, etc. user’s information seeking behavior has also changed. User don’t want physical visit to library, instead of that he wants required information right on his screen at his seat with remote location. This results in no face to face reference services.

Third factor is information professional or reference librarian. First two factors have an impact on this third factor. They are also changed according to changing environment. Role of traditional reference librarian and recent reference librarian has not changed. Both are giving same services only the ways have been changed.

Reference services have been continuously changing from traditional to automated to hybrid to digital. Technological invention played important key role in reference services in post half of 20th century. Face to face communication changed to postal and then came telephone communication. Also libraries explored use of microfilm, microfiche, tapes, sound recordings, etc. Then comes full text databases and electronic card catalogues. Gradually the electronic card catalogue shifted to the online public access catalogues (OPAC) which provided local as well as remote access. It was followed by invention of CD-ROM then in late 1990’s libraries moved from CD-ROM to internet databases. Internet database made great revolution in reference services. (Dollah, Wan Ab. Kadir and Singh, Diljit, 2009: p. 413)

According to Kasowitz (2001), many libraries and organizations have responded to increased need for formal methods of remote communication, between users and librarians by providing reference service via internet or digital reference service to users. Lankes (2000) gives five reasons for moving to electronic reference services:

1) Increasing access to resources beyond the library.
2) Lack of geographical constrains for users.
3) The need to differentiate services to different populations of users in the face of shrinking budgets.
4) Increase in complexity of information resources and the need for specialized knowledge.
5) New options for answering reference questions.

Academic libraries were the first to provide digital reference services, in the early 1980s. One of the first services to go online was the Electronic Access to Reference
Services (EARS) launched by the University of Maryland Health Services Library in Baltimore in 1984. (Dollah, Wan Ab. Kadir and Singh, Diljit, 2009: p. 413)

2.7 Elements of Digital Reference Service

The term “Digital Reference”, “Virtual Reference”, “e-reference”, “Internet Information Services”, “Live Reference” and “Real Time Reference” are used interchangeably to describe reference service that utilize computer technology in some way (Kaza, 2005). A digital reference transaction will usually include following elements:

1) The user
2) The interface
3) Electronic resources
4) The information professionals.

If we see traditional elements of reference service, it has only three elements i.e. user, resources and information professional. In digital reference the interface element has been added. In traditional reference service this element was absent because of physical visit of user to reference desk. As in digital reference physical visit is not necessary due to which the interface element gets added.

The most important part of reference service is user. User needs and expectations are of prime importance and always given first priority. Users are the centre point of reference services. As we know due to advanced technology, remote access is increased and physical visit of user to library is decreased. Due to this digital reference is convenient for such technosavvy users.

The second element in digital reference service is the interface. It is new element added in digital reference. It includes form of digital reference service e.g. web form, e-mail, Chat, video, etc.

The third element is electronic resources. In traditional reference service it was information or knowledge base. Now it includes electronic or CD-based resources, web resources, local digitized materials, etc. as well as print resources.

The fourth element is the information professional(s). It remained the same in traditional as well as in digital reference service. This is also important element of reference service without which reference service is incomplete. Information professionals are also changing according to changing environment and technology. If
we see present and past of reference service, we found that present work is not different from past; only the way of doing work is changed. Present work in reference service includes technology advancement and method of delivering information has been changed.

All the four elements of digital reference service are interlinked. They all are important equally. (Maharana, Bulu and Panda, K.C., p. 2)

### 2.8 Classification of Digital Reference Service

The digital reference service may be distinguished into three categories:

- **2.8.1 Asynchronous transaction**
- **2.8.2 Synchronous transaction**
- **2.8.3 Collaborative networks**

Following figure gives a clear idea.

![Topology of virtual reference service](Image)

*Topology of virtual reference service*

(Original Source: Sharma, Kumar and Singh, 2005: p. 983)

(Sourced from Maharana and Panda: p. 3)

#### 2.8.1 Asynchronous Transaction

This transaction involves a time gap between the receiving question and providing answers. In other words it refers to the formats of digital reference service that do not occur in real-time. These transaction include e-mail based, web form, ask-a-service, virtual reference desk (VRD) service, question point, online path finder service, etc. E-mail based service uses one or more e-mail addresses to provide the
user a contact for reference help. Web forms are the forms which are placed on the library website that support the users for details about their information needs.

2.8.1.1 E-mail based reference service

This is a common, simple, cheaper and cost beneficiary service which involves to and fro exchange of information. User sends the query in form of a message and after time delay receives back an answer. Patrons can ask a query even when the library is closed. Library gives reply by e-mail, fax or phone as per user’s convenience. (Chandwani, Anita, 2006: p. 2-3) (Maharana, Bulu and Panda, K.C., p. 3) (Bullard, Kristan A., 2003: p. 6)

Advantages of E-mail based reference
- Helpful to shy users which have psychological barrier to communicate face to face.
- Very useful to those users who have poor oral communication skills.
- Removes physical boundaries.
- No need of any extra software.
- No need of extra training.
- Useful for reference librarians also because they get time to think, plan out strategy and then search and answer the query.
- No boundaries of time for users.
- Cost-effective also.

Disadvantages of E-mail based reference
- Difficult to judge the urgency of needed information.
- May have problem of band-width or technical problem.
- Speed of receiving and answering query may depend on communication link over internet.
- Face to face interaction not possible.
- Reference librarian will not be able to clarify the doubt regarding exact need of user.

2.8.1.2 Ask-A-Services

There are some ask-a-services provided to users as follows:
- Inforocket: available at http://www.inforocket.com

It is charge based reference service and charge per question varies from $5 to $75.
- Askme: available at http://www.askme.com
  It is a free service where users can mail a question and enter e-mail address.
- All Experts: available at http://www.allexperts.com
  Free web-based reference service where answers are provided by subject experts like doctors, engineers and scientists, etc.
- Question point: available at http://www.questionpoint.org
  It's a co-operative virtual reference service launched by the Library of Congress and OCLC, Dublin. This service combines an infrastructure of software and communication tools with a global network of cooperating libraries worldwide.
- Britannica: available at http://www.britannica.com
  It's a free information service on the web which allows users to search and retrieve information from Encyclopedia Britannica and a large number of other web resources. Along with this, there are a number of services available where users can conduct a search for reference query.

Infoplease (http://www.infoplease.com)
Internet Public Library (http://www.ipl.org)
Reference desk (http://www.referencedesk.org)

2.8.1.3 Reference via Web

E-mail based reference service has merits as well as demerits. To overcome these demerits, web forms for transactions were developed as Ask-A-Librarian website. This provides a structured web form where the user must respond to queries, along with their questions. The web form can be accessed from the library home page or reference web page. Then users have to fill and send this form to the library through e-mail. Answers are provided by e-mail, phone or post. This web form is useful for reference librarians as well as users as it gives a detailed, structured format of questions. The form is constructed carefully to avoid confusion, stress, and frustration of users. (Chandwani, Anita, 2006: p. 3-4)

2.8.1.4 Virtual Reference Desk (VRD): http://www.vrd.org

Virtual reference desk permits electronic queuing of users, co-browsing, web page sending, pre-defined or “canned” text message, screen capturing, slide shows, demonstration, chart transferring or conferencing and complete transcript record of
the full session. The virtual reference desk works to advance “Ask A Services” on the internet and digital reference in general.

2.8.1.5 Online Path Finders

Path finders are guides created to help users for finding information on a specific topic. Due to availability of more information on the internet, online path finders are popular. Some well known path finders are-

a) Library of Congress Website: [www.loc.gov](http://www.loc.gov)
b) Library U: [http://www.libraryu.org](http://www.libraryu.org)
   Its world’s leading provider of e-books. Its vision and aim is to enhance the role of librarians as stewards of knowledge, support their important role in serving millions of people everyday who need information.
d) Internet Public Library path finders: [http://www.ipl.org/div/pt/](http://www.ipl.org/div/pt/)
   This is collection of projects from author biography to western philosophy.
e) Path Findersonline.org: [http://www.pathfindersonline.org](http://www.pathfindersonline.org)
   This is official website for path finders of the North America Division.

Advantage of online Path Finders

- Online pathfinders are available to users whenever and wherever they can access the internet. Online pathfinders don’t have to wait for hours and weeks for librarians reply. This convenient, self help nature of online path finders is important advantage.
- The possibility of including web links to electronic resources along with text, a multimedia, digitized image, sound files is another advantage.
- A third advantage is guided searching. It helps in avoiding irrelevant web sites. Guided search helps in eliminating problems of false start and end.

Limitations of online Path Finders

- Their static nature is one of the weaknesses. Most online pathfinders are static annotated lists of resources or web links and don’t have any interactivity with users.
- Many online pathfinders are more complex in structure than printed ones and it can cause confusion to user.
- Another weakness is lack of individualization. Specific information needs of a particular individual are not part of an online pathfinder. (Sharma, Sumati; Kumar, Ashok and Singh, Mohinder, 2004: p. 15-16)

2.8.2 Synchronous transaction

Synchronous digital reference refers to formats of digital reference that occur in real-time. Synchronous transaction takes place in ‘real time’ with an immediate response to query such as in chat based service, video conferencing or web cam services, Digital Reference Robots, Real Time Reference Services (Live Ref, 24/7 Ref), etc. The interaction between the user and reference librarian is live.

2.8.2.1 Chat based reference

It is also referred as instant messaging. It is a real time communication between two or more computer users over the internet. It is very famous way of communication over the internet. It is only text based. Main benefit of chat reference is that it permits the patron to stay online while getting reference assistance. Its disadvantage is that it is suitable only for one – to one communication, not suitable for multitask. This makes chat slower and required additional reference staff at busy hours.

2.8.2.2 Video Conferencing or web cam services

It is introduced as a solution to the communication problem occurring in text based services. This service is in digital form and includes visual part where reference librarian and patron can use text and speech transactions like face to face communication.

2.8.2.3 Digital Reference Robots

When reference librarian is not available, artificial intelligence is used to respond the query, it is known as digital robots. Most popular example of this service is Ask Jeeves. This service involves use of software for searching the database of question and answers.
2.8.2.4 Real Time Reference Service

Also known as real time live web reference and it is the latest trend in digital reference. Some of the well known examples are:

a) 24/7 Reference [http://www.247ref.org]

Set of software tools that enable librarians to provide real time reference assistance to their users over the internet. It can be used to:

- Communicate with users using real time chat.
- Guide the user’s browser to the best resources on the internet with collaborative browsing.
- Send images, files, power point presentations to user’s computer.
- Use customized, pre-scripted chat messages and web pages to improve efficiency.
- Organize scripts by subject, language category or according to user needs.
- Customize the software to integrate with participant library’s website.

b) Live Reference

It is registry of real time reference services, which is created by Gerry Mckiernan. It is categorized listing of libraries that offer real time library reference or information services using chat software, live interactive communications utilities, call centre management software, web contact centre software, bulletin board services, interactive customer assistance system or related internet technologies.

c) Know-it-now services [http://www.cpl.org]

CLEVNET Library consortium’s know-it-Now service is an association of 31 public libraries in the Los Angeles area. These services are available to users on the web 24/7, except on certain holidays. Basically the service is extension of text based chat reference. However, it has more features and capabilities than pure chat reference. (Sharma, Sumati; Kumar, Ashok and Singh, Mohinder, 2004: p. 16-17)

2.8.3 Collaborative Networks

Increasing user needs and information explosion are the root causes of collaboration. Library and Information science field is also using the collaboration concept from long time. Resource sharing is basic example of collaboration. Collaboration helps each member library for getting desired information. Various
libraries and organizations have understood the advantages of providing digital reference service through collaborative services. The Collaborative Digital Reference Service (CDRS), provided by the Library of Congress, is an international network of libraries. This is free reference service project of Library of Congress and more than 100 partner libraries from various countries. The aim of this collaborative network is to provide professional reference service to the users, researchers at anytime and anywhere through an international digital network of library and information centers. This is worldwide network of libraries in which OCLC builds and also maintains a database which include three main elements- member profiles, request manager and knowledge base.

Member profile contains member information regarding strength and features. Request manager contains software for entering, routing and answering reference questions. Knowledge base is a searchable database for questions and answers for future use. (Chandwani, Anita, 2006: p.6)

2.9 Objectives of Digital Reference Services

There are various reasons and benefits of providing digital reference services. These vary from library to library. Some of the objectives are:

- To provide excellent service.
- To assist users in their educational and research related needs.
- To provide individual help.
- To provide and maintain an appropriate collection of reference resources in print as well as electronic format.
- To help users in searching exact information.
- To save the time of users as well as library staff.
- To save space occupied by print resources.
- To make information search interesting and convenient for users.
- To promote remote access.
- To avoid physical visit to library which will help users automatically as they can get required information at their place.
- To educate users regarding resources and research techniques in order to help them in getting required information. (Maharana, Bulu and Panda, K.C; p. 3)
- To extend digital reference service to users who are physically challenged and can’t visit library.
- To allows users to contact library online and in real time 24/7 so that they can get required information at any time and from any place.
- To satisfy user information needs.
- To reach more and more users as per their convenience.

2.10 Facets of Quality for Digital Reference Services

The 1997 Virtual Reference Desk Expert Panel has identified eleven characteristics and features (referred to as facets of quality) for building a digital reference service for the educational community and its fifth version is published in June 2003 (Virtual Reference Desk Expert Panel, 2003). The facets are classified into two main categories: user transaction and service development/management. The user transaction category includes the components that occur during the question-answering process and features visible to the user. The service development / management category includes decisions made during creating and maintaining the service that affect overall quality and user satisfaction.

2.10.1 User Transaction

It includes following components.

Accessible: Digital reference services should be easily accessible and navigable by any internet user, regardless of equipment sophistication, physical disability or language barrier.

Prompt turnaround: Questions should be replied as quickly as possible. Actual turnaround time depends upon question-answer policy and available resources such as staffing, funds, technology, etc.

Clear response policy: Clear communication should be done either before or at the start of every digital reference transaction to reduce any user confusion and inappropriate inquiries.

Interactive: Digital reference services should provide opportunities for an effective and interactive communication between users and experts so that users can communicate necessary information and clarify vague questions.
Instructive: Quality digital reference services should be instructive and should offer more to users than straight, factual answers; they guide users in how to formulate questions, subject knowledge and information literacy.

2.10.2 Service Development and Management

Authoritative: Experts of a digital reference service should have required knowledge and educational background in the services given subject area or skill in order to qualify as an expert. Specific levels of knowledge, skill and experience are determined by each service and its related discipline or field.

Trained Experts: Services should extend effective orientation or training processes to prepare experts to respond to inquiries using simple, clear and effective language and following service response policies and procedures. Training of information specialists is one of the most important criteria of planning and operating a digital reference service.

Private: All communications between users and experts should be held in complete privacy.

Reviewed: Digital reference services should regularly review their processes and services. Ongoing review and assessment helps to ensure quality, efficiency, and reliability of transactions as well as overall user satisfaction.

Provide access to related information: Along with direct response to user questions, digital reference services should also offer access to supporting resources and information. Services can reuse results from question-answer exchanges in resources such as archives and Frequently Asked Questions (FAQs).

Publicize: Services should inform potential users about the value that can be gained from use of the service. A well-defined and structured public relations plan can ensure that services are well-publicized and promoted on a regular basis. Care should be taken that publicity should not create more demand than the service has capacity to handle. (Vijaykumar, Manju and Vijaykumar, J.K., 2005: p.4) (Bullard, Kristan A., 2003: p. 8-9)

2.11 Implementation and Maintenance of Digital Reference Services

While implementing and maintaining the digital reference service following points should be considered:
1) Recruiting new librarians

Care should be taken to appoint staffs who have new technology skills. Now a days library schools are designing curriculum according to changing technology in library field. This helps while appointing new library staff.

2) Staff Training

When new staff appointment is not possible, staff training should be organized for current staff. These training programmes should be frequently organized. It helps current staff to redesign their skills and competencies.

3) Designing Prototype

This includes creating and testing the service. Computers, softwares, trained staff, etc. are the basic and essential requirements in creating the digital reference service. It requires pre-testing before the final implementation.

4) Interface Design

The online reference desk should be designed to permit easy access to resources for large number of users. While planning the site, one must think about hardware and technical limitations of end users. Requirement of hardware for using this service should be clearly stated.

5) Legal Issues

While providing digital reference service, legal issues must be considered and care should be taken accordingly. Some of these are national information policy, copyright, public information legislation, etc.

2.12 IFLA Digital Reference Guidelines

The purpose of these guidelines is to promote digital reference best practices on an international basis. “The terms, “Virtual Reference”, “Digital Reference”, “E-Reference”, “Internet Information Services”, “Live Reference” and “Real Time Reference” are used interchangeably to describe reference services that utilize computer technology in some way…..” (IFLA Digital Reference Guidelines: p.1) IFLA’s discussion group on reference first met in 1998. In 2002 realizing the importance of these issues and growing audience, IFLA created the official standing committee on reference work.
Defining a user base:

Before starting a digital reference service, it is necessary to find who is target clientele. Think how it can enhance and expand an institution’s user base. If institution has online service provision then physical location doesn’t matter. By this service institution’s traditional users as well as new users may get benefited. These guidelines are mainly divided into two broad categories.

1. Administration guidelines.
2. Practice guidelines.

2.12.1 Administration Guidelines

Before establishment of new services one must review procedures and policies of an institution. This includes:

A) Reference Policy

- Set goals for new reference service.
- What will be the review period for policy?
- Compliance with copyright and other legal limitations.
- Explain who can use the services in detail.
- Determine policy regarding questions, client misbehavior, etc.

B) Planning

- Create working group and establish service priorities.
- Develop concrete vision and initial action plan.
- Review available software, services and sources of funding.
- See the possibility of co-operative service.
- Secure managerial support.

C) Staffing

- Select staff on the basis of interest, ability, availability, ICT skills, interpersonal and communication skills.
- Explain clear responsibility, job description and assignments, etc.
- Consider how many librarians, technicians, etc. are required.
- Schedule the staffing according to user needs and expectations.
- Determine rescheduling of workload, back-up, technical support, maintaining reference standard, limitation on use, etc.
D) Training
  - Determine who will train the staff, time period, orientation, professional
devolution, etc.
  - Key skills should include multi tasking, clear communication skills, searching
  skills, interviewing skills, etc.
  - Regular updated training necessary.

E) Interface Design
  - Provide appropriate workspace for staff.
  - Access should be regardless of language, technical capability and physical
  impediments.
  - Set up virtual workspace properly.
  - Should be user friendly interface and easy navigation.
  - Clearly state Do’s and Don’ts, minimum hardware requirements.
  - Provide means of feedback, etc.

F) Legal Issues
  - Librarians should be familiarize with public information legislation,
national information policy, copyright, privacy and confidentiality issues,
licensing agreements, digital reference and information freedom.

G) Publicity and Promotion
  - Identify target audiences.
  - Develope project logo/name/identity.
  - Create strategic links from library website.
  - Contact local media.

H) Evaluation
  - Conduct user surveys of both patron and staff.
  - Compile and evaluate statistics of service, technical or policy issues.
  - Implement changes after statistical analysis.
I) Collaboration

Collaborators must
- Establish a common vision of the services.
- Determine common guidelines for execution.
- Establish accountability.
- Think over future problematic issues like copyright law, licensing agreements, liability, national information policy, etc.

2.12.2 Practice Guidelines

i) General Guidelines

Participants should-
- Be committed to provide effective assistance.
- Show professional courtesy and respect.
- Acknowledge receipt of user question.
- Apply good search strategies, etc.

ii) Content Guidelines

Digital reference services should
- Informative, promote information literacy.
- Maintain objectivity; use neutral questioning, interview technique to determine “the real question”.
- Provide with accurate answers, well structured written response.
- Avoid jargon, acronyms, abbreviations, etc.
- Select and site only from authoritative resources.
- The librarian should add value to information and do his/her best to locate and recommend at least one resource for every question.

iii) Chat Guidelines

- Chat should be initiated as soon as possible.
- Queries should be responded to in the order that they are received.
- Take care that other users are waiting.
- Ensure that user is not disconnected at regular intervals.
- Bookmark URLs which are used frequently.
- Use appropriate spelling, grammar and capitalization, etc.
iv) **Guidelines for chat sessions**

- Allow the user to fully explain his need.
- Use open ended questioning technique.
- Break up long responses into smaller blocks.
- Use complete citations.
- Use client’s name, avoid yes/no responses.
- Clarify confusing terminology.
- Avoid excessive jargon.

### 2.13 Methods of Digital Reference Services

Digital reference service is an advancement of traditional service that is emerging as natural solution for user’s increasing information needs in changing environment. There are various methods for operating digital reference service. These are discussed below.

#### 2.13.1 Online / Digital Services

Digital service is a network of experts, intermediation and resources placed at the disposal of patron seeking answer online (Magamma, M., 2013: p.7). These includes following services:

i) **Web OPAC**

OPAC stands for Online Public Access Catalogue. An OPAC displays all the bibliographic information of library. OPAC is modern and flexible form of traditional catalogue card and provides access to any recorded information within a computer. Online Dictionary for Library and Information Science (ODLIS) defines OPAC as, “An Acronym for Online Public Access Catalogue, a database composed of bibliographic records describing the books and other materials owned by a library or library system, accessible via public terminals or workstations usually concentrated near the reference desk to make it easy for users to request the assistance of a trained reference librarian. Most online catalogs are searchable by author, title, subject and...
keywords and allow users to print, download or export records to an e-mail account.”  
(Husain, Rashid and Ansari, MeltabAlam, 2006: p.41)

Web OPAC is a library catalogue on the web or intranet. In other words web OPAC is an OPAC provided on the web and anybody can access it from anywhere with the help of internet. It functions to facilitate the patron’s search for library holdings. It is useful for patrons because they can search library holding by author, title, subject etc. by sitting anywhere in the world. Also users can do reservation of library materials remotely. It is important application of library which requires high speed networks like LAN, WAN, Internet, and Intranet with broadband width.

According to Online Dictionary of Library and Information Science (ODLIS), “An Online Public Access Catalogue (OPAC) that uses a graphical user interface (GUI) accessible via the World Wide Web as opposed to a text based interface accessible via telnet."

OPAC usage is limited while web OPAC usage is global. Web OPAC is accessible through internet. It has facility of using hypertext links to allow navigation through bibliographic records. It has solved problem of physical space in library. It also saves the time of users as well as staff.

In spite of these advantages, there are also disadvantages of web OPAC. It does not provide sufficient information in the retrieved bibliographic records to enable the user to judge the usefulness of the documents. It does not rank the retrieval sets in decreasing order of probable relevance to the patron’s search criteria. Also does not provide open-ended, explanatory searching through pre-established linkages between records in the data base to retrieve documents related to those already found. Some existing web OPAC in India are –

-Indian Statistical Institute Library, Delhi
  http://www.isid.ac.in/library/new_search_/ib.html

-Tata Institute of Fundamental Research Library, Mumbai
  http://158.144.68.87/ISSearch.html

-Tata Institute of Social Sciences Library, Mumbai
ii) Subject portal / Subject gateways

The term subject gateways or subject based information gateways are emerged during 1990s. It is described as, “A network resource discovery service which provides database of internet resource descriptions with a specific subject focus and created according to specific selection and quality criteria.” (Heron, Susan J. and Hanson, Ardis, 2003: p.3) World Wide Web is rapidly becoming fastest increasing repository of data. People use internet widely. What librarians do for books, the same thing the subject gateways are doing for internet. It is an internet search tool for helping users to find information on the internet. For example electronic journal software datasets, electronic books mailing lists and articles or papers.

Using subject gateways instead of search engine, results in the return of more authentic and related web pages from search. Each gateway has selected and utilized a standard metadata schema for describing the resources incorporated into gateways. The metadata is applied by librarians or educators with experienced knowledge of the disciplines. (Poonkothai, R. and Ganesan, A., 2008: p.102-103)

Subject portals are newest resources. An example of the transition of subject gateways into portals is EEVL (Enhanced and Evaluated Virtual Library) which is award winner free service and provides timely, authentic access to the best engineering, mathematics and computing information available on the internet. Experts select, catalogue, classify and index the subject materials and ensure that only current, high quality, useful resources are included. Effective portals accomplish one of the three goals or all three goals as:

a) Establish procedures for creating web portals that link the expertise of interdisciplinary researchers.

b) Establish a procedure for digital libraries to exchange and share documents, queries and services among digital collections as well as within a single digital collection.

c) Address the different levels of interoperability. Interoperability includes defining document, query types, managing resources, items described in the portal, establishing intellectual property rights and providing as wider collection related to subject area. (Heron, Susan J. and Hanson, Ardis, 2003: p.3)

Portals should guide the patrons through the use of effective metadata, guided queries and human factor architecture that will provide targeted online content with increasing dependability and convenience to users. It should be done through
standards, dynamic content linking tools, semantic web engines and standardized user interfaces.

iii) Online database / Web database / Bibliographic database

As its nomenclature suggests, it is available online or on web. There are large resource collections of machine readable data that are maintained by commercial agencies and can be accessed through communication lines. Most of the libraries subscribe these databases for easy access and use of current information for users. Examples of these are web of science, current contents, SciFinder Scholar, Eicompendex, etc. It also includes some disadvantages. First one is that it only includes bibliographic data and does not include full text data. Second disadvantage is that the information cannot be searched and accessed when the system is down for any reason. On the other hand, it is useful for technosavvy users and remote access (Bhatnagar, Anjana, 2005: p.430-431)

iv) Institutional Repository

When we use the term ‘Institutional repository’, we use ‘institution’ to present the educational or research establishment which will be library’s parent body. Institutional repositories emerged from universities, but now spreading into other types of educational institute also. The first and still best known disciplinary repository was arxiv (www.arxiv.org) which is repository of research papers in particle and high energy physics.

Institutional repositories are digital collections of the output created within a university or research institution. The purpose of repository may differ according to type of institution. In most cases they are established to provide open access to the institution’s research output. Repositories are based on internationally agreed set of technical standards i.e. they expose the metadata which includes the bibliographic details such as author names, institution affiliation, date, titles of article, abstract etc. of each item in their collection on the web. There are almost 1300 repositories around the world and growing at an average rate of one per day. The statistics on the numbers and where they can be found in the Registry of Open Access Repositories (ROAR: http://roar.eprints.org/) and in the Directory of Open Access Repositories (Open DOAR http://www.opendoar.org/). Institutional repositories contain peer-reviewed journal articles and conference proceedings, now research data are increasingly created in digital form.
Datasets may be of many types – spreadsheets, photographs, audio files, video files, diagrams, charts, etc. Some institutional repositories also contain books or book chapters, theses, dissertations, and presentations. Anyone with help of internet can find themselves an article or dataset in an institution’s repository via a web search. (Enabling open scholarship EOS accessed through www.openscholarship.org)

**Advantages of Institutional Repository**
- Explores the output of institution to the world.
- Increases the visibility and impact of the output as a result.
- Manages and measures research output and teaching activity.
- Provides work space for work in progress.
- Supports interdisciplinary approaches to research.
- Individual authors also enjoy the same increased visibility for their work and impact.
- Repositories form permanent and important part of scholarly communication process.

v) E-books and e-journals

E-books are invented by Michael Hart, a student at the University of Illinois, in 1971. He founded project Gutenberg, the first and largest collection of e-books available online. The first commercial e-book was launched by Random House in 1981. In mid 1990’s, e-books were started to be as alternative to traditional print documents. Although e-books continue to represent only a smaller part of the total book market and its supply has increased slowly over the past 20 years. (Owen, Victoria and others, 2008: p.3)

Defining e-books depends mostly on the situation in which the term is utilized. Coyle describes an e-book as simply the electronic form of a literary work; Anuradha considers an e-book to consist of both digital content as well as physical devices, such as hand held e-book readers. While for Rao, e-books are comprised of texts published in electronic form as well as physical books converted into digital form, and also books in computer file format, or an electronic file of words and images of monographic character, all of which can be displayed on a desktop, notebook, computer or portable device including dedicated e-book readers. (Owen, Victoria and others, 2008: p.2)

A significant difference between e-books and e-journals is that most e-book distributors protect their e-books with digital rights management. It means user can not copy whole book at a time, only limited pages can be copied depending on policy
of distributor. In print material, copying a reasonable number of pages is allowed. While e-journal aggregators monitor for things like systematic downloads, it is normally quite simple for users to print off or save an entire journal article. Pdf is universally accepted as the standard file format for online journal articles. On the other hand there is no standard format for e-books. There are advantages of e-books and e-journals like remote access, availability, convenience, ease of handling, no requirement of physical space to store, etc. Also there are difficulties like only half of the print books acquired by academic libraries are available as e-books, many e-books are published after three to eighteen months of print-editions, when purchased individually e-books costs more than print edition etc. (Walters, William H., 2013: p.195-203)

**vi) Electronic document delivery services**

Due to effect of economic and technological factors, libraries are seeking more creative ways to fulfill user needs. No library has the enough resources to purchase all the books published in the world. The price of serials has increased by 138 percent and unit price of monographs by 58 percent. Increased familiarity with the internet and other online research services has opened new doors for users and they expect hard copy of every document which they saw online. In response to these increased demands and expectations, libraries now work together. (Kinslow, Carmela: p.21)

Document delivery services (DDS) provide users copies of documents including articles of scientific journals on demand. These documents are provided by various means like xeroxing, mailing etc. Now these are stored electronically and also provided to users through electronic means. Documents are stored and delivered electronically in either image or optical character recognition (OCR) form. Patrons may order documents by electronic mail, fax or in real time from computer terminals. Libraries provide documents by mail, fax, electronic mail or online. Previously document delivery involved hybrid medium.

Advancement in optical storage and data compression has increased electronic storage and retrieval facility. Also increased network capacity, World Wide Web and line fidelity has resulted in higher data transmission speed. Increased digitization, information and communication technology, internet bandwidth has decreased the average time of delivery. It has helped users a lot. (Hugenholtz, P. Bernt, 1993: p.3-5)
vii) **Online current awareness services**

The international encyclopedia of information and library science (2003) defined a current awareness service as one “Notifying current documents to users of libraries and information services” (Naqvi, Tanveer; p.100)

Sometimes current awareness service is also called as selective dissemination of information. Its origin is traced in 17th century. During 18th century around 1830 abstracting journals are created to notify users’ recent publications and then after a century later, rapid growth of technology such as computer and internet have changed this scenario. Slowly computers have taken over much of these services, but library professionals still have been playing important role of organization and dissemination of information. For some period, private sector was using commercial services. Afterwards some current awareness services are made free and are provided through web. A couple of new services are also introduced; these are news alert services, tables of contents. Table of contents are very popular and easy to set up and cover multiple journals or offer additional functionality. These are quick, easy and almost always free. User can also get topic auto alerts by e-mail from various databases, publishers and also from google and other search engines. But this got the problem of overloading of inbox as all these are sent by e-mail. To get rid of this new concept was introduced called as the feed. Many websites offer alerts when their sites have been updated. Instead of using e-mail, the information is sent to a central place where users go to read all feeds as per their convenience. This has resulted in less e-mail and less time spent on checking individual web sites. RSS (Really Simple Syndication) and Atom are the most common feeds, but there are others also. For using them you need a feed reader or aggregator, a piece of software that collects information from sites that have feeds. You have to add your favorite sites on aggregators, and then aggregators go out regularly to collect the feeds and group them together for you. You have to go to aggregator as per convenience and look at the results. Other approaches include preprints, e-zines, electronic newsletters, blogs and electronic lists, social book marking, etc. (Barr, Dorothy; 2006: p.14-17)

2.13.2 **Real Time Reference**

It is also known as real time live web reference and also it is latest trend in digital reference. It includes following services.
i) Instant Messaging Service

According to International Engineering consortium, “Instant Messaging (IM) is an internet protocol based application that provides convenient communication between people using a variety of different device types.”

Instant messaging is a type of communication service over the internet which enables individuals to exchange text messages and track availability of a list of users in real time. There are many free public domain instant messaging services. But most popular are AOL Instant Messenger (AIM), ICQ, MSN Messenger and Yahoo! Instant Messenger (YIM) (Mannan, Mohammad and Oorschot, Van P.C.: p.1)

Instant Messaging is also known by chat reference or virtual reference. It has become important point for users to get information and reference help. It is referred as unique method of communication between library staff and users. Instant messaging provides cost beneficial means of communication in real time and also supports effective communication between employees. It provides informal means of communication which helps library staff to create good relationship with users.

ii) Voice over Internet Protocol (VoIP)

Voice over internet protocol is recent way of communication. It is one of the important and advanced technologies in communication world. It is developing telephony solution which allows Voice and data traffic together on the same IP based network. Now a day’s telecommunication networks are getting replaced by data communication network and also voice signals are transferred over data networks by converging them into data packets. In VoIP, calls are transmitted over an IP network instead of using PSTN. VoIP is becoming popular because of wider availability of internet with high bandwidth. (Feroz, S. and Dowland, P.S.: p. 83)

VoIP is simply a way to make phone calls through the internet. VoIP transmits packet through packet switched network in which voice packets may take the most efficient path. While public switched telephone network (PSTN) is a circuit switched network which requires a dedicate line for telecommunication activity. (Kazemitabar, Haniyehand others, 2010: p.352) Key benefits of using VoIP as over WIMAX networks, includes best quality of service, affordable cost and reliability. But there are many threats of using VoIP network over WIMAX network if compared with wire DSL network, such as network capacity, architecture, system design and quality of service.(Jalendry, Sheetal and Verma, Shradha, 2015: p.161). VoIP is a technology which is used to make telephone calls over the internet using broadband connection
using computer network instead of a regular phone connection. VoIP converts the analog signals from the phone to digital signals so that the signals can travel over the internet. Anyone can make a VoIP call by just picking up the phone and dialing relevant number.

**Advantages of VoIP**

- One can save a lot on his telephone bills because having a broadband internet connection doesn’t need to maintain another line just for phone calls.
- Facility of conferencing allows talking with many people at the same time without paying any extra charges.
- can use in library for interactive communication in reference.

**Disadvantages of VoIP**

- Many of VoIP providers don’t have back up power in case of power outages.
- Most of the time VoIP calls does not connect with emergency numbers.
- VoIP providers don’t have directory assistance.

**Features of VoIP**

- VoIP is cost effective for long distance calls if we compare with charges of the PSTN.
- In case of bandwidth and quality, VoIP is good option than PSTN.
- Hardware and software required for VoIP is computer with full duplex capable sound card, broadband internet connection, dialer software, headset with mike.
- Components included in VoIP are customer premise equipment, call processing and management application, voice handling server. (Feroz, S. and Dowland, P.S., p.83-86) (Singh, Rahul and Chauhan, Ritu, 2014: p.15)

**iii) Chatterbot**

Also known as chatbot, conversational agents, artificial conversation entities, chatterbox, talkbot, bot is computer applications that imitate human personality. A chatterbot is interactive, responding in sentences that track the conversation in a way that is meaningful to humans. Library users who want more interactive library experience, like this characteristic of chatterbot. Users feel this something livelier than a search engine. One of the important points of these bots is their ability to handle common directional and predictable questions. Reference librarians can feel free from common questions because bot can execute routine and repetitive tasks. The
chatterbot is programmed with information and pulls together necessary information, reformatting and presenting it in a manner that meets user needs. (Allison, DeeAnn; 2011: p.2-3)

A chatterbot is a computer program which conducts a conversation via auditory or textual methods. These programs are designed to engage in smaller talk with the aim of passing turing test by fooling the opposite partner into thinking that program is a human. The term “Chatterbot” was originally coined by Michael Mauldin (Creator of First Verbot, Julia) in 1994 to describe these conversational programs. Many chatterbots now include functional features such as games and web searching abilities. A chatterbot may be deployed in a smartphone app also. One popular category of smartphone app that relies on the chatterbot is the “dating sim” or romancebot category. Chatterbots have also been incorporated into devices not meant for computing such as toys. Bots are frequently used to fill chat rooms with spam and advertising or to help in remembering personal information such as bank account number. Common examples are found on Yahoo! Messenger, Windows Live Messenger, AOL Instant Messenger and other instant messaging protocols. (Wikipedia, the free Encyclopedia)

iv) Video Calling / Video Chat / Video Conferencing

Now a day video calling has become popular. It is largely available as camcorders have spread over the online environment; new smart phones built with advanced cameras and as video chat services like skype, google talk and apple ichat have become an important feature of the online and smart phone environment. Also teleconferencing has become more important in the business environment (Rainie, Lee and Zickuhr, Kathryn; 2010: p.3)

Video conferencing technology includes a variety of telecommunication systems that transmit voice, pictures and data over telephone and internet connections. Use and application of video conferencing technology has been increased in various fields like education, library, health care, business and research. This technology provides distance learning, research and reference application. This form of digital reference includes visual element which may be solution for problems in text based services. Librarian and user may be able to use both text and speech for reference transactions. Use of video conferencing technology has been increased in professional and formal education programs. Video conferencing technology for reference purpose
is effective and convenient medium for users. Video conferencing provides a rich medium where multiple nonverbal and verbal cues, use of natural language and immediate feedback is possible. It gives pleasure to librarian and user also that they can feel face to face interaction (Sedgwick, Monique and Spiers, Jude; 2009: p. 1-6).

There are also some disadvantages of video conferencing. It is dependent on specific equipments; high bandwidth of internet, clear network etc. Video conferencing is not useful for shy users. It is technology dependent method. Another disadvantage is that user satisfaction may be influenced by the bandwidth of the internet connection. Also challenges included are staffing, training, time for implementing service, lack of mobility for staff involved with service and cost (Magamma, M; 2013: p. 5).

2.13.3 Question Point Reference Service

Question point is a powerful product of OCLC which allows quality online reference service in a cooperative environment. Availability of 24/7 and shared global expertise are the benefits of question point. The success of question point mostly depends on the regular training as well as effective marketing. Users found it to be useful tool for communication with reference librarian, even though there is low satisfaction rate concerning their experience (Qobose, Edwin and Mologanyi, Baipuso., 2015: p. 9).

2.13.4 Web Form Service

This service includes two types of services. One is web form and another is frequently asked questions (FAQ). The web form has to be accessed from the library homepage or the reference web page. Then the fields in form are to be filled in by the user and the form is finally submitted back to the library. Answers to the query are usually provided by e-mail, phone or post (Magamma, M., 2013: p. 5).

2.13.5 Web based reference services

Because of the development and application of advanced technology, especially computer, internet and web technology, every filed including library has changed. The traditional library services have changed greatly in recent years. Another reason behind this is changing user demands and expectations. As a result,
libraries are moving towards various new services in which web based services are recent one. Users can access information according to their convenience, saves time and cost, available 24/7, these are the advantages of web based library services. Web based reference services include following services.

i) Bulletin Boards

Bulletin board systems (BBS) started in the late 70s, as a means of communication for virtual community existing in cyberspace where participants usually under pseudonames may send and receive public and private messages to each other on any topic, transfer software, play online games etc. Ward Christensen and Randy Suess of USA had discussed on 18th January 1978, about designing of the first electronic BBS in the world and implemented the system on 16th February 1978 (Ramaiah, C.K., 1995: p.23)

A bulletin board is an electronic communication platform which contains posted messages and articles related to common topic, subject, theme or area of interest. It allows users to call, leave or retrieve messages. This message may be send to all users of the group or only to selected users. But drawback is that all messages can be read by all users. Many libraries are using bulletin boards for their web based library services. The bulletin board system can be used as an interactive medium of communication to call suggestions on activities and services of library. It can also used as a platform for marketing library services (Bhatnagar, Anjana, 2005: p. 432)

The bulletin board is an online system for a cost effective distribution of information in electronic format. Some bulletin boards are considered more of a talk-net than a platform to exchange research information. Many bulletin board services display discussion topic list with brief details under broad topic heading. Some bulletin boards provide file transfer services. Various bulletin board services are available on national / international networks around the world allowing information exchange via e-mail and computer conferencing to a group of users working in same subject area. Initially bulletin board services were started in universities and research institutions but now private agencies are also operating such services (Ramaiah, C.K., 1995: p. 23- 31)

ii) Web Contact Center

Various libraries use web contact center software which has been developed for e-commerce application for digital reference services. Web contact center offer a
variety of features. It allows communication via e-mail, web form and chat and also enable more interactive collaboration through various tools such as page pushing, escorting and co-browsing (Magamma, M., 2013: p. 5)

iii) Search Engine Reference Service

Search engines are huge databases of web page files that have been integrated automatically by machines where as the subject directories are human compiled and maintained. Every page of website is indexed by search engine while subject directories links only homepages. For an information retrieval system, search engine is a popular key. A search engine is computer software which searches electronic material collections to retrieve citations, information or documents that matches user’s query and answers it. The speed of answering user’s query is high. It gives answer within fraction of time, due to which search engine is popular among users. User can get any information or reference very quickly. The materials retrieved by search engines may include text documents, facts extracted from text, images or sounds. While a query is a question created by user and it is phrased so that it can be interpreted properly by search engine. Depending on the type of software, it may be collection of commands, a statement in either full or partial sentences, and one or more keywords or in the case of non text searching, an image or sequence of sounds to be matched. (Bhatnagar, Anjana, 2005: p.431)

Due to technological advancement especially in computer, smartphone, internet and World Wide Web, users can search any required information at anytime from anywhere. For this important requisites are computer or smartphone with internet connection. If any user has these devices then he can search any required information quickly. Top ten most popular search engines in the world today are google, Bing, yahoo, ask.com, AOL.com, Baidu, Wolframalpha, duckduckgo, internet archive and chacha.com (source www.google.com)

iv) Web Based User Education

User education has been defined as “Instruction which equips library users with the skills to enable them to be independent and sophisticated users of libraries and their resources”. (Murugan, Senthur, 2013: p.3)

Enormous growth in publications as well as resulting complex nature of libraries and the literature organization and dissemination methods traces the need for
user education. According to Thomas G. Krik planning of user education programme requires two things namely orientation and bibliographic instruction. Rathore (1992) summarized three levels of user education-

- At the beginning of every academic year for newly admitted students.
- Subject oriented instruction for undergraduates at a stage when they are admitted to special branch or subject.
- Literature search training at the beginning of their research work (Murugan, Senthur, 2013: p. 3-4)

**Main aims of user education are**-

- To train the users to use the various resources of library effectively.
- To provide the users independent information seeking skills.
- To encourage the users for getting the assistance of library staff.

Information technology has a great impact on user education program. Although there are various traditional methods of user education, information technology in library has changed these methods. Along with lectures, library tour, printed broucher, guides, seminars, orientation, instruction, audio visual method, etc. the new methods are also necessary. These new methods include using internet, browsing, searching, downloading of required information, exploring online database etc. Due to such reasons traditional method of user education is changed to web based user education (Murugan, Senthur, 2013: p. 4-5)

Web based user education is flexible and interactive medium for users. One can see web guides and teaching tools everywhere on the web because they can be easily updated, accessed and printed on demand. The library web site uses web-based user education for inculcating training to patrons in exploring the basic library skills. These skills include glossary of library terms, using OPAC, locating books, magazines, bibliographic data, how to navigate library website, how to select relevant database, guidelines for searching CD ROM, how to locate web based database, other electronic resources, using Boolean operators and searching resources on internet (Murugan, Senthur, 2013: p. 5)

v) **User feedback from service**

Users are always important part for libraries. If we see five laws of library science, users have given most attention. Every library runs on the principles of these five laws. Recently developed digital reference service does not have exception for
these principles. Digital reference services also consider user as important part. Due to which the reference librarians expect feedback from users. User feedback helps in judging the effectiveness of services. A suggestion from user feedback helps to improve service, quality of service, effectiveness of service. Feedback also helps to add new feature or discard old feature of service. Feedback mechanism is medium of interactivity, where reference librarian and users can understand each other’s views. It is helpful to improve service and serve better to patrons. User feedback gives opportunity to remove gap in service if any. It gives pleasure to listen what users expect from library. In feedback form, the libraries provide an online form for asking questions to librarians, libraries, also sending suggestions, views and comment upon the library services which helps in building the services in more effective ways.

2.13.6 Web 2.0 Services

The term web 2.0 is coined by Darcy DiNucci in 1999 and is popularized by Tim O’Reilly at the O’Reilly Media Web 2.0 conference in 2004. The important feature of web 2.0 is that it permits users to interact and collaborate with each other in web space and enables creation of community knowledge (Hazra, Sheuli, 2015: p. 50)

Tim O’Reilly tried to define web 2.0 as, “it is the network as platform, spanning all connected devices; web 2.0 applications are those that make the most of the intrinsic advantages of that platform: delivering software as continually updated service that gets better the more people use it, consuming and remixing data from multiple sources, including individual users, while providing their own data and services in a form that allows remixing by others, creating network effects through an architecture of participation and going beyond the page metaphor of web 1.0 to deliver rich user experiences.” (Sahu, Hemant Kumar; Pathak, Sandip Kumar and Singh, Surya Nath, 2010: p.3) Mukhopadhyay (2008) in his paper categorized web 2.0 services in four major groups:-

a) The read and write component.

b) Social networking component.

c) Collective intelligence support component.

d) Information mash ups component.

Although these groups are not mutually exclusive (Hazra, Sheuli, 2015: p. 51)

Web 2.0 Services includes following services:
i) Library blog

Blog is short for web log—an online journal where information including text, audio, video, images is posted on a regular basis and appears in chronological order. It is developing very rapidly. It is quick and popular way to share thoughts with the world. This is one of the tools of web 2.0 services. It falls under read / write web component category (Hazra, Sheuli, 2015: p. 51)

Blog is a powerful two way based tool. A blog is a website on which library patrons can post their views, ideas, thoughts, comments and suggestions. Any matter entered on a blog is known as blog post. These posts are made in journal style and are displayed in chronological order. It allows searching of entries listed in specific categories. It also links to other sites of interest and provides places for comments and monthly archive of previous entries. Any library patron can publish a blog post easily and cheaply through a web interface and also any user can post a comment on blog post.

Blog in academic library

- It can be used for the collection development because users can request the required resources.
- Library can use blog as a marketing tool for advertising the library and its resources.
- It can be used as platform for discussion.
- It can be used as forum where patrons can post their views, queries, concerns, ideas, comments, suggestions etc.
- It can be used as platform where users can comment on library services and activities. (Sahu, Pathak and Singh, 2010: p. 5)

ii) Twitter

Twitter is a free micro blogging service that allows its users to send and read text based messages of up to 140 characters known as “tweets” via the twitter website, external applications or short message service (SMS). Access to tweets can be restricted or openly available. Library and information professionals know that twitter is fast growing; free messaging service for people and libraries can make good use of it without spending much time or efforts. Twitter has millions of users and it is good place to find and connect people interested in your institution and your areas of expertise. It is designed for exchanging information.
The majority of libraries use twitter for communicating with users. Twitter can be used as public relation mechanism. Many libraries tweet about resources, services, activities, events and community information. Some libraries accept the reference questions via twitter. Libraries can also offer sms or text a librarian services through twitter. Libraries can also use twitter for marketing the library services, resources, etc. (Beaton, Barbara, 2012: p. 6-8)

iii) Library facebook service

Face Book and My Space are two popular social networking sites launched in 2004 and 2003 respectively. My Space provides facility for organizations to generate their own profiles and pages and can be utilized by libraries. Face Book allows individual librarians to create profiles. By using these two services libraries can create a page to reach new users, users can set up interactive and personalized web profiles with personalized information like education, age, areas of interests, hobbies. Patrons can upload photographs, videos, music; create blog, post comments on other patron profile pages and send messages. It allows to share and change resources dynamically in an electronic medium (Hazra, Sheuli, 2015: p. 51) (Sahu, Pathak and Singh, 2010: p. 9)

iv) Social Media

Before a decade social media has been rarely used in profession by librarians. Now the situation has totally changed. As social media has become popular, librarians are also using it in profession. Social media is widely used by library professionals to fulfill various objectives. Popular social media channels used are face book, twitter, blog, flickr, YouTube, research gate, WhatsApp, Skype, etc.

WhatsApp Messenger is a cross platform messaging app which permits users to exchange message without having to pay for SMS. This application is compatible with iPhone, BlackBerry, Android, Nokia and other smart phones. WhatsApp features include one to one chat, group chat, push notifications, sending and receiving audio, video, gif, and pdf files. Now user can make audio and video calls also. (Shambare, Richard, 2014: p. 544)

Skype is created in 2003 and acquired by Microsoft in 2011, is a Voice over Internet Protocol (VoIP) communication tool that can be used to conduct audio or audio/video “telephone” conversations between internet connected computers. It
permits conversations to take place anywhere in the world, and both the service and software are free. In recent years, Skype has added mobile applications for android and ios devices. Basic Skype service is free and includes Skype to Skype calls, one to one video calls, instant messaging and screen sharing. The Ohio University (OU) library was well known as an early adopter of providing Skype based reference service (Beaton, Barbara, 2012: p. 2-3)

**Advantages of using Social Media**

- It is very good collection management tool which offers flexible ways to present resources.
- It helps to market events, services, news and presence.
- Costs of using social media are considered to be low.
- It requires less training.
- It facilitates rapid dissemination of information, news, etc.
- It is interactive medium of communication with users.
- It helps to collect feedback from users which will help to improve existing services.
- It facilitates communication enhancement both within the library and with other departments. (Taylor and Francis, 2014: p. 2-5)

### 2.14 Evaluation of Digital Reference Services

Evaluation is important to get the feedback regarding the service provided by the library. Library is non-profit and service based organization due to which evaluation process is essential. To evaluate means to assess the quality, to judge the standard of the service. Library service should be evaluated to know its significance for users and to measure user satisfaction. Evaluation also gives chance to measure the cost effectiveness as well as staffing and training issues related to any service. It also helps to judge the impact of that service on library. Digital reference services should be evaluated on the basis of their policies, procedures and also on the basis of reliability, quality, efficiency, effectiveness and weakness, etc. While evaluating digital reference service, user satisfaction must be given priority. (Chandwani, Anita, 2006: p. 6) McClure and Lankes (2001) propose four main components of measurement for digital reference services. These are as follows:
1. **Outcome measures** (quality of answers)

   Accuracy of responses, appropriateness to user audience, and opportunities for interactivity, instructiveness, and impacts resulting from the digital reference process.

2. **Process measures** (effectiveness and efficiency of process)

   Service accessibility, timeliness of response, clarity of service procedures, service extensiveness (percentage of questions answered), staff training and review, service review and evaluation, privacy of user information, user awareness (publicity).

3. **Economic measures** (costing and cost effectiveness of digital reference)

   The cost to conduct a digital reference session, infrastructure needed to support quality digital reference services, and impact of these costs on other library expenditures.

4. **User satisfaction** (degree to which users engaged in digital reference services are satisfied with the process and the results)

   Satisfaction indicators can include accuracy, timeliness, and behavior of the staff, technical considerations, physical facilities and others. (Gross, Mellisa; McClure, Charles and Lankes, David R., 2001: p. 22)

### 2.14.1 Methods of Evaluation

Before evaluating reference service, it is necessary to think why the service is being evaluated, what is expected by assessment. Then next step is which method should be used for evaluation because there are various methods. These are:

1. **User Feedback**

   It includes feedback, suggestions of users. Also includes users reply on service as well as answers they received from library. It is very important because their feedback is helpful for planning and improvement of service.

2. **Rating**

   It is another method of evaluation and very common. As we know library provides rating scale like 1-5 for service. Users rank the services from 1 to 5 according to their satisfaction.
3. Survey and Questionnaire

It is most popular form of reference evaluation and also for digital reference services. Questionnaire is used for knowing the feedback of users.

4. Observation

In this method, questions with predetermined answers are sent to users for knowing their response about service.

5. Interview

This includes individual and group interviews. This also helps in getting feedback of users about the service. But it is quite difficult to conduct interview because users may be scattered across the globe.

6. Case Studies

A combination of above mentioned methods is used for examining service for a case study. Case studies are mostly used when researching new service or product. These studies are often presented in academic journals and conferences.

2.15 Advantages of Digital Reference Services

1. Facilitates information search through computer mediated services:
   Majority of scientific, technical and scholarly publications are now available electronically and through web based technology. The digital reference services help common user to locate the required information available electronically.

2. User can get the needed information over the own desktop, without moving physically.

3. It saves the valuable time of users and ultimately digital reference services helps to implement fourth law of library science.

4. Real Time assistance:
   Digital reference service provide online and real-time assistance to patrons to search locally available resources as well as forward the request for locating such resources to other partner libraries and return the appropriate assistance to the concerned patrons.

5. 24/7 online assistance service:
   In traditional reference service there is limitation of time, but digital reference service provides the mechanism for 24/7 online services. Users can send query
at any time of their convenience, if the library is in position to facilitate such service then user can be supported round the clock.

6. If digital reference service consortium is there, it enhances span of service and helps to provide large size of manpower support as well as varied collections.

7. Digital Reference Service can also provide varied platforms for special interest groups to intercommunicate within themselves to exchange available information and ideas. (Guha, Tamal Kumar, 2004: p. 257)

2.16 Disadvantages of Digital Reference Services

1. Face to face interaction with patron is not possible.
2. Library staff may not be able to clarify the doubt regarding exact need of patron.
3. Possibility of technical problems.
4. Dependent on technology.
5. Speed of service depends on the speed of internet and data traffic.

These are the disadvantages of digital reference services.

2.17 Trends and Challenges in Digital Reference Services

Large numbers of libraries in developed countries are providing digital reference services. Providing reference over internet has been increased. Research by Janes (2000) found that 45% of academic libraries and 12.8% of public libraries offer some type of digital reference. In Indian context, increasing number of consortia in academic domain shows increased importance of digital reference services. (Guha, TamalKumar, 2004: p. 258) A large number of reference sources including encyclopedias, thesauri, handbooks, dictionaries, directories, abstracting services like chemical abstract, biological abstract etc. are available on the internet. (Chandwani, Anita, 2006: p. 7)

Challenges in digital reference and the digital library are common to some context. Metadata and standards for interoperability have same approaches like joint services and information re-use. Obviously questions of intellectual property and re-use of digital products are common. Technical problems, institutional repositories, problem of networking, are also common issues. Two issues are specific to digital reference (Lankes, et .al.2000), these are
Scalability - how digital reference service can grow (scale) to handle a large number of questions given that traditional scaling mechanisms, such as service hours and geographical constraints run counter to user’s expectations on the internet?

Ambiguity – how digital reference services can identify a priori the amount of context and human intermediation needed to meet a user’s needs? (Lankes, R. David, 2004: p. 3-4)

Other issues include transition from traditional face to face service to remote access service. Also includes quality aspect, kind of reference interview, real time versus non real time service, media selection in digital reference as well as economics of human intermediation. (Lankes, R. David, 2004: p. 4)

2.18 Works Cited


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