September 2019

Digital Preservation: An Overview

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Introduction

Digital preservation encompasses all such activities that are undertaken by a digital curator to ensure that the digital content for which the digital curator has responsibility is maintained in such usable formats that it is usable over a period of time and can be made available in meaningful ways for currently existing and future users, beyond the limits of media failure or technological change. Digital content refers to information that was created in or converted to digital form **(Digital Preservation Coalition, 2006)**. Digital content consists of a varied range and combination of various information types like as for example text, images, geospatial data, audio and video. Libraries acquire digital materials through different channels or procedures that may include buying digital content from publishers or aggregators and licensing, maintaining access to these online databases and Journals. Moreover, libraries and other different institutions round the whole world are taking different projects in order to convert their analogue collections to digital form with an aim to increase the access to the resources, which was so far confined to the four-walls of their libraries and institutions, many a times, without ensuring their long-term availability and accessibility. The crucial issue of moving a digitization pilot project to a fully operational system with elements of preservation and sustainability built-in is generally not given serious consideration that it deserves **(Jantz and Giarlo, 2005)**. The fact that the risk of loss of data in digital formats are very much greater than any other physical form and thus is required to be addressed in greater details. We always remain in fear that the access to digital resources is threatened more by technological obsolescence and to a lesser degree it is thought to be due the fragility of digital media. The rate of change of technologies in this world of growing technologies over shorter periods of time spans is such that we always remain in fear that the information may be rendered inaccessible even within a decade. Thus we may say that preservation is an immediate challenging issue for digital resources than for traditional resources. Throughout its lifecycle, digital content depends upon information technology of different kinds, including the following types of technologies:

• The software packages used for the creation, storage, management, processing, and most importantly providing access to the available digital content.

• Different file formats supported by different software packages at the time of creation and those software's to which the digital content is converted or transferred over time as software packages and file formats are continuously evolving with updations, extensions, new trends and features.

• The digital storage media to which the digital content is stored at the time of its creation and the media to which it is copied or transferred over time.

• The combinations of operating systems, different computer programs, various security mechanisms, computer hardware, and different communication networks which support and enable the creation, management, protection, and most importantly access to digital content for use over time.

• The standards for formats and practices that develop and emerge within digital preservation, information technology and other communities which are responsible for digital content as new information technologies become more widely used and stable.

In recent years we have seen a wide range of scanning technologies coming forth, among which the most trending is the 3D scanning technology which has gone a long way since its first appearance in cultural heritage modeling and digitization **(Remondino, 2011; Bandiera et.al,2011; Benedetti et. al, 2010; Andreozzi,2003)**. The bulky and costly scanners which were considered for the same purpose many years ago are lagging far behind of these new emerging technologies that are delivering and helping a long term dream of the practitioners of various such technology loving institutions and organisations they are very fast, accurate, available at low costs, helpful in "personal" scanning with the help of a hand held device.

Some Precious and Valuable 3D Technologies Used In Digital Preservation

Handheld 3D Scanning

The 3D scanning is used to acquire the three dimensional geometrical structure of an object in a real environment in order to manipulate it for many possible aims. Usually, the result of a 3D scanning is a set of points in the virtual space called "point cloud". Those points are used to create a surface "mesh" by a triangulation procedure. In the last decade 3D scanning has played a relevant and pivotal role in many fields, like that in digitization of different Cultural Heritages. Compactness, flexibility and robustness of 3D scanners is given by the miniaturization and integration of the electronic and optical sensors as well as by the algorithms used to acquire 3D geometry. Hence, 3D scanners may be divided into different categories with respect to some specific feature. Two main classes of 3D scanners are the ***active scanner class*** and the ***passive scanner*** class **(Arcifa, 2010; Gallo, 2010; Stanco, 2011; Stanco, 2012; Santagati et.al 2013)**. The active scanners operate by projecting electromagnetic signals which are used for estimation of the ***point cloud depth***. On the other hand, the passive scanners do not emit any such signal, but uses only the acquired information to infer or deduce the point positions in 3D space. Among the technologies exploited in the active scanners the most common are the laser triangulation, structured light scanner and Time of Flight scanner (T.O.F) ones. As for passive scanners, the depth estimation is achieved through stereo vision or range imaging techniques (e.g. Structure from Motion).The scanner mobility is another critical aspect to consider. We may distinguish handheld scanners from not portable ones. In the modern world of technology the handheld scanners represent an interesting resource in many research, commercial and education fields as medicine, industrial engineering, architecture, Cultural Heritage, libraries, preservation and so on. This is because of the low cost and affordability related to performance gained and the convenience ensured by the portability of such devices.

Microsoft Kinect

Microsoft Kinect is massively employed in the home entertainment field and this device is widely available in commerce. It consists of an infrared emitter, a sensor and a RGB camera. Exploiting structured light through a red dots pattern. Kinect can scan an object returning a mesh into RGB-D space, so meshes could be easily textured. It also contains an array of microphones to be used as interface for remote voice control. Microsoft provides a SDK to implement and develop new applications with its sensor. Kinect requires wired energy supply and a processor unit to perform computations so it is not an independent sensor. These sensors are quite affordable, portable and for this reason they are among the most diffused ones for the private users **(Cappelletto, 2014 and Remondino, 2011).**

Scanify Fuel 3D

Scanify Fuel 3D is a handheld device, which can be handled like a steering wheel. It consists of two 3.5 Megapixels RGB cameras, three Xenon flashes (light emitters), three LED guide lights and two triggers. It is based on a combination of photometric and image-stereo technology for 3D scan, so it can reach depth accuracy of 0.35 mm. Photometric technology, acquisition time is under 0.1 second, reducing noise from scanned object movements. Furthermore, it performs its own motion compensation exploiting an optical target placed in the scene: this marker could be tracked, so the scanner can accurately estimate all the relative positions and orientations between itself and the target.

Google Project Tango

"Project Tango" is the name given by Google to its smart-tablet device capable of making 3D scans. Currently, it is provided only to developers: a registration is required to a whitelist of developer for users in order to acquire a Tango device. In this project an invitation is sent through e-mail with further instructions to obtain the sensor. The sensor itself is embedded within a tablet that performs computation, so this makes Tango an independent handheld scanner. Besides to depth perception, it can also perform motion tracking and area perception.

Artec Eva and Artec Spider

Artec Spider and Artec Eva are the two working handheld scanners manufactured by Artec 3D company. Both of them are semi-professional scanners which allow acquiring a high resolution mesh by the use of structured light technology. The Artec Eva is presently available in two versions: lite version and standard version. The lite version of this technology is cheaper than the standard version, but it does not have a camera sensor which could acquire color information to register the textures of the scanned 3D objects also. The Artec Eva is also capable of acquiring 2,000,000 points/sec. with the accuracy of upto 0.1 mm and a resolution of 0.1 mm. The relative accuracy over the distance between the scanner and the object surface is mostly upto 0.03% over a range of 100 cm however the suggested working distance is 0.4 – 1.0 m. The frame rate is 16 FPS (frames per second). The meshes thus acquired can be automatically aligned in each frame. On the other hand the Artec Spider has much better accuracy (0.05 mm) but available at a higher price, moreover it is able to obtain 1,000,000 points/sec. with a resolution of 0.1 mm. The suggested working distance is 0.17 – 0.35 m which is lower than that of the Artec Eva. That is why the Spider scanner is designed to scan small objects with a high complex geometry. The color sensors mounted on each of the Artec Spider and Artec Eva standard version is a camera with a resolution of 1.3 Mega pixels. It guarantees the medium quality of the obtained textures. Both of these scanners are designed to be handheld, in fact they are very lightweight (0.85 Kg) and thus present an appropriate handle for a practical scan. It is important to note that these scanners need to be linked with a computer of mid-high range hardware. Artec 3D scanners are selected for different purposes and applications, such as industrial manufacturing, quality control, plastic surgery, and study, scanning of cultural heritages **(Alberghina et. al, 2015)**

Why Digital Preservation?

Traditional libraries are nowadays increasingly and rapidly getting transformed into digital libraries, even if not fully but at least partially. The availability of web-based digital sources information is exerting ever-increasing and tremendous pressure on the traditional libraries, which in turn are spending larger portions of their budgetary allocations either for acquiring or accessing web-based online or full-text search services, CD ROM products, online databases, multi-media products, etc. The digital information products and services thus available, in turn have triggered major changes in the traditional policies and practices from buying and storing information services to accessing them. Besides, buying access and acquiring digital collections, libraries are putting their efforts on initiating digital library projects in their respective institutions in order to build their own digital collections **(Arora, 2002)**. At present most of the libraries over the world are increasingly converting their existing print collections into digital formats or are increasingly acquiring collections that are "born digital". Moreover, the academic communities look upon libraries to preserve materials that were ever accessible to them on Internet at least in an offline digital format, such as CD-ROM. As we know access to digital sources of information have definite advantages over its paper-based or microform-based counter-parts in terms of ease of usage, accessibility and functionality. However, long-term preservation of digital information is destroyed by short media life, obsolete hardware and software; steady read times of old media, and defunct Web sites **(Chen, 2001)**.

Challenges for Preserving Digital Contents

Even if digital technology offers a lot of advantages over their print counterparts, it along with other associated technologies like Internet and web are in a continuous flux of change. New standards and protocols are being defined on regular basis for different file formats, compression techniques, hardware components, network interfaces, storage media and devices, etc. The digital contents constantly face the threat of "techno obsolescence" and transitory standards. Magnetic and optical discs as physical media are being re-constructed continuously to store more and more data. The threat of backward compatibility remains constantly for different products, including software, hardware and associated standards and protocols that were used in the past. The hindrances in maintaining access to digital resources over time are linked to evident differences between digital and paper-based material. Some of the important challenges for preserving digital contents are as follows:

Dynamic Nature of Digital Contents

The starting problem with digital preservation is the contents itself **(Chen, 2001)**. Preservation in analogue world involves stagnant objects like printed documents, manuscripts and other artifacts, gathering and storing these resources in any form or shape is simple and straightforward process. Preserving digital contents requires reconsideration in terms of meaning and purpose of preservation. There are different types of digital materials, which cannot be duplicated in traditional hard-copy or analogue media, like for example, interactive Web pages, GIS (geographic information systems), and virtual reality models. For instance, web sites have different links that not only undergo change but also point to dynamically changing sites. As the object grows and varies over time, new trends and questions emerge about what it means to preserve a digital object**.** Approximately 28% of the URLs referenced in Computer and Communications of the ACM articles between 1995 and 1999 were no longer accessible in 2000 and the figure increased to 41% in 2002 **(Spinellis, 2002).**

Fragility of the Media

The media used for storing digital contents are inherently highly fragile and unstable because of problems inherent to magnetic and optical media that deteriorate quickly and can fail suddenly due to exposure to heat, humidity, airborne contaminants, or while faulty reading and writing on devices **(Hedstrom and Montgomery, 1998)**. Magnetic storage media are highly sensitive to dust, heat, humidity and other climatic conditions. Most of the storage devices, may deteriorate very quickly without displaying any physical characteristics of external damage because of lack of suitable storage conditions and proper management. Deterioration of storage media may lead to corrupted digital files in such a fashion that it may not be easy to identify the corrupted portion of digital contents. Moreover, unless and until digital contents receive preservation treatment at an early stage, it is likely that they would be left in unusable conditions in near future.

Technological Obsolescence

Digital archiving requires relatively frequent investments to overcome rapid obsolescence introduced by rapid technological changes **(Feeney, 1999)**. Technological obsolescence can be of such extent that it may affect hardware (including storage media and devices to read them), software and file format at any time. Not only are the computers continuously superseded with their quick and more powerful versions, but also the media used to store digital contents become obsolete within two or three years before they are replaced by newer and updated versions of that medium, or at sometimes by new types of media that are smaller, updated, faster, and easier to read. The materials stored on older media could be lost because the hardware or software to read them may become obsolete. Obsolescence also affects software that is used to create, manage, or access digital contents since the software are being superseded by newer versions or newer generations with more capabilities.

Shorter Life Span of Digital Media

The greatest concern of digital preservation is short life span of digital media and higher rate of obsolescence of the hardware and software used for accessing these digital records. Fast changes in the IT industry and the move from science-based developments to commercial development of software and hardware systems, has resulted in media becoming inaccessible at a rapid pace. Magnetic tapes, optical storage disks (e.g. CDs and DVDs) are produced for short-term storage of digital resources and thus cannot be used for long-term archival retention.

Make Use Possible

For a very small subset of valuable but damaged documents, digital imaging technology is possibly the only viable and cost-effective mechanism for facilitating its use for users. A recent experiment involving digitizing oversize colour maps **(Gertz, 1995)** demonstrated that the only way to use the maps, which have faded badly and are very brittle, is to view them on a large colour monitor after digitizing and enhancing them. **(Mintzer and McFall, 1991).**

Maintain Digital Objects

Once digital conversion of the original document has been completed, the challenge of protecting the digit contents from corruption or destruction becomes the preservation focus. Digital preservation typically centers on the choice of interim storage media, digital imaging system life expectancy, and the concern for migrating the digital files to future systems as a way of ensuring continued future access **(Preserving Digital Information, 1995)**.

Principles of Preservation as Applied to Digital Preservation

The basic principles of preservation that are being employed for preservation of analog media are also applicable to preservation in the digital world. **Conway, 1996** identified five principles, i.e. longevity, choice, quality, integrity, and accessibility that are being practiced for preservation of analog media and can be extended to digital preservation.

Longevity

The longevity of digital contents depends on the life expectancy of the access system, including hardware and software. Digital storage media must be handled with care; however, storage media is likely to have longer life span as compared to computer systems that are used to retrieve and interpret the stored data. Migration of digital contents should remain a continuing activity to ensure perpetual availability and access to digital information.

Selection

The process of selection should be a valued judgment involved every time when a decision is to be made to convert documents from paper to digital image and migrate it from one storage media and access system to another so as to continue preserving the information for future use **(Conway, 1996)**. Selection of digital contents for preservation should reflect the broader institutional mission.

Quality

Quality in the digital world is concerned with usefulness and usability of digital contents and is essentially governed by the limitations of capture and display technology. Imaging technology, for example, facilitates scanning at resolution of 1500 dpi, however, the printing and display technology has its limitation, since it can only faithfully display images at maximum of 600 dpi. Quality of the digital object, including the richness of both the image and the associated indexes, is considered to be the heart and soul of preservation in the digital world **(Conway, 1996).**

Integrity

Digital preservation encompasses physical as well as intellectual integrity of digital contents. In terms of digital preservation, the physical integrity of digital resources is determined in terms of loss of information that occurs when a source is created in the process of scanning, and compressed mathematically for storage or transmission across the networks **(Lynch, 1994)**. Librarians can exercise control over the integrity of digital resources by authenticating access procedures and documenting successive modifications to a given digital file.

Access

Digital technologies put forward a preservation solution for the documents in the libraries and other important organisations, institutions with increased access to them over different data networks. The access to digital resources thus occupies the central position in preservation process in digital world. Preservation in digital world is not simply the act of preserving access but also includes a descriptive metadata of digital resources being preserved. Acquisition of non-proprietary hardware and software components can ensure everlasting access to digital content. The librarians and archivist must encourage vendors for adoption of open system architectures and non-proprietary hardware.

Digital Preservation Strategies

Digital preservation activities can be divided into two broad components as under:

i) activities that promote the long-term maintenance of digital content and

ii) activities that provide continued access to its contents.

Several strategies have been proposed for quality digital preservation, but we are unable to find a single solution that may be appropriate for all data types, situations, or institutions **(Tristram, 2002)**. A set of digital preservation strategies can be applied to a digital object depending on its life-span as mentioned below:

Long-term preservation: Continued access to digital materials, or at least to the information contained in them, indefinitely.

Medium-term preservation: Continued access to digital materials beyond changes in technology for a defined period of time but not indefinitely.

Short-term preservation: Access to digital materials either for a defined duration of time, while use is predicted but which does not extend beyond the foreseeable future until it becomes inaccessible due to of changes in technology.

UNESCO's Guidelines for the Preservation of Digital Heritage (2003) group these strategies under the following four categories:

1. Short-term Strategies

1.1. Bit-stream Copying
1.2. Refreshing
1.3. Replication
1.4. Backwards Compatibility and Version Migration

2. Medium- to Long-term Strategies

2.1. Migration
2.2. Viewers and Migration at the Point of Access Emulation
2.3. Canonicalization
2.4. Emulation

3. Investment Strategies

3.1. Restricting Range of Formats and Standards
3.2. Reliance on Standards
3.3. Data Abstraction and Structuring
3.4. Software Re-engineering
3.5. Universal Virtual Computer

4. Alternative strategies

4.1. Analogue Backups
4.2. Digital Archaeology or Data Recovery

These strategies have demonstrated to work in certain circumstances over limited spans of time. None of these strategies have proven themselves against unknown threats over centuries of change. It is, therefore, in the fit of things for preservation programmers to look for a combination of strategies, especially when they are responsible for a wide range of materials over extended periods of time.

1. Short-term Strategies

Short-term digital preservation strategies are most likely to work for a short span of time only. Such strategies include bit-stream copying, refreshing, replication, technology preservation or computer museum, backwards compatibility and version migration.

1.1 Bit-stream Copying

Bit-stream copying is commonly known as “backing up data” and it refers to the process of making exact duplicate copies of a digital resource. It is considered as one of the necessary component of all digital preservation strategies, but in itself, it is not a long-term maintenance technique, though it deals only with the question of data loss due to hardware and media failure, be it resulting from normal decay and malfunction or natural disaster. Bit-stream copying is mostly combined with remote storages so that the original and the duplicate copies are not victims of the same destruction events.

1.2 Refreshing

Refreshing means copying digital information from one long-term storage medium to other storage medium of the same type, without any change whatsoever in the bit-stream (e.g. from a decaying 4mm DAT tape to a new 4mm DAT tape). Refreshing is considered as a necessary part of any successful digital preservation project. It vigorously addresses both decay and obsolescence issues associated to the storage media.

1.3 Replication

Replication constitutes a group of digital preservation strategies. Bit-stream copying is one form of replication. LOCKSS (Lots of Copies Keeps Stuff Safe) is a consortia type of replication, whereas peer-to-peer data trading is an open, free-market type of replication. A LOCKSS Alliance of participating libraries has been formed and the system is currently in beta test mode.

The purpose of replication is to modify the longevity of digital documents while retaining their authenticity and integrity through the process of copying and by the use of number of storage locations.

1.4 Backwards Compatibility and Version Migration

This strategy depends on the capability of different current versions of software to interpret and present digital material created with older versions of the same software and save them in current accessible format. Although in backwards compatibility, the presentation may be confined to temporary viewing, whereas version migration permanently transforms documents into such formats that can be dispensed by the current version of the software. For example, most web browsers have capability of interpreting and exhibiting materials written using older versions of the HTML standard. MS Word, Excel and Access applications, normally allow previous versions of their file formats to be changed and resaved in the current version, as part of application upgrade paths. The options of conversion into current versions may not be available for all types of technologies.

2. Medium to Long-term Preservation Strategies

Strategies identified for medium and long-term preservation are most likely to work for a long duration of time. Such strategies should be used for those digital resources that are likely to be of great value and have greater importance for a longer period of time. Medium and long-term preservation strategies include following:

2.1 Migration

Migration is a wider and affluent concept of digital preservation than refreshing. Migration is a group of organized tasks framed to achieve the recurring transfer of digital materials from one hardware or software configuration to another or from one generation to a successive generation of computer technology. The main aim of migration is to preserve the integrity of digital resources and to hold the capability for clients to retrieve, exhibit or otherwise use them in the face of constantly changing technology. Migration includes refreshing as a means of digital preservation but varies from it in the sense that it may not always be possible to create exact digital copies or a replica of a database or any other information source because hardware and software undergo constant changes and still maintain the compatibility of the resources with the emerging generations of technology. Although migration theoretically goes beyond addressing viability by including the conversion of resources of data to prevent obsolescence not only of the physical storage medium, but also of the encoding and format of the data resources. However, the impact of migrating complex file formats has not been widely tested yet **(Conway, 1996)**.

2.2 Viewers and Migration at the Point of Access

In migration viewing facility is being provided at the point of access and it has been proposed as an alternate for recurring and incremental migration. This process involves the use of suitable viewers, software tools or transformation methods which provide service at the time of access, by using the original data streams. For example:

i) The migration on request approach has been developed in CEDARS and CAMILEON projects that employ a software tool to record method of access. Access to digital resources is provided frequently depending on the method of access. With the passage of time technology changes, the software is upgraded to reflect changes in the method of access **(Cedars, 2002; Mellor, Sergeant and Wheatley, 2003)**.

ii) The TOMS (Typed Object Model Server) approach provides transformation techniques for common document and data types, allowing a server to choose a suitable transformation path for a range of object types **(Thibodeau, 2002).**

2.3 Canonicalization

It is a technique designed to determine whether the essential characteristics of a resource have remained intact while conversion from one format to another. Canonicalization depends on the creation of the representation of a type of digital object that conveys all its key aspects in a highly deterministic manner. Once created, it could be used to algorithmically verify that a converted file has every aspect of its essence intact after conversion.

2.4 Emulation

This technique uses a special type of software, known as emulator to translate instructions from original software to discharge on new platforms. The old version software is believed to run “in emulation” on newer platforms. This method simply attempts digital preservation by eliminating the need to keep previous hardware working. In emulation software and hardware is combined to reproduce all necessary characteristics required for performance of another computer of a different design, allowing programs or media designed for a particular environment to perform operations in a different which is usually a newer environment. Emulation requires the creation of emulator programs to translate codes and instructions from one computing environment so they can be properly executed in another computing environment.

3. Investment Strategies

Investment preservation strategies involve investment of efforts at the time of archiving digital materials. Such strategies include: Restricting Formats and Standards, Reliance on Standards, Data Abstraction and Structuring, Encapsulation, Software Re-engineering and Universal Virtual Computer.

3.1 Restricting Formats and Standards

Preservation programmers may decide to store data only in limited range of formats and standards. This can be attained either by only accepting material in specified formats or by converting material from other formats to the desired formats before storage. All digital sources within an archival repository of a particular type like for example colour images, structured text can be changed into a single chosen file format that is thought to embody the best overall amongst its characteristics such as functionality, longevity. For, example most of the graphical and textual information can be converted into PDF format.

3.2 Reliance on Standards

This strategy involves the use of open, widely supported and available standards and file formats that are likely to be stable for longer durations of time discarding proprietary or less supported standards. Such standards or formats may either be formally agreed or may be de facto standard formats that are widely adopted by the industry **(Moore, 2001)**. For example, most of digitization programs choose TIFF (Tagged Image File Format) as an open, stable and widely supported standard for creation of preservation master images. Thus reliance on standards may lessen the possible immediate threat to a digital resource from obsolescence, but it is not considered a permanent preservation solution.

3.3 Data Abstraction and Structuring

Data abstraction is sometimes also known as normalization. It involves analyzing and tagging data so that the relationships, functions and structure of certain specified elements can be elaborated. Using data abstraction, the content representation can be liberated from certain specific software applications. However the digital contents can be read using different applications at the times of technological changes. Data abstraction makes document application independent and simplifies the transfer of data between different platforms and over different generations of technology. However this technique has its limitation as it requires extensive development of different tools and methods for analysis and processing in order to correctly display and tag each form of data **(Moore et al, 2000)**.

3.4 Software Re-engineering

Digital materials are mostly attached with application software used for creating them. The application software, in turn is dependent on a specified system or platform in order to function properly. Application software gets most affected by technological changes. Moreover, they are mostly unsuitable for preservation strategies, including continuous migration. Software reengineering may offer lots of strategies for transforming software technologies, similar to transformation of data formats. Some possibilities of such a technology may include:

i) Adjustment and re-compiling of source code for a new platform;

ii) Reverse-engineering of compiled code into higher level code and transferring that to the new platform.

iii) Re-coding of the software from scratch, or re-coding in another programming language.

iv)Translation of compiled binary instructions from one platform directly into binary instructions for another platform.

Reengineering technology application would require a source code, which may not be available except for open source programs and software that are developed in-house. Even when source code is available, transfer to other platforms is not an easy job; it requires considerable time and effort per object **(Lorie, 2002)**

Data Management

Managing digital resources in the archives generate its own data about what material is stored, what can be accessed, and about the management of the archive. This stored data must be managed to support use of the archive, and to support its effective administration.

Access management

This function provides a user interface of the archive, allowing users to browse, search and explore its holdings, they can also request for resources and receive its copies. Access to archives may either be restricted or it may be made available to all potential users. The accessibility function may well require mechanisms to control access. The basic function of preservation planning is to monitor threats to accessibility of digital resources and to specify action required to fight such threats. As archival storage work for data protection, its continuing access has to be ensured. The technological changes that affect accessibility should be monitored keenly. The remedial measures and actions may involve migrating or upgrading of the digital resources into different formats or encoding them or even changing the metadata that describe the means of access and links to current access tools. The preservation programmers and libraries should advocate valuable practices among manufacturers of digital contents with an aim to facilitate long-term availability of the material for which the programme will be responsible. There is also a need to understand and give clearances who would likely be the users of the resources, so that preservation and access arrangements can be made according to their needs and expectations.

Conclusion

It has become increasingly necessary to address the long term sustainability of both physical and digital information and make sure that this knowledge is disseminated across the societies. Libraries have traditionally served as the archivists of information and knowledge and this approach should potentially be applied to the digital world. Without a comprehensive approach to digital preservation, physical books may be lost forever while insane social media (like Facebook) comments will be preserved for eternity. A balance needs to be maintained between implementing top down centralised information management structures, regulation and harnessing the capacity of different communication technologies for horizontal communication and engagement while drawing upon the innovative potential of people generated information and knowledge. In some instances the use of free but imperfect or inaccurate tools can have negative results. Frequent problems are faced in processing acronyms and industry or sector specific terms. It is always thought that in more informal settings even imperfect digitization techniques still have the capacity to provide valuable and helpful levels of access to multilingual resources. One of the new and emerging trends is the automated translation technique which is thought to adequately support about 90% of communication needs in future. This will involve a combination of statistical and artificial intelligence methods along with increased mobilization of people-sourced inputs. The low cost production and rapid design opportunities offered by 3D printing technologies will revolutionize and thus will also disrupt the global manufacturing industries, although many of these innovative utilities are likely to run into conflict with existing copyright and IPR regulations. Moreover attempts by different governments to apply national laws to the Internet in relation to defamatory or inflammatory resources will perhaps potentially pave the way for further regulation of other aspects of online activity which creates the risk of creating an internet divide increasingly. Alongside the need of internet for different digital preservation strategies to address the long term sustainability of physical and online information is very much important. Thus a key challenge for Internet governance will be to maintain a balance between vertical information management structures and effectively harnessing the potential of the internet for horizontal communication and engagement. Although lots of technologies exist and can be beneficial in the means of preserving our valuable, important and such resources which are at the verge of loss or extinction, if not preserved digitally on time, but till now most of the technologies in major part of the world are confined to the theories only and are not being implemented on ground due to carelessness towards the importance of such resources. Initiatives need to be taken for the timely implementation of these technologies in order to preserve our valuable resources.

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