

Implications of Distributed Information Technology for South Pacific Development

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Abstract

The global digital communications network, colloquially known as the "internet", has received much attention in recent years from business, media, cultural and government interests. This paper looks behind the hype and sales-pitches at the essential features of the medium which have made it (and will continue to make it) the central technology for the dissemination of information in the next century. It is a particularly important technology for remote communities, since all information resources (educational, commercial and recreational) can be transmitted using a standard set of protocols (Hypertext Transfer Protocol, File Transfer Protocol, Network News Transfer Protocol), over any physical medium (packet radio, satellite, phone line and optic fibre), in any data format that can be digitised (radio, television, text, graphics and sound). The implications of this non-coercive technology are explored in the context of the impact on development in the physically distant communities of the South Pacific.

Digital Communications Technology and the World Wide Web

One of the key issues in sustainable South Pacific development which has been highlighted in numerous governmental and U.N. reports (e.g., UNDP, 1992), is the future role of information technology in enhancing the access of local communities to global resources. A key element of the Pacific Sustainable Development Network, under the Agenda 21 programme administered by the UNDP, is the transfer of technology to countries with traditionally weak science and technology bases. The mechanisms identified in the SDN agreement for a communications infrastructure include the PEACESAT satellite, and packet radio technology, however, the agreement also stated that "no single communications option can meet the needs for information exchange and communications" (UNDP, 1992). Whilst this may have been true five years ago, the rapid expansion of the internet, and particularly the development of the World Wide Web (WWW), has radically changed distributed information technology - it is now possible to transmit more information in many different formats through a single communication channel, using the internet protocols.

The WWW is a collective term for describing the physical act of data transfer between computers residing on (usually) physically dispersed networks, using these standardised data transfer protocols. This includes traditionally analogue systems, such as radio and television, which, when digitised, are retrieved using the same data exchange mechanisms as electronic mail and other digital systems. This

paper argues that this fundamental shift in communications technology will play a key role in the development of a single communications medium which will give South Pacific communities access to global information resources.

The internet, as it exists today, grew out of the work of DARPA (Defense Advanced Research Projects Agency, USA), which was displaying the new networking technology by 1972, followed closely by Telenet, a commercial service, in 1974. This technology eventually gave rise to the standard set of medium-level network protocols called TCP/IP, whose key properties are outlined below. These protocols permitted the exchange of information in packets, across any digital communications medium. The WWW, which relies on TCP/IP as a communications medium, was developed at CERN (European Laboratory for Particle Physics, Switzerland) (Segal, 1995), and permits all information resources to be retrieved with a single file description, the Universal Resource Locator.

Unfortunately, the significance of a distributed network implemented as a means of exchanging information between academics at separate and often remote institutions, has been lost in the recent commercialisation of the WWW. This paper further argues that distributed communications technology, of the kind represented by the internet, has much more significance for remote communities than for those with physical access to the information in a non-digital form. For example, a student at George Washington University can physically visit the Library of Congress with ease - until recently, an almost impossible task for a student from the University of the South Pacific. However, with the advent of on-line services provided by the Library of Congress (<http://www.loc.gov/>), the student at USP will no longer be disadvantaged relative to his/her GWU counterpart.

This is only one example of how access to information, whether of an educational, commercial, or recreational nature, will no longer be limited by physical distance from the sources of desired information. In addition, it is the diversity in delivery of information services, and the active role of the "user" of the service, which distinguishes the new technology from traditional services. For example, whilst radio transmission of programs in a serial order using analogue technology is commonplace in many parts of the Pacific, streamed audio services via the internet permit the user to access radio services from all over the world from a single source. Radio Australia, for instance, broadcasts South Pacific news in Tok Pisin, French and English, and is available via the World Radio Network streamed service (<http://www.wrn.org/stations/abc.html>). In addition, once local communities have the ability to receive information through the internet, it is trivial to then make information available for a local, regional or global audience, through packet radio and satellite transmissions using the WWW protocol.

The central issue for many potential users or service providers remains the cost of purchasing computer equipment, networking, and transmission technology. However, the central thesis of this paper is that the internet, as a unified, multi-protocol, distributed system, is actually a more cost-effective technology than individually making purchases of equipment for each type of information that is required. The networked computer can replace the need for radio, television, video and audio hardware, and make printed libraries redundant. With the increasingly lowered entry-costs of computer technology, compared to the inflatory costs of paper-book purchases, the internet is an attractive proposition for the provision of information services in remote communities. The so-called "client-server" architecture of many internet protocols, in which the client computer requests information from a central server, is realised in many cases by having connections between the client and a regional computing service, which then has the major connection with a satellite or other transmission technology. For example, the University of the South Pacific (<http://www.usp.ac.fj/>) could in principle act as the major relay for local communities who connect to the university's main UNIX system via modems and a telephone line, or

via packet radio transmission, similar to the role envisaged in the original Pacific SDN plan (UNDP, 1993).

Internet Protocols and Services

This section reviews several of the major internet connection protocols before reviewing the implementation of those protocols in the provision of information services. Further details may be found in Aboba (1993).

TCP/IP (Transmission Control Protocol / Internet Protocol)

TCP/IP is the protocol on which all other services are built. It defines all computers on the internet as nodes, and gives them a unique 32-bit numeric and human-friendly address. An example is the node which hosts the "home page" of the South Pacific Journal of Psychology's electronic resources at the University of Newcastle (<http://hiplab.newcastle.edu.au/pacific/pacific.html>). The numeric IP address is 134.148.232.1, which corresponds to "hiplab.newcastle.edu.au". TCP/IP also defines the methods used to connect computers together, how data is exchanged (using "packets"), and how the packets sent from a particular node to a server determine which path to take through the network (routing). The low-level implementation of TCP/IP is different for each computer operating system and architecture, but it provides a seamless interface to transfer data whether across ethernet, packet radio, or satellite systems.

SMTP (Simple Mail Transfer Protocol)

SMTP permits the exchange of packets between computers that contain electronic mail messages. "E-mail" is rapidly replacing telephone and written letters as the secondary means of interpersonal communication after speech. In fact, using an adjunct protocol called MIME (Multipurpose Internet Mail Extensions), it is possible to send voice messages as e-mail messages encoded as text. E-mail addresses are usually specified in the form user@computer (ours are pwatters@hiplab.newcastle.edu.au and s_mayafe@eduserv.unimelb.edu.au).

NNTP (Network News Transfer Protocol)

USENET news is a primary source of information for all users of the internet. Newsgroups exist which contain discussion "threads" on almost any conceivable topic, and are defined at a global level (e.g., sci.psychology.research for discussions of psychology), or issues at a regional level (e.g., soc.culture.pacific-island).

File Transfer Protocol (FTP)

FTP was the one of the earliest protocols used to transfer files from one computer to another, using the TCP/IP protocol. It is predated by the UNIX-to-UNIX copy program by AT&T in 1976 (UUCP), and other protocols which developed concurrently with dial-up bulletin-board services, such as FIDO-NET, in 1983. FTP uses a set of standard commands which can be used to retrieve ('GET') files, and transmit ('PUT') files. The convention of 'anonymous FTP', where the exchange is initiated by using the login name 'anonymous' to retrieve publicly available files, is still widely used.

Telnet

Telnet permits the user to establish a peer-to-peer connection with any arbitrary internet host which runs the UNIX operating system. For example, although this paper is written on a keyboard in Cambridge, each keystroke is being sent to a computer in Australia, where it is stored. It makes no difference whether I am typing on the console in Australia, or from halfway across the world. Telnet is also commonly used to access on-line databases, such as library catalogues. In addition, virtual conference systems use the telnet protocol to allow many users to interact on a single host. For example, the Foothills Community (<telnet://toybox.infomagic.com:2010>), a primarily social forum, has been on-line since 1992.

HTTP (Hyper-Text Transfer Protocol) and Universal Resource Locators (URL)

HTTP embodies the concept of distributed information by assigning all resources on the internet with a Uniform Resource Locator (URL). As well as referring to hypertext documents written in the Hyper-Text Markup Language (HTML), it can refer to any resource that uses a different protocol. Some interesting examples are:

- The Pacific Studies Virtual Library (<http://sunsite.anu.edu.au/spin/wwwvl-pacific/index.html>) is a subject listing by country and resource for Pacific studies.
- South Pacific Trade Commission (<http://www.sptc.gov.au/>) provides access to trade and commerce information produced by the South Pacific Forum.
- Sustainable Development Dimensions (<http://www.fao.org/WAICENT/FAOINFO/SUSTDEV/DOdirect/DOengC01.htm>) is the information service of the FAO Sustainable Development Department.
- South Pacific Centre for Communication and Information in Development (<http://acij.uts.edu.au/UniTavur/spcenciid/about.html>) is a centre which provides educational programmes in journalism and electronic media.
- South Pacific Study archive (<http://bio.sci.kagoshima-u.ac.jp/kurcsp/arvhicespst.html>) has articles from South Pacific Study and the Memoirs of the KURSCP.

Internet Search Engines and Indexing

The gopher protocol was a structured information protocol which slightly preceded the WWW, and had the advantage that all information in a hierarchy was searchable on a particular host through a standard index. However, the nature of WWW is such that no central indexing is possible, although a number of searching technologies have made the WWW navigable. Search engines, such as the Webcrawler (<http://webcrawler.com>) and Alta-Vista (<http://www.altavista.telia.com>) provide free search services which locate information on any topic in the WWW. For example, if one types in a query like "South;Pacific", all the resources which are associated with the keywords are returned, and are easily accessed. Similar technology is used in the Wide-Area Information Service (WAIS), which queries specific databases, both commercial and public-domain.

Implications of Distributed Network Technology for Development

How do the above sets of protocols and services provide a framework for the goal of communications technology transfer? The answer to this question lies in the fact that these protocols and services can be integrated and accessed through a single piece of client software, such as the Netscape Navigator (<http://www.netscape.com>) and the Microsoft Internet Explorer (<http://www.microsoft.com>), even though different protocols are being used to serve the information, and many different mediums are being used in the physical information transfer. This client software can access digital radio broadcasts, or video feeds, without the end-user being concerned or even aware of how this is implemented in terms of satellite systems or ethernet connections. A single system, with a single means of connectivity (e.g., packet radio or modem/phone connection), can replace the many different systems which may once have been required to access the many different sources of information available anywhere in the world. Whereas a radio and television, in combination with a printed newspaper might have provided the basis for news services in the past, the use of a single system with multiple protocols means that digitised electronic versions of these services are available through a single machine. This reduces the costs associated with having to purchase many different client systems (e.g., radio and television receivers), and also may have long-term implications for sustainable development in non-technological sectors, such as the reduced need for paper, since print newspapers are potentially redundant, since they are available on-line (e.g., the Straits Times is available at <http://www.straitstimes.asia1.com>).

Although these technological developments have impacted upon many societies, we feel that their impact will be greatest upon communities where physical distance was once a barrier for communications. Island communities, in particular, would benefit from distributed information technology, since physical distance need not translate into technological distance. In addition, technological development along these lines does not enforce cultural or social norms on indigenous communities, since they are free to create content and communications along the lines that they wish, which makes the World Wide Web a non-coercive, locally-relevant medium (Carr, 1996). This is in stark contrast to the traditional introduction of other forms of technology and media, such as television, which enforces a single medium, which may be seen as an imposition rather than development (Gergen and Gergen, 1971). However, other considerations, such as the cost of equipment, and training, mean that the development of an integrated communications strategy relies largely on governmental and U.N. sponsorship. It is hoped that the potential benefits of the provision of distributed information technologies will be recognised, and incorporated into future South Pacific infrastructure planning.

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