Designing a New Communication System to Support a Research Community

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ABSTRACT

Over the past six to seven years a number of polytechnics and institutes of technology in New Zealand began offering degrees in the area of applied computing, with a focus on information systems, information technology and software development. In introducing degree courses in computing areas, institutions have had to face the challenge of incorporating a more academic, research-supported approach. An even greater research expectation is predicted after a number of indications recently from the current government that applied research with relevant industry partners will be used as a differentiator in new tertiary funding models. In addition, institutions are expected to seek opportunities for collaboration on various developments.

In the context of these demands, this paper presents a design for a communications system to support research. The system would utilise a range of media to provide multi-dimensional support for the development of a research community. The design suggested is a web-based model providing a virtual working environment in which users can meet, communicate and work together. It is proposed that the model would use intelligent agent mechanisms for collecting, storing, retrieving, linking and sharing information as required by the users. This model would provide the foundation for a collaborative research and development environment for institutions offering computing-related degrees.

KEYWORDS

Communications system, research community, communications media, intelligent agent

1. INTRODUCTION

This paper proposes the design of a new communications system to support a range of research activities for a specific research community. For the purposes of the discussion, the specific 'research community' referred to is defined here as the group of polytechnics and institutions of technology in New Zealand offering or planning to introduce computing and information technology degrees, and undertaking research activities. However, it is envisaged that the design concepts proposed could be scaled to a wider

environment.

A number of different computing-related degree courses are offered at polytechnics and institutes of technology. This has added to differentiation between institutions, where before they were all offering essentially the same national diploma course through their association with the National Advisory Committee on Computing Qualifications (NACCQ). NACCQ now has an additional role connected with the necessity for member institutions to be involved in research activities, involving support for the ongoing development of a research culture, and the provision of research vehicles and mechanisms. These include the establishment of a refereed journal of applied computing published twice yearly, the allocation of time at the annual conference for presentations of research papers, the availability of funding for approved research projects, and the recommendation that the NACCQ web pages should include information on research activities.

It is this last point that is of particular interest, in relation to the problem of providing a relevant and appropriate communications connection between the new system and its users. NACCQ is already supporting both institutions and individual staff members in computing and information technology areas, and it is possible that the NACCQ web pages could provide a front-end interface to the proposed system.

2. DESIGN PLAN FOR A NEW COMMUNICATIONS SYSTEM

2.1 Objective

To design a new communications system using new media that provides support for a range of research activities for a specified research community. The specific 'research community' is defined as the group of polytechnics and institutions of technology in New Zealand offering or planning to offer computing and information technology degrees and undertaking research activities.

2.2 Problem Statement

In recent years a number of polytechnics and institutes of technology in New Zealand began offering computing and information technology degrees. They faced the challenges of integrating their original vocational focus into a more academic, research-supported context, and producing the research outputs required from institutions teaching degrees. A new communications system, utilising a range of media, will provide multi-dimensional support.

The system must support both experienced researchers and those starting research activities for the first time. The system must also support groups of people undertaking collaborative research, who may be located together or who may be separated both geographically and in a time sense.

2.3 Relevant Research Activities and Outputs

The New Zealand Qualifications Authority (NZQA) definition of research describes five categories: basic or fundamental, strategic, applied research, scholarship and creative work. The definition also describes two further categories that may be equivalent to research in certain cases: consultancy and professional practice. Cater *et al.* (1998, p.50) reported that in the polytechnic sector the most common areas for computing research "are likely to be c, d, e, f and g, although f and g are somewhat contentious in their definition." They suggested that appropriate research outputs could include presentations, seminars, conference papers published in conference proceedings, papers published in refereed journals, theses, research reports, technical reports and working papers, software products, and other publications.

2.4 Proposed System Model

The new system will provide information on research topics and activities as required, for members of the defined research community, and allow members to communicate directly and indirectly. It will provide information on research methods, specified research topics, and links to other research areas; it will provide information on what research is currently being undertaken, by whom, at which institution, including links to earlier research; and will allow researchers to ask questions and interact with the system in an intuitive and natural manner. The system can be described as a conceptual model, and as a real system available today with future enhancements planned.

As a conceptual model, the proposed system consists of a computer interface, linked to the Internet, providing a virtual working environment in which users can meet, communicate and work together, and providing an intelligent mechanism for collecting, storing, retrieving, linking and sharing information as required by the users.

In real terms, the proposed system consists of a Web page, with a browser interface to the Internet; facilitating email, chat, and discussion lists; linked to a database of information on research activities, incorporating search engines able to carry out relatively complex queries; providing publishing access for users; and providing users with access to a virtual environment where people could meet and discuss research. Later enhancements planned include a personalised interface configurable to the user's preference, providing a virtual/hyper-reality environment enabling the user to work and communicate with others in a range of ways; managed by an intelligent software agent, possessing characteristics of artificial intelligence, and capable of learning; linked to object-oriented, distributed databases of information which are dynamic in design and structure, under the control of the intelligent agent, and capable of growth, replication and self-maintenance.

2.5 System Content

The system will contain the following:

- Detailed information on current research mechanisms and concepts. This will include guidelines, policies and procedures relating to various research topics and activities.
- Online tutorials for research terminology and methods.
- Database of past, current and planned research activities undertaken by members of the research community as defined in the objective, with links to other relevant research.
- Facilitation and coordination of the research activities undertaken by users.
- Support for various media types.
- Links to other research groups with collaborative characteristics and virtual environments.
- Access to online journals, videoconferencing, Internet telephony, list servs, usegroups, and chat and email services.
- Publishing mechanisms for adding information to the system.
- Evaluation and rating mechanisms.

2.6 Design Issues

Negroponte commented "The big changes in computers and telecommunications now emanate from the applications, from basic human needs rather than from basic material sciences" (1995, p.76). Consideration of a number of design issues is critical in ensuring the main objective of the communications system is to successfully support people in meeting their research needs.

- Recognition of the multi-dimensional perspective of the system and its essential dynamic aspects, including people, relationships, materials, technology infrastructure, time, and space.
- A focus on human needs rather than technology. Determination of the human objectives should occur first, then consideration of appropriate technology, not other way around.
- Database design able to cope with large amounts of information in different formats.
- The capability of the system to operate across different platforms and environments, and provide information in an appropriate form which can be accessed and understood easily.
- The design of the form and capabilities of the human-computer interface and the intelligent agent. The concept of redundancy is relevant in ensuring the interface provides an acceptable cognitive and emotional match with users.
- The ability of the intelligent agent to effectively filter the sheer volume of available information and report on what is most relevant to the user.
- Speed of access, enabling timely access to information required quickly.
- Protocols and guidelines for authorisation and privacy issues.
- A rating or value component to the system that allows information to be evaluated and rated in terms of its credibility, relevance, and currency, and cost.
- Development of applications involving virtual reality, hyper-reality and artificial intelligence.
- The time/space compression challenge of anywhere/anytime communication, including the problematic aspects of real-time communication. Clear (1998, p.81) reported on the growing need

to support collaborative work across boundaries of time and space.

- Recognition of opportunities in technology convergence and ongoing development.
- Creating and using virtual environments, and resolving distributed system aspects of sharing virtual reality.
- Incorporating aspects of chaos and complexity theory by recognising and allowing for discontinuity and underlying patterns.
- The ability to build essential cybernetic functionality into the system structure, with mechanisms to deal with feedback and collaboration.
- Creation and maintenance of virtual teams, with recognition of cross cultural aspects and allowing for differences in languages and cultures.
- Time required for to users to learn, reflect and integrate an awareness of the new media.
- Quality control mechanisms and international benchmarking, including consideration of the status of material published in online journals. Roberts (1998, p.122) reported on the potential impact on the new information technologies on scholarly publishing.
- An object-oriented design approach to the management of the material (text, video, audio, images), thus allowing for complexity of objects, using component architecture, modelled visually, automated, and with the ability to control ongoing changes.
- Guidelines for intellectual property and copyright issues that relate to ownership, control, use and distribution of material.
- Cost and funding issues relating to the establishment and maintenance of the system.

2.7 Methodology

Two main design approaches are planned. First, a qualified systems approach, using object-oriented design and incorporating prototyping and using visual representation tools and models. The systems approach allows the multi-dimensional aspects of the proposed system to be explored and relationships identified. This communications system will consist of people, materials, relationships, technology infrastructure, time, and space, and these multi-dimensional aspects can be conceptualised and explored using a systems approach. However, as indicated above, a pure systems approach will be modified through the incorporation of other features, some gained from complexity theory concepts: self organising change, individualisation, user centred approach, rapid reaction to feedback, and transformative innovation. The management of material (text, video, audio, images) will be controlled by the object-oriented approach, which allows for complexity of objects, and is congruent with component architecture, visual modelling, and automated change control.

Prototyping methods of development are appropriate and relevant. The Internet already provides cybernetic mechanisms for requesting, distributing and sharing information, and developing system and software prototypes. Visual representation will provide models allowing the tracking and documenting of system changes and modifications to be seen more easily.

Second, media selection will be used, in which appropriate media which support dynamic interfaces and linkages are chosen and implemented. The dynamic aspect to the system will be reflected in both its architecture and capabilities, particularly the ability to successfully meet the changing needs and wishes of the users. The media to be used in the new system will have characteristics capable of supporting flexible, interactive, collaborative, virtual environments, be responsive to individual needs and choices, and utilise user-friendly technology that is enabling but unobtrusive. Included in the system media will be the representation of an intelligent software agent, a software entity with both centralised and distributed characteristics, that will be able to profile the personal requirements of a user, and employ applications that learn and improve over time in accordance with these user requirements. Media forms to resolve problematic aspects of time, space and distance will be incorporated.

3. CONCLUSION

"Shared knowledge will be the dominant productive source of 21st Century economics with consequences we cannot now even imagine" (Lipnack and Stamps, 1997, p.236).

There are great advantages in utilising both the systems approach and media selection in the

design of this communications system. It must be emphasised that the system is for humans, and for their support in a particular field of endeavour. The design must allow for dealing appropriately with chaos and complexity. In the context of the system design, and the use of prototyping methods of development, the most important point is that the new system incorporates cybernetic mechanisms from the beginning, and all feedback from users is considered seriously in relation to ongoing system development.

The development of real and virtual environments that support collaborative work, research and learning is a critical issue. It is not effective in any sense for institutions to each spend time and energy creating individual research models without first considering what collaborative action may be possible and achievable. A communications system to provide support for the identified research community of interest would assist individual staff members struggling to achieve required research outputs in a challenging environment. It would also provide institutions with access to a wide range of valuable and strategically useful information about research activities and achievements.

REFERENCES

Cater, J., Clear, T., and Young, A. (1998) "Collaboration in Research: Providing Vehicles for Research Outputs." Proceedings of the National Advisory Committee on Computing Qualifications Conference, Auckland, 8-10 July, pp. 49-56.

Clear, T. (1998) A Generic Collaborative Database - Part of a Strategy to Internationalise the Curriculum and Develop Teamwork and Communication Capabilities. Proceedings of the National Advisory Committee on Computing Qualifications Conference, Auckland, 8-10 July, pp. 80-93.

Lipnack, J., and Stamps, J. (1997) Virtual Teams. New York: John Wiley & Sons Inc

Negroponte, N. (1995) Being Digital. London: Hodder and Stoughton

Roberts, P. (1998) Scholarly Life in Virtual Universities. In M Peters and P Roberts (Eds.) (1998) Virtual Technologies and Tertiary Education.