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***Abstract*-This paper describes a plan to combine IT support for major tertiary hospitals through to independent GPs under a single application support provider. The objectives of the centre being to improve coordination between health providers, reduce GP IT support problems, provide access to Web skills to all players in order to support a thin client model for health IT delivery.**

I. Introduction

This paper describes a proposal that is currently being moved through the various approval processes of the Australian public sector to build an application service centre which will service the IT needs of the health sector. Unlike the traditional IT outsourcing arrangements this centre will combine support for public sector hospitals with direct provision of IT for independent medical and allied health practitioners to thus facilitate the effective operation of Web based coordination technologies. In addition to these health oriented activities, the centre will use the model of a tertiary teaching hospital to implement a new model for educating IT professionals.

II. Australian Health System Structure

The Australian health system shares many features with the national health services of other developed nations, but with some of those features coloured by the particular history of the Australian health system in terms of its political evolution. Australia was formed as a federation of six states in 1901, with state governments given constitutional control of health care. As a consequence, state governments finance and operate all government hospitals and most government controlled community health services. The federal government has no constitutional role in health care, however, it is the main collector and distributor of taxation revenue. In this financing role, the federal government controls a national universal health insurance scheme, known as Medicare. Through this and a number of granting schemes, the federal government pays for a proportion of the private fees for medical practitioners, as well as supporting the supply of pharmaceuticals and special schemes targeted at disadvantaged groups.

One of the by-products of this funding split, is ongoing concern over the shifting of health costs between state and federal levels. [6] If a patient is treated in a public hospital then the cost is borne by the state government, whereas if the patient is discharged into the community to be visited by their general practitioner (GP) then the cost is borne by the federal government. The result of these perverse incentives has been to bounce patients between community and hospital care with unsatisfactory impacts on their health. To address this problem, state and federal governments have experimented with improving the coordination of services to reduce this problem and improve overall levels of care. Much of this work has exploited information technology (IT) to improve communication for this coordination task.

The other axis in patient care has been a split between public and private health services. The public health services consist of major tertiary teaching hospitals, rural hospitals and some community services, mostly targeted at specific health issues. The private sector contains private hospitals of varying sizes, but mostly located in urban areas, and also the provision of most medical services outside the major public hospitals. Most medical practitioners are in private practice, but their services are partially or totally funded on a fee for service basis by the federal Medicare system. In addition to the public Medicare system, individuals can obtain private medical insurance to cover the costs of some allied health services and the costs of being treated in a private hospital or in a public hospital when admitted as a private patient. One of the consequences of this private/public structural split is that most medical practitioners, in particular GPs, operate as small independent businesses.[5]

III. Problems in Health Service IT Delivery

As indicated in the previous section, the fragmentation of the health sector has compromised patient care and efficient resource use. Patients can be discharged from hospital without their GP being notified of their discharge, their treatment in hospital or the treatment regime on discharge. As a consequence the patients condition may deteriorate before the GP is made of aware of the patient's discharge, by which time the patient must be returned to hospital. Improved communication between elements of the sector could reduce adverse events and improve the delivery of care. The provision of communication systems between hospitals and community based services is complicated by a mismatch in IT resources - particularly in terms of IT skills and access to support staff.

Whilst Australian hospitals are confronted by similar resource pressures as exist in other developed economies, they still have significant IT budgets. In the private GP practices, there has been a low uptake of computerised clinical records. Approximately 80% of GP practices have computerised billing systems, but only between 3% and 10% use IT for clinical records. [3][4] Through the federal government's Practice Incentives Program (PIP), GPs have been given $10,000 for the installation of PC's in their consulting rooms.[7] This initiative has produced a marked increase in the presence of PC's and their use for clinical

prescribing. However, the use of these PC's for full clinical records, access to Web based information resources, and for service coordination has been hampered by the usability of the available software, the unreliable support available through small PC vendors, and the overheads of maintaining continuous data communications.

Within the hospital sector, IT managers face many pressures common in all major organisational contexts. There are however some problems that derive from the hospital environment:

wide variety of applications requiring support. A finance or manufacturing company which may have many users, but the focus of the applications will be constrained by the core business of the organisation. Also the increasing use of ERP software suites has meant that many of these applications share a common interface. Whilst all of a hospital's departments are focussed on health care delivery, they may be engaged in very divergent activities, from medical imaging to intensive care monitoring. Compounding this problem is the tradition of clinical directors of individual departments purchasing PC based systems to address their own needs with consequent problems of interfacing with other systems and divergent user interface standards.

training a large number of rotating staff. As with any large organisation, a hospital will have a large number of users requiring training on their systems. An added complication is that many of these permanent staff may be part-time staff working on evening or weekend shifts. In addition, junior medical and some nursing staff will be working on rotations which move them to new departments every ten weeks, necessitating repeated training on localised applications software used in their new departments.

availability of IT staff. For the major public teaching hospitals with the largest IT infrastructure, the public sector salary structures applying to these institutions prevent the offer of salaries to competent IT staff which are commensurate with those in the private sector. This has been particularly true for staff with Web based skills.

A solution exists for two of these problems yet which accentuates the third problem. The move to thin client browser based applications will reduce the variety of applications operating on departmental PCs and thus simplify support needs. In addition, the use of a uniform browser based user interface will reduce the re-training requirements. Unfortunately the move to browser based solutions demands skills which demand the highest premium in the commercial marketplace, exacerbating the IT skills shortage. [1]

IV. Independent Health IT Service Centre

The rise of digital communication networks is most commonly associated with the World Wide Web and the ability to access remote information. However, one of the most important information industry trends enabled by these networks is the move back to centralised processing through the use of desktop computers as so-called "thin" clients (that is, they require very little processing capacity). [2] At the moment, this trend has been manifest mostly in the intranets of larger organisations where it is becoming standard to use remote information and application servers, with desktop computers supported by a centralised administration.

A related trend is toward outsourcing, in which larger organisations may not only hand over the IT function to the specialist outsourcer, but may move the actual processing and management to a central facility operated by the outsourcer.

The proposed solution to the problems outlined in Section III is establishment of the Health Operations Centre for the Hunter (HOCH). This centre will be managed by an external IT outsourcing company with expertise in facilities management, desktop support and applications development. The systems to be supported will wherever possible be selected or developed with a thin client, browser style interface. The initial activity of the centre will be the support of applications within the hospitals and area health service installations across a significant proportion of the state. This would represent the consolidation of the applications support across a number of currently independent data centres within regional area health services, with presumed economies of scale in terms of operations, application development and desktop support.

The move to browser support should reduce the training commitments, and simplify the desktop support demands by users. The more flexible remuneration options possible in the private sector and the presumed industry expertise of the outsourcer will overcome staffing problems for these browser developments. The outsourcer would still need to accept a commitment to a 24 x 7 level of support.

What takes this proposal beyond the simple outsourcing of hospital IT to an external centre, is the formation of virtual networks of outsourcing clients amongst the community health care providers as the first SME (Small and Medium size Enterprise) clients of the centre. Within the Newcastle region, a government sponsored organisation - the Hunter Urban Division of GPs - has a program of supporting the IT needs of GPs. The expanded range of resources available through a major outsourcing company could expand on this support.

In comparison to other SME target groups, networks of GPs form an ideal SME market for the provision of ASP and information services as they are relatively homogeneous, technically aware and have an existing organisation representing their interests in the form of Divisions of General Practice. One of the major difficulties in successfully implementing IT integration proposals has been the organisational barriers to gaining agreement and coordination of IT services across a range of health care providers. The co-location of information processing for a major government health unit, together with SME support services for GPs at the centre, would assist in providing for rapid and effective implementation of IT services to support health information exchange and care coordination.

The Hunter Urban Division of GPs, which has endorsed this project, already has a nationally recognised reputation for its programs to support clinical GP systems. With the Division coordinating the enlistment of GPs and defining the requirements for their desktop maintenance, the centre can provide a support infra-structure which is both predictable and continuously available.

The channeling of the IT support for a large number of GPs through such an ordered and supervised process will yield insights into the obstacles that remain in the design of effective clinical systems. Similarly, the desire of the centre operators to reduce their overheads for help desk support, together with the relationship with University researchers, may provide insights into the causes of problems with the larger hospital based information systems.

By providing support to the major systems in the health network, the centre will be positioned to develop workable solutions to integration problems within the health system. For example, where currently breakdowns in pilot information exchanges between hospitals and GPs result in calls to the hospital's IT group and to the independent retailer who sold the GP their desktop system, the centre could isolate the failure to whichever element in the exchange process is at fault and apply a solution.

The siting of the centre in Newcastle takes advantage of the comprehensive health care services provided within the Hunter regional area. The full range, from community health facilities, poly-clinics, rural and peripheral hospitals, through to a tertiary teaching hospital, exist within the one Area Health Service.

V. Problems in IT Education

Computer science and information systems education has been designed against a world in which purpose-built systems supported relatively small business units. The analysis of the business requirements and the development of the technological solutions for these could be scaled up from the toy systems built in most class rooms. It was possible to require a work placement as part of the program, to round out the student's experience. However, as the number of students grew and the willingness of employers to take on students diminished, this practicum was usually replaced by a project on which students worked in teams.

The important trends to packaged software, networked systems and integrated information have not been well accommodated in most tertiary courses, and certainly have not been anticipated by proactive changes in course content.

We are now facing an era of complex integrated systems, in which many different types of processing units will be linked in intricate networks. These processing units will range from dedicated control and personal computing devices, through to high performance centres acting as information service bureaux for global companies and the home leisure market alike. There will be an enormous increase in the amount of knowledge and data captured and archived.

Yet the majority of University programs throughout the world remain based on skills sets largely identified a decade or more ago (eg. Association for Information Systems IS'97 Curriculum Report, the Australian Computer Science Core Body of Knowledge). Such programs assume that the curriculum provides foundational knowledge sufficient for students to rapidly adapt to changes in technology. It is not clear that this assumption is justified, as employers are increasingly complaining about the disconnect between practice and teaching, and about the amount of on-the-job training required.

Key problems affecting the provision of education in information technology include the following [1]:

> The rate of change of technology and associated rate of change of organisational and business models makes it difficult to assess what are the foundational principles in the discipline
>
> High salaries are offered by other parts of the industry compared with traditional academic salary levels, so it is difficult to attract good staff with leading-edge knowledge
>
> The increase in complexity of systems and the expense of providing state-of-art exposure makes it difficult to expose students to leading-edge practice
>
> Industry pressures (over demand for services, rapid rate of change) make industry reluctant to engage in post-graduate training.

VI. Utilising the Medical Education Model

The teaching of medicine has many elements in common with the teaching of information technology. Both impact on economies and society. Both are complex and multidisciplinary. Both experience rapid change. Both are government priorities.

Since its first intake of students in 1978, the Faculty of Medicine and Health Sciences at the University of Newcastle has gained an international reputation for the use of problem based learning (PBL) in its undergraduate medical program. The success of this approach has resulted in its adoption by other leading Australian and international medical schools. The PBL approach has also been incorporated into a number of other disciplines at the University of Newcastle, including law, architecture and nursing. PBL has also been incorporated into the final year project work for information systems students.

Whilst the inclusion of PBL techniques has improved the educational value of the student projects, there is also significant value to be gained from copying the common medical education model of incorporating medical education into a tertiary teaching hospital.

There are five characteristics of university medical education that are also applicable for the teaching of information technology:

> Practitioners play a key role in teaching and in research, and have long term relationships with the University partly based on a sense of professional duty.
>
> All students receive a grounding in the workings of the entire human body, its diseases, diagnoses, and the planning and implementation of intervention strategies.
>
> Students have guided access to real patients (metaphors for organisations), with the access progressively increasing in risk throughout the course of the student's study.
>
> There is teaching on-site in major teaching hospitals, involving state-of-the-art equipment and practices.

Students are exposed to research-in-progress, involving observation and trials on real patients.

All of these characteristics could be replicated in a program which placed students for a clinical year in a large modern application support centre which had a teaching obligation: the analogue to the "teaching hospital". In addition to its leading edge operational practice, the centre would provide research facilities to ensure continued improvement in the performance of its partners and its customers.

The type of three year University program envisaged will entail a first year of study designed to give an organisational foundation for subsequent information technology study. This would provide mastery of the basic principles required for understanding and describing organisational systems, strategies, and behaviours. In the second year, emphasis will shift to the study of information technologies that support enterprises, leading to greater understanding of how technology interventions can alter structure, function, and behaviour. The approach will be problem based, with hand-on experience with the technologies as they are introduced.

These experiences will prepare students for the intensive training in the third year. This year would be spent in "clinical" study based around the applications support centre, in which they will work with organisations under supervision. Students will rotate through specialty services, participating fully in teams. Students will graduate with the technical and human skills required to contribute immediately as IT professionals at the leading edge of practice, but with a scholarly base that would enable them to play a leading and continuing role in innovation.

VII. Problems with Regional and Small Business Uptake of Sophisticated IT Services

The need for Australian organisations to adopt information technologies has been set as a national priority. Government initiatives to overcome adoption inertia include providing information and assistance through the Australian Electronic Commerce Network, which aims to foster awareness of electronic commerce among SMEs. However, there is real concern that Australia, and particularly regional Australia, will be seriously disadvantaged in the changing commercial, educational and social environment brought by the Internet.

Partly the problem is the poor quality of regional telecommunications infrastructure, due to extensive distances between regional centres in Australia. However, small business also lacks the expertise to choose, install and manage IT resources. Many small business owners make their firm's technology decisions, but, because they often see technology spending as a cost rather than an investment, they make short-term needs-based purchasing decisions. The alternative use of consultants is an expensive choice for many small businesses, and again, ignorance makes the selection of the appropriate consultant difficult. In such a climate, use of information technology is rarely strategic.

The use of the HOCH centre to support virtual corporate networks of SME's involved in health (ie GP practices and other health providers), will provide the basis for extending the range of activities into other sectors. Just as an analysis of the needs of GPs have been used to determine a base for a service level agreement, a similar process can be used for other industries. Through this mechanism the centre can assist in the broader uptake of IT and ecommerce across a range of SME's.

VIII. Conclusion

The project described in this paper represents a novel approach to delivering IT services to the health sector. The HOCH centre provides not only a new model for exploiting the Web based delivery of basic functionality, but also a solution to the coordination problems encountered by the sector. In addition to the improved IT support for both hospital and community based health services, the model used to support the GP and other independent health providers can be extended to provide IT services to other collections of SME's. The centre also extends the model of medical education into education of IT professionals.

References

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