Recommendations on the Design of Hospital Intranets

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Abstract. Intranets are being widely introduced in hospitals like in many other organisations. Although their development is just like setting up any other information system in a hospital, there is a tendency to neglect well established principles of software engineering and information system design in that area. Starting from a functional definition of an intranet, we illustrate its potential importance for a hospital from different aspects. A systematic framework for an iterative design and maintenance process is suggested. Some important design principles are depicted.

1. Introduction

Intranets are being widely introduced in enterprises and public institutions. A number of hospitals are developing intranet services (e.g. [1], [2], [3], [4], [5], [6]). Many intranet projects are initiated and carried out by enthusiastic individuals or by hospital computer departments who are convinced of the advantages of this technology. Typically, they start with the provision of services which are available at low costs, planning to convince as many users as possible of their usefulness. In this way they hope to gain support at the hospital's executive level and receive the funding necessary for more costly services ([7]).

The advantage of this "grassroots" approach lies in the low initial risk, high staff motivation, and its likeliness to produce pragmatic solutions ([7], [8]). However, it carries a considerable risk of getting stuck halfway, never being widely accepted or used by more than a minority of computer enthusiasts, and never receiving the funding necessary to build a truly comprehensive intranet ([9]). This is due to the fact that these projects are often driven by technology and technologic enthusiasm rather than by the goals and needs of the organisation – that they aim to convince people by "pretty utilities" instead of systematic and precise support of their workflow. The development of an intranet is just another software development project – it should not neglect long standing experiences and established methods of informatics and software engineering ([10], [11]).

2. Background

In our institution, we gathered practical experiences with the implementation of a hospital intranet and an "Extranet" of an international scientific association ([12]). Starting from the problems we encountered and the solutions we found, and supported by proposals made in literature, a stepwise and cyclic approach for designing hospital intranets is suggested, which tries to avoid the drawbacks mentioned in the introduction while preserving the enthusiasm of the potential contributors and users.

3. What is an intranet?

Usually, an intranet is being defined as a "private" version of the Internet within an enterprise or institution, using Internet protocols like TCP/IP, HTML, and others ([13], [6]). This technological definition may raise some questions. An information service – let's say the hospital library's retrieval system for scientific literature – uses Novell's IPX protocol: is it therefore not part of the intranet? And, if not, will the users of the retrieval system understand the difference? On the other hand, take a laboratory system and an electronic patient record system exchanging laboratory data via a communication server, using the FTP protocol: is this automated communication between two application systems part of the intranet? And, if so, will the person responsible for the administration of the hospital's intranet assume responsibility for maintaining that communication link?

To avoid thus being trapped by one's own definition, a more functional definition of the intranet is suggested:

The hospital intranet is

a set of network-based services which provides a defined group of users (typically employees and patients) with the possibility to retrieve and share information internal to the organisation, to co-operate in pursuing the work processes of the organisation, and to acquire relevant knowledge and skills; it is aimed at rising the health care quality and overall productivity of the hospital and

relies on standard networking and application technology.

4. What are the benefits of an intranet for a hospital?

To implement and maintain the services of a full-grown intranet is a costly undertaking ([14]). What are the benefits that a hospital can expect from engaging in this field?

Cost reduction. First of all, it might be able to *reduce costs* ([15], [16]): costs for printing, copying, distributing and storing information material; costs for unnecessarily prolonged processes, caused by missing, outdated, inaccurate or difficult-to-retrieve information; costs for redundant and uncoordinated activities caused by inadequate communication between the people involved. With widely established tools and mechanisms, an intranet can be used to distribute and exchange information. There are two aspects, however, that should be kept in mind. When assessing the long-term cost-benefits of the intranet ([17]), it should be considered that the costs of technical equipment and the development of "content" are usually doubled by maintenance costs. Another concern is that if the intranet is introduced with the sole purpose of reducing costs, there is some danger that it will not be accepted by its potential users ([18]). The hospital's executives may find that it is much cheaper to distribute directives and guidelines via the intranet, but that their publication goes unnoticed as the intranet provides too little support in everyday work to be used regularly ([19], [9]).

Quality improvement. If retrieval and exchange of information are being made easy, quick and reliable, the work processes of a hospital will be more efficient ([15]) and the quality of their outcomes is likely to improve in terms of patient health and satisfaction of patients and employees ([20], [1], [4]).

Workflow support. The intranet can *support the personal workflow* of the hospital's employees. This means that the intranet not only enhances the overall effectiveness of work processes but effects a subjective facilitation for the individual user, increasing his/her productivity, providing him/her with more time for higher level activities, and raising his/her motivation ([16], [21]).

Patient information. *Patients* may be provided with information via the intranet, e.g., about their disease and its therapeutic options, the internal standards and conventions of the hospital, or advice for the time after discharge ([22], [23]). This carries a high potential of better informed decision making, thus giving the patients a greater sense of self-control.

Shaping corporate identity. For the *corporate identity* of an organisation to be effective, it has to be reflected in the organisation of the work processes. The intranet mirrors at least part of a hospital's work processes and thereby inevitably shapes the employees' picture of their employer's identity. Taking this into account, an intranet is the optimal tool for presenting, demonstrating, and affirming corporate identity to the employees in everyday work – and to patients, too ([24]).

5. Suggestions for the design process

Due to the high strategic relevance of an intranet, its development has to be initiated and monitored on the *executive level* (e.g., the board of directors or its affiliated committees). Like in every strategic software development process, its potentials have to be realised by careful processes of planning, design, implementation and continuous improvement. The design of the intranet has to be closely aligned with the *business policy* of the hospital so that both are being perceived as authentic ([25]). Business policy also builds the ground on which the concrete objectives of a hospital's intranet can be reproducibly stated (<Hills, 1996 #14>, [26]).

A system of objectives is the starting point for any appropriate design and implementation process. The objectives serve

as a justification of the efforts required,

as a guideline to solve conflicts which inevitably arise during the design and use of the intranet,

as a model to identify deficits and to prioritise improvement projects,

as a measure for the success of the projects.

The system of objectives usually is structured hierarchically and contains priorities (for an example see table 1); it has to be consented by all relevant groups in the hospital. Otherwise, those groups are not likely to support and use the intranet to the extent necessary ([18], [9]).

Table 1: Example section of a possible system of objectives.

anet	: System of Objectives (cut-out)							
To support staff development by providing high-quality, cost-effective, relevant and								
convenient computer-based training services and self-learning material.								
Toe	nhance inter-person and inter-department communication by providing							
effici	ent, convenient and secure services for the exchange of messages, docu-							
ments, and media, in order to								
e1)	increase the efficiency of work processes,							
e2)	improve interdisciplinary co-operation in health care, research and teaching							
	(at a university hospital),							
e3)	make the utilisation of internal services (the library, the computer centre, the							
	training centre, the media centre, the typing service etc.) easier and more ef-							
	ficient							
	To su conv To eu efficie ment e1) e2) e3)							

As soon as the objectives and their priorities are agreed upon, *projects* can be set up. Projects are defined to create new intranet services as well as to improve existing ones.

Each project is linked to a subset of the system of objectives to which it is meant to contribute (for an example definition of a project see table 2). To ensure the usefulness of the services developed, the potential users of these services should be part of the project group ([9]). Table 2: Example header of a possible project definition

Project definition: P3: Training Resources Information System - TRIS (cut-out)
Project goal: To create an intranet service of the hospital's Training Centre providing the
employees with
- an up-to-date directory of internal training courses, supplemented with information about
learning objectives, time schedules, conditions for participation, prizing information etc.,
- an up-to-date directory of computer-based learning materials and programs, supple-
mented with information about learning objectives, technical requirements, availability,
registration etc.
- an intranet forum for clients of the Training Centre to openly discuss the details and
usefulness of the centre's courses and products.
Related intranet Objectives:
- d), e2), e3),
Project Group:
- Training Centre (in charge)
- Representatives of relevant user groups: nursing, medical, administrative
- Computer Centre (technical implementation)
Time schedule:
Resources:

Up to this point, we described intranet development as a *top-down* procedure; in many organisations, however, local projects are formed as a reaction to local problems, independent of centrally defined objectives and priorities. This *bottom-up* initiative is far to valuable to be wasted. Taking the system of objectives as framework, local projects can be integrated into the common efforts to build a useful intranet. If a local project doesn't fit into the system of objectives and priorities, the first step should be to verify the system by exploring the motivation for this project.

Each project concludes with an evaluation of the efficacy, or usefulness, of its achievements ([25]). This can be done in a group of "pilot users", usually comprising the users in the project group. In case of a positive result the new service is introduced into routine use on the operational level, usually allocating responsibility to the intranet administrator.

The status of all intranet projects as well as the objectives' degree of accomplishment is constantly changing as the projects evolve. The evolution of the intranet may be called a iterative, or cyclic process. To monitor the status of the overall venture at the executive level, an *objectives-projects matrix* (OP matrix) can be set up and continually updated (see table 3). The OP matrix shows at a glance whether important objectives are pursued by one or more current projects and whether current projects contribute to one or more important objectives. After the evaluation of a project the OP matrix is updated and the status and priorities of the objectives are revised. New projects may be defined.

Continuous improvement

Once the evaluation of an intranet service achieved positive results, the service is introduced into routine use in the hospital. This introduction may be associated with a transfer of responsibility, from the project team to the operational domain (e.g., the intranet administrator). Evaluation, however, doesn't stop here. Like in clinical pharmacology, a sort of "post marketing surveillance" is necessary to assess the usefulness of services in everyday practice. So, for instance, the user should be encouraged to report "adverse effects" and usage problems. Systematic monitoring of usage parameters is necessary not only to assess the popularity of a service in the course of time (e.g., page access rates), but also to find out if the service is being used as intended (usage frequency of selected functions, communication partners, type and volume of exchanged documents etc.; [18], [26]).

The OP Ma	trix (cut-out)				
	Curre	nt projects Status		P3: TRIS Evaluation	
Objectives	Priority: A-C	% achieved	L		L
d	А	10%		•	
e1	A	20%			
e2	С	20%		•	
e3	В	50%		•	

The results of user reports and the monitoring process may indicate starting points for improvement and extension of the services. They have to be fed back regularly to the executive level (e.g., the Intranet Planning Board) where they are considered for revisions of the project schedule. Post marketing studies have to be carefully planned and, like a clinical trial, need to follow a "study protocol" ([27]). This protocol must be created in the project phase of the respective service and handed over to the operational domain when introducing the service into routine use.

Intranet services must be regularly updated and extended. If they are not, users will soon cease to access them as no new information is to be expected ([9], [26]). *Content maintenance* has to be planned during the project phase: responsibilities and workflows have to be defined which ensure the currentness and accuracy of all content. Local knowledge and commitment should be exploited for this task ([28]).

6. What principles apply to the implementation of an intranet?

Obviously, the selection of methods and tools depends strongly on the objectives that have to be reached; the selection is on of the first tasks of every project. There are, however, some general principles which should apply to all projects and guide the overall design process. Those principles ensure that general requirements are met and that projects are set up and designed in a co-ordinated way, avoiding redundancy and utilising synergies. Here are some principles which should be considered (and elaborated) in every intranet.

Accessibility. If a hospital plans to support its employees and patients with the functions of an intranet, an important prerequisite is that the whole target group has *easy and permanent access* to it (i.e., to a networked PC with the necessary software). The intranet will not be successful if readily available only to a privileged subset of employees. Furthermore, every user must be provided with minimal functions to *personalise his/her intranet environment* in order to save or bookmark important information, to privately communicate and to pre-configure often-used ways. Given a perfect infrastructure and complete functionality, the intranet still will not work as expected if the users are not adequately *informed, motivated and trained* in its use.

Content Management. Content is the life blood of an intranet ([28]). It has to be accessible, understandable, current, accurate, and useful. The bigger the success of an intranet, the faster the demands for additional and better content will grow ([26]). To systematically keep all information up-to-date, to extend it where required and to supervise all necessary workflows and communications, a *Content Management system* has to be in place ([29]). To be able to draw on local competence and commitment for producing and updating content, easy-to-use *Authoring systems* are of substantial value ([28]).

Even when all necessary services are operational and streamlined, substantial efforts at the operational level are necessary to keep all information up-to-date, to delete obsolete information, and to supervise workflows and communications

Selective centralisation. The creation and maintenance of an intranet has substantial *organisational implications*. At times there will co-exist many larger and smaller intranet projects which have to be co-ordinated. Lacking co-ordination leads to redundant functionality, incompatibility of solutions, and "information islands" ([9]). How, then, should the development and maintenance process be organised? To do it centrally would have the advantage of better co-ordination, better control, and less redundancy. However, central departments tend to lack flexibility and sensitivity to local users' demands, require a good deal of bureaucracy and are often overloaded with work. The solution is to centralise selected activities which are necessary to ensure co-ordination and efficiency as well as to pool expensive competence. All other activities should then be delegated to local project groups or single persons in order to utilise local knowledge, flexibility and commitment.

Integration and Standardisation. There are some *principles of information processing* which apply to intranet as they do to all information management systems. First of all, there is the need for *data integration*. Data should be captured only once in a way that they can be used for multiple tasks. *Functional integration*, on the other hand, makes sure that once a way is found to solve a certain problem (e.g., by purchasing or developing a software function) this solution is applied to all similar problems, too. Integration requires a lot of coordination and standardising efforts, but it increases quality and productivity. *Standardisation* of information and processes to a certain degree is a prerequisite to integration. Furthermore it enables communication across organisational and technological borders. Standardisation must not be taken, however, to a point where it restricts the diversity of activities and initiative supported by the intranet.

Security. A strong concern in the health care sector is *information security*. Systems generally have to be available around the clock, seven days a week. Loss or corruption of information can have serious consequences for the health of people. Personal health data and personal work data must be ranked highly sensitive. Since experience shows that more than half of the breaches to confidentiality and integrity of data is committed from *within* organisations, security precautions have to be taken as if the intranet services were provided in the Internet. They have to be equivalent to established standards in hospital information systems ([30], [8], [24]).

7. Synopsis

It has been depicted that the development and continuous improvement of an intranet is a cyclic process involving three domains of responsibility (see figure 1).

Figure 1: Intranet development and continuous improvement process. The process includes multiple cycles; its stages and activities are situated in one of three domains. Determination and continuous update of the business policy, the intranet's system of objectives, and of general design principles are performed in the executive domain. All activities for defining, planning, designing, executing and evaluating projects are done in the project domain. After successful termination of the project the intranet service goes into routine use. The responsibility for



support and maintenance as well as for usage monitoring is transferred to the operational domain. The results of all evaluation steps are fed back to the proper domain.

In conclusion we want to emphasise six core recommendations for the successful introduction of an intranet into a hospital:

Strive for the support of the top executive level which it deserves due to its strategic importance;

Closely align the development to the business goals of the hospital;

Utilise local competence and commitment in well-defined projects;

Co-ordinate all projects centrally and monitor them against a consented and regularly updated system of objectives.

Use adequate tools to collaboratively provide and maintain content.

Evaluate the efficacy and long-term usage of every Internet service and feed back the results into the co-ordination process.

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