

## 7. Intranets

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An intranet is a private mini-Internet, cut off from the outside world (see Figure 1). Inside the intranet, people use linked computers to browse material held on the server or to send messages, files or other information in the same way as they use the Internet. If there is a special 'firewall' computer, authorized people on the intranet can also access material in the outside world on the Internet or NHSNet but no one in the outside world can access the organization's intranet (unless specifically permitted). The firewall acts like a one-way valve, so instruments are ideal for healthcare organizations, with their identifiable patient data and other confidential information<sup>1</sup>.

### PROS AND CONS

Why should a healthcare institution wish to install an intranet? First, organizations within the National Health Service have low budgets for information technology (IT), often relying on a range of out-of-date equipment and unable to insist that only one brand of personal computer (PC) is installed. Because free or inexpensive e-mail and web browsing software are available for nearly every kind of computer, including obsolete PCs and Macintoshes, an intranet is an ideal low-cost way to link these up and allow users of heterogeneous systems to access material throughout the organization.

Second, once employees are familiar with browsing the organization's intranet from one computer, they will be able to perform the same and other tasks from any linked computer. With the limited NHS budget for IT training opportunities, this is useful.

Third, the speed of change in healthcare means that the chosen computing system must be very flexible and capable of development with minimum input from expensive IT staff<sup>1</sup>. Intranets satisfy this requirement well, even allowing information from numerous 'legacy' systems to be brought together on one screen<sup>2</sup>. The other implication of rapid change is that NHS organizations create and revise mountains of paper documents (general practitioners receive 15 kg of guidelines alone every year<sup>3</sup>). An intranet means that only one copy of each document—the current

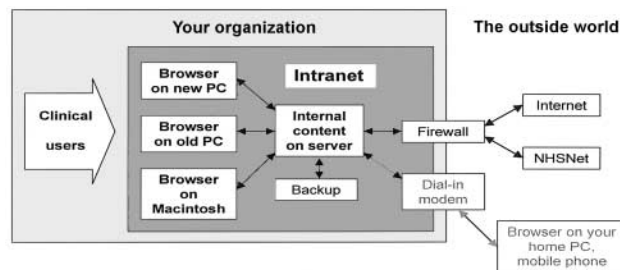


Figure 1 How an intranet relates to your organization and the outside world

version—is maintained and available, and any authorized person who needs to refer to it can do so, from any linked machine. Because the document is held on a central server with daily backup, it is safer than one held on the author's office PC. To ensure that no document copies—paper or electronic—are needed, every person who needs access should be granted it, whenever and wherever he or she works. A consultant holding an outreach clinic at a health

### Box 1 Benefits common to an intranet and the Internet

**Everyone 'has' the latest version of every document:** single organization-wide shared filing cabinet/library for documents and information with no duplication (unless it is copied or printed out)

**Anyone can join in:** browsers work on every platform and most operating systems, even obsolete Macs, PCs, Suns or personal data assistants

**Easy navigation:** browser programs provides 'back' and 'forward' buttons and easy access to a list of recently browsed pages

**Fast complete detailed searches:** all documents are held in electronic form and indexed

**Easy customization:** users can readily 'bookmark' a document or page by adding it to their list of favourites in the browser

**Easy sharing of expensive hardware** such as high-capacity file server, high-volume printers, automatic-feed optical mark readers (for patient surveys or research)

**Eases training and support:** web browsers are a single universal program; 'thin clients' and 'application sharing' mean that the same software package is installed once by an expert and downloaded to your computer

**Allows access to multimedia:** e.g. for training and reference

**Allows access to masses of data:** web servers can construct pages dynamically from information held in databases.

Table 1 Benefits of a local intranet over the Internet

Local intranet	Unrestricted access to Internet
Allows a sense of ownership: provides a first stop before the Internet, with local news and information	No local ownership: content of the first stop before the Internet depends on the particular Internet service provider used
Directs staff to local high-quality content relevant to the organization, with no distractions	Hugely varying content, many distractions
Maintaining confidentiality of local material is simple: firewall automatically isolates intranet from outside world	Maintaining confidentiality is complex: requires knowledge, administration of passwords, etc.
Organization oversees intranet content, architecture and security, how staff access the wider Internet	Organization has less control over content, how staff access the Internet
Differential access: access levels can be tailored to different professional groups, roles, functions, etc.	No differential access
Allows quality improvement: the organization can measure use of intranet resources to improve its information services	Hard to implement quality improvement, e.g. monitor staff use of remote sites, provide guidance, improve quality of content
Allows economical access to licensed material: bulk site licence for material cheaper than many individual licences; well-designed intranet ensures that licensing conditions will not be violated	Expensive <i>ad hoc</i> access to licensed material: more expensive; staff may share passwords etc., violating licensing conditions
Improved performance and reliability: organization can invest in local network and servers to improve performance	Variable speed and reliability: at the whim of the Internet services provider; often limited to 56k modem link

centre or working from home will need to use documents or data held on the trust intranet. This means extending the trust network beyond obvious physical boundaries—for example, by using a secure dial-in route as shown in Figure 1. Careful configuration is needed to ensure it does not become a back door for unauthorized access; one approach is a ‘defender’ system, which receives your call then dials you back on a previously authorized number. Access to intranets from third-generation mobile phones will also be needed soon, since these devices may replace phones, pagers and PCs for many staff who never even leave the building during office hours. In future, we may move toward larger closed health intranets, to support continuity of care and mobile health workers in community care organizations<sup>4</sup> or bigger health regions<sup>5</sup>.

Fourth, finding a paper document—especially the latest version—can be a headache, even when you know exactly which document you want. It is much harder when all you know is that a document must exist somewhere on the topic. An intranet is like an electronic library, holding all documents in digital form with a detailed index; thus you can search by text words or key words, even when you do not know where it is or what it is called. Box 1 summarizes the general benefits of both an intranet and the Internet,

while Table 1 contrasts specific benefits of an intranet with those of a direct link to the Internet.

**Drawbacks**

On the minus side, setting up an intranet is not always technically or organizationally straightforward. It can be expensive, with costs including:

- Capital costs of the server and firewall and of installing a high-capacity network with ubiquitous access points
- Revenue costs of staff to support and maintain the network and intranet server, to train users and contributors
- Costs of obtaining material, whether externally licensed or internal. For example, licensing of a few bibliographic databases and a score of full-text journals to an NHS hospital intranet might cost around £10 000 a year. Costs also include the time spent by staff on assembling, organizing and updating internally contributed material.

Some of this expenditure may be necessary for other purposes, such as electronic prescribing or picture archiving systems.

What other drawbacks? Here are a few. The organization is responsible for any abuse of copyright material—for example, if people scan textbook images onto their pages. By preventing staff from accessing the Internet in an *ad-hoc* way, the organization takes on the responsibility of training users to get best out of the intranet; some users may resent restriction of their access to the Internet because the firewall prevents them downloading programs or setting up an open-access Internet server. Once connected to an intranet, an internal rogue user or virus has greater access to other people's information. A single linked machine which also has a modem connection to the Internet can also threaten the security of the whole intranet. Finally, where a partner organization already has its own intranet, there is sometimes a dilemma about whether to join it or build your own. Failure to address this in one UK teaching hospital gave rise to three network points on the wall behind every PC in the oncology unit—one each for the NHS Trust, the medical school and a major cancer charity.

An understanding of the distinctions between an intranet and the Internet and the potential drawbacks of intranets is only the first step in exploiting this attractive technology. One further possibility, allowing the user the benefits of access to the Internet as well as the intranet, is to extend the intranet outside the organization to a few carefully selected Internet sites, such as Royal Colleges or providers of licensed content. This approach has been called the extranet model.

## CLINICAL APPLICATIONS OF INTRANETS

### Publishing and browsing static content

This is the traditional application of intranets, to enable clinicians and others to access a variety of documents, including:

- Browsing 'frequently asked questions' with clear, concise, answers on topics of importance to the organization
- A local bulletin board, perhaps with the current issues of local newsletters and an archive of past issues
- Lists of current research in progress, courses and conferences, etc
- Documents about quality standards and performance; the organization's annual report, listing how each department matched up to these standards
- Junior doctors' or laboratory handbooks, local policy documents
- The local formulary and book of local or national practice guidelines.

### Accessing databases over an intranet

Clinicians will be familiar with use of computers in a library to access knowledge sources such as drug information

(WeBNF [www.pharmpress.rpsgb.org.uk], Micromedex), Best Evidence / Clinical Evidence [www.evidence.org], electronic textbooks, bibliographic tools, library catalogues and full-text journals (e.g. Ovid [www.ovid.com]). However, such knowledge sources can be networked over an intranet to give access from your desktop PC. In a recent French study, this doubled the use of Medline, leading to many more searches relevant to patient care<sup>6</sup>. The same technology can allow access, via a web browser, to information traditionally held in rather hostile databases. Such data might include:

- Patient data—a master patient index with patient demographics or more clinical information such as laboratory, radiology or endoscopy<sup>7</sup> reports or even a full electronic patient record<sup>2</sup> or picture archiving and communications system<sup>8</sup>
- A directory of local people, services and clinics, held in frequently updated form in a database
- A directory of all drugs available, with their characteristics<sup>9</sup>.

### Interactive tasks

Increasingly, clinicians are using communications and information technology to assist in more complex tasks. In the past this often meant learning the quirky commands of specific software tools, but many of these functions can now be achieved through a web browser operating over an intranet. Here are some examples:

- Communication: sending and receiving e-mail to individuals or discussion lists, both internal and external to the organization. When combined with on-call schedules, a calendar and work schedule, a personnel directory and a clinical information system, this can greatly improve departmental function<sup>10</sup>
- Decision support tools ranging from a simple form with blanks to calculate anion gap or risk of ischaemic heart disease to a complex computer model such as the Heart Disease Program<sup>1</sup>
- Interactive learning resources such as patient simulators or complex case data combined with multi-choice questions. Many institutions already have much material that can be converted to intranet format<sup>11</sup>, or it can be written from scratch. For example, in Sydney, 400 faculty members have placed material on their intranet to support the new problem-based undergraduate medical curriculum<sup>12</sup>
- Booking of NHS resources, such as outpatient appointments or meeting rooms; ordering reprints from a library; scheduling a meeting with peers by use of their web diary

- Collaboration tools such as a shared departmental reference database or tools for joint authoring, submission and tracking of a research project
- Telemedicine tools for referral and case discussion by use of 'lean' videoconferencing or store-and-forward techniques<sup>13,14</sup>. Linkage of neurosurgical stereotactic instruments to an intranet has even been reported<sup>15</sup>.

New applications of intranet techniques are constantly being invented; see the Oxford clinical web applications directory [www.oxmedinfo.jr2.ox.ac.uk/cwap/dir.taf?f=home]. The new NHS Plan<sup>16</sup> makes extensive reference to the use of such technology to improve clinical practice and patient outcomes, but so far few if any of the above have demonstrated such benefits in rigorous studies.

### COMMISSIONER PERSPECTIVE

From the perspective of the organization, an intranet needs high-level support and this can be part of the strategy for quality, human resources, risk or knowledge management. Construction and maintenance of an intranet, and training people about it, is an ideal role for library and information services staff, who are already experts in indexing, PC training, networking, Internet and intranet technology, and negotiating access to copyright material. It is *not* a project that can be left to the IT department. This is because a well designed intranet needs to:

- Include high-quality information: content should be regularly checked for accuracy and currency by those who provide it
- Be easy to browse: logical organization, consistent design
- Be easy to search: across the whole site, similar documents, within a single document
- Be comprehensive: provide access to most of the resources that staff need most of the time, allowing access to relevant external Internet sites
- Be fast and reliable: minimum network or server delays, up-time 99.5% or more, few dead links
- Preserve confidentiality: appropriate use of password controls
- Provide added value over the Internet / own resources: linking related information (e.g. a drug formulary with electronic prescribing system, evidence-based information about laboratory tests to a laboratory report<sup>17</sup>)
- Reinforce local identity: include information of interest to the organization—news, organization chart, who's who, functions, resources.

To build and maintain an intranet that meets all of these criteria is hard, but the task can be eased by software tools such as server log analysers and web spiders which automatically map and check links, index pages and check page download times. Getting the first version up and running is greatly helped by saving word-processor files in the HTML format used by web browsers or as PDF files for viewing by use of Adobe Acrobat. However, in the long run the material will need to be formatted specifically for the intranet medium, moving away from simple linear documents. Many of the tasks required cannot be automated, and individuals contributing material must adhere to a loose style guide, otherwise every page or section on the intranet will look different and users will become disoriented. It is also important to devise a comprehensive logical menu structure for the whole site, content being fitted in as it becomes available, and to identify and apply a controlled vocabulary of index terms. Every page must be dated and the webmaster needs tools for linking pages to authors and revision dates. There are various useful sources of design principles for intranet-based electronic health records<sup>1,2,18</sup>.

### CONCLUSIONS

With all the superlatives about the Internet, organizations may be slow to realize that equal or greater benefits are available to them from installing an intranet. Intranets have most of the advantages of Internet technology and very few of the disadvantages. However, developing a successful intranet does require investment and a strategic view. At present it is hard to say whether an intranet is the key factor in those few NHS organizations that have achieved 'modernization', or whether their intranet is merely a marker of organizations with a clear sense of purpose.

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