

PLANNING INTRANET/EXTRANET

General approach – Exploring benefits

Synopsis

Intranet is a local network that covers the premises of one Firm/Organisation with the objective of speeding up working procedures and production process. It is an efficient tool for the employees in a Firm/Organisation as, through their terminal, they can individually access information, can establish multilateral contacts among them and can reduce circulation of papers when carrying on their work. Their turn, Firms/Organisations may, by assigning a closed working area, select skilled personnel to develop special studies and activities, or may create specific working groups to implement new processes and new projects.

Extranet is the connection, over public network, of two or more Intranet systems that facilitates the communication among areas far located (same Company or different Firms & Organisations); the system can expand the activity of one Firm/Organisation to other Entities which support the same production/research process. The system may provide same facilities and may satisfy same objectives as it occurs with Intranet.

Intranet/Extranet are supposed to improve production process and are expected to provide organisational and economical benefits: in this sense, existing literature produces some limited examples (mainly administrative process) of economic advantages which are measured in term of time and labour savings. The paper tries to analyse this aspect of Intranet/Extranet and to discuss some current conclusions: what is certain is that the new technology cannot take positive return to all actors of production. If time saved does not improve labour efficiency it may turn into excess of personnel which Firms/Organisations may decide to reduce. In this way they may achieve better significant internal economy and recover competition.

Especially for Firms producing services or consumable goods, the apparent paradox is that Providers of Intranet/Extranet are selling technology and unemployment.

CONTENTS

- 1. **Introduction**.....
- 2. **Intranet**.....
 - 2.1 – Basic equipment of a web server.....
 - 2.3 – Updating the system.....
 - 2.4 – The management team.....
- 3. **Extranet**.....
 - 3.1 – Network configuration.....
 - 3.2 – Implementing an Extranet.....
- 4. **Evaluating benefits**.....
 - 4.1 – Intranet benefits.....
 - 4.2 – Extranet benefits.....
- 5. **Measuring benefits**.....
 - 5.1 – Direct cost saving.....
 - 5.2 – Labour savings.....
 - 5.3 - Increase in productivity (Annexes 1 and 2).....
- 6. **Conclusions**.....

1. Introduction

The idea of creating a local working area by connecting together calculators goes back to about 1970 and comes from two Xerox researchers (Metcalfe and Blogs); the idea was made public in 1976 under the name of “Ethernet” but it took longer than 10 years to become a commercial reality. Its first standard was, in fact, defined in 1982 by a co-operation of Xerox, Digital Equipment and Intel. A final codification was established in 1983 by the IEEE (Institute of Electrical and Electronic Engineers).

To day, a LAN (Local Area Network) is defined as a network of symmetrical and heterogeneous calculators connected, within a local area, by a reliable transmission link. An Intranet is, then, a network built inside a Firm/Organisation that uses Internet technologies to enable personnel to find, use/share documents and Web pages. The system integrates into Firm & Organisation structure as to become the primary way for employees to obtain work-related documents, share knowledge, collaborate on designs, access training, learn Company news.

An Intranet system has, usually, access to Internet by which it can communicate with the world. But, in case of a specific production process, it may happen that two or more independent Intranet areas are connected together, over the public network, either to create a close and unique working area and/or to link distant working groups. The whole system is called Extranet. When adopting Extranet, Firms/Organisations involved have to harmonise procedures, so that the method of working becomes the same to all users connected.

There exist various software and hardware to implement an Intranet/Extranet network: consistence among systems is regulated by different International Organisms. The most important are: ITU (International Telecommunication Union), ISO (International Organisation for Standardisation), IEEE (Institute of Electrical and Electronic Engineering). ITU coordinates the suppliers as to ensure harmonisation among different systems. IEEE is the organism that standardised Ethernet networks. ISO produced the model OSI (Open System Interconnection) that describes the architecture of the system.

2. Intranet

Building an effective Intranet means thinking about how documents can be used to complete tasks, how tasks can be organised into processes and how those processes can be framed into standard procedures. Intranet is not specifically a tool, it is rather a working support whose utilisation, when carrying duties and providing/obtain information, can significantly change the

working procedures. Consequently, the introduction of Intranet requires a cultural change within the Firm/Organisation which adopt the system.

2.1 – Basic equipment of a web server

Centre of the system is a server which contains, besides a common database, all documents and information coming from users connected to the network. The users may be located close to the server itself, may be scattered over different premises of the company, or located in far sites by an external connection.

Main component parts of a web are:

- the **web software**. Any web server has a simple function: it stores documents, sends back files or executes programs on request. It is just because the work is stored on a web server that users are enabled to search stored documents/information whose author and location they do not know in advance.
- the **Hypertext Markup Language (HTML)** code, the language of the web and the control codes used to format text and set up links to other pages.
- A **graphic editor** to manipulate images and save them into proper file formats supported by most web browsers.
- A tool to **check links** to ensure that they are still valid. Such tools analyse and verify links, product visual maps of web site, and allow tests to verify that all documents have the right references.
- A tool to **trace access of users to files**. Various information are recorded; among others: the IP address of origin, the date and time of the connection, the pages requested.
- an **animation tool** for producing video special effects.
- A **search engine** to find information and documents in the web. Search engines vary widely according to kinds of documents (text, graphics) and to the specific index.
- **IP desktop applications**, such as browser, e-mail, training, workflow, etc.
- A “**help applications**” client-oriented that expands web functions, such as those used to play streaming video or audio or animations

2.2 – The network scheme

Once the Central Unit is equipped with the necessary software (Linux/Unix for instance) it can provide a number of features to the system. The whole software is adapted to the company’s needs either at the level of storing and maintaining data and at the operating level, where users put forward questions, research particular files, recall office automation supports, organise their working plan, interact with internal and external points.

PC Firewall

Users

5

Local
Server

Fix IP

Linux
Unix

Web Site
Access to Internet (band sharing)

1

2

Access to central database

3

Access to other nodes

4

Access to web site: working groups
 new projects
 share of tasks

n

Access to internet - All users have access to Internet. They use a common band which they share, to avoid collision when more than one node transmits.

Access to central database – All users have access to documents and information stored into the Central Unit. Information/documents can be downloaded only for reading unless otherwise authorised (interaction, modification, updating).

Access to other nodes – All users have access to other terminal stations in the local network. In this way they can communicate to each other, exchange files, share experience.

Access to web site – All users have access to a Unit which can be organised according to the needs of the company. In particular, whether the company wants a particular project to be developed, it can assign the Unit (or part of it) to a selected groups of employees who carry on individual tasks; in this case only authorised users have access to special files in the Unit.

To simplify cost analysis, the network scheme, used in this paper, is figured as a circular area whose surface “S” coincides with the actual area over which employees, belonging to same Firm/Organisation, are distributed. At the centre is the Web server; users, with their individual terminations, are connected to the centre by junctions whose length ranges from 0 to the radius “R” of the area. Total cost of the system is composed by the cost of common parts (Web hardware and software) theoretically located in the centre, the distributed cost of local network (junctions per users) and the cost of individual terminations (PC, e-mail, access to internet etc) proportionate to number of users.

R

2.3 – Updating the system

The potential of a Web site depends upon its regular updating. As the system has to provide a flexible working area always easy to access it is necessary to keep its validity over time and to

improve interaction with users by continuous revision. In particular, the following basic facilities are of interest to employees as they get a continuous re-organisation of documents in terms either of tasks and processes .

Tracking documents – The control of documents produced is an important requirement for the management of files in Intranet. If, in fact, the memory of Central Unit can keep, adequately marked (changes made, users visiting the files, dates and times of access), a number of different version of documents under implementation, employees can avoid making their own final provisional version.

Restricting access – When implementing a new process or studying a new project, the system must have the ability to let only selected group of users to access appropriate files: in this way, they can carry on their work, independently from other users, in a protected area.

Updating files – To avoid losing time or losing files, it is necessary to prevent employees to modify the same files at the same time. Users can have access to documents in the central Unit only under authorisation. When an updated and checked document is stored, then only the reading access to that file is usually allowed.

Growing of files – Since the number of managed files is assumed to increase over time, an efficient indexing and searching system must be available. Any new document/file added must, then, be classified, indexed and recorded as to facilitate, at any time, searching and retrieval. Whether files or documents produced are related to one another, the classification and indexing should be grouped to account for their interrelation.

Applications – The system allows users to download most standard file types like Word, Access, Excel, Text, Html.

2.4 – The management team

A management team decides how and when Central Unit has to store different version of documents and relevant manipulation. The smallest effective Web team has 3 people: the designer, the technical expert and the manager. Ideally, a Web group should have at least 5 people or more: an HTML specialist, a designer, a programmer, a system and database administrator and a manager.

The HTML Specialist

HTML is considered as the easiest task to perform because it is easy to learn and many supporting tools exist. Anyway, it is preferable that the HTML specialist has some previous experience otherwise making the task going smoothly might take time.

The designer

The Web site needs graphics. Almost every site requires use of image manipulation, whether it is a graphical menu, a more conservative page design, or simple demonstration graphic, for illustrating and presenting programs.

The programmer

The experience requested to a programmer depends on the platform on which Intranet or Web site is based. The most useful parts of a site will usually be the parts built on server-side scripting, including database access and mail functions.

The system/Database Administrator

This expert has to take care of Web server configuration, revision control, maintenance of site and site statistical analysis. He can, as well, delete and/or update security permission.

The manager

Web site maintenance takes a tremendous amount of communication to run smoothly. This person must have an effective task management process, and should be proficient in the principles of information architecture, user interface issues, and these days, at least a cursory knowledge of search engine optimisation.

3. Extranet

Once Intranet was implemented, a new idea was rising of letting to other Firms/Organisations pursuing same business interests the access to own Intranet even in a partial and controlled way. It was seen as a significant advantage since the communication among different Firms-Organisations might be as important as the communication among members of same Organisation: the objective is to exchange experience, harmonise parts of a common production process, develop, in co-operation, new projects.

From practical point of view, the “expansion” of Intranet can help group of employees exchange documents and experience within a larger group of other people. As this way of working may still provide, in comparison with traditional handling process, reduction of document printing, lower recourse to circulation of papers, lower need for meetings, it is expected to produce further cost saving.

Properly configured, the Extranet might increase and enhance employees efficiency, reduce time and errors when drafting document, provide extensive resources to employees and improve their capacity to perform their tasks.

3.1 – Network configuration

The extranet makes use of software that concern: the Web, the Internet, group-ware applications and firewalls. The Web’s major contribution to Extranet is the capacity of using different platforms; while the group-ware applications satisfy the requirement of sharing data.

Extranet allows project teams to communicate and co-operate through discussion sites. Within these sites they have access to e-mail, message boards, file transfer and directory listing.

LAN

LAN

LAN

LAN

The establishment of an Extranet among different Entities involves two significant organisational moves: the protection of privacy over public network and the harmonisation of working procedures (storage of data; working process). From operating point of view, in fact, access to the system must be taken under control: for most companies installing Extranet, protection against unwanted intrusion is made up of a products centred on a “firewall” which is a software that analyses incoming or outgoing data to stop any unauthorised transmission or unwanted access to information. From human point of view, as Extranet might involve two different working cultures, the working procedures should possibly turn uniform as to get the benefit of increasing labour efficiency.

The scheme of system, for cost analysis, is composed by two parts: the first one is represented by the cost a number of basic Intranet areas whose reference cost satisfy the scheme given previously; the second one is the cost of junctions that connect the basic Intranet areas.

3.2 – Implementing an Extranet

Extranet can be implemented by providing direct and full access to the Intranet of a Firm-

Organisation. In this case it involves employees of the same Firm/Organisation who must be recognised by the system. For a greater level of safety a double password might be imposed, for instance. As alternative, when a great number of users not reliable is accepted, the access can be limited only to a single application.

In this respect, a significant example is the service of home banking. The service, as it happens in some countries, can work at two access layers. The first one accepts only enquiries about own bank account and stock shares: to get the first layer it is sufficient a password. The second one allows bank activity (credit transfer): in this second case there is a second procedure of recognising.

Of course the Extranet of great Organisations that serve a large number of clients are the examples more significant to all appearances about the use of this technology but an Extranet is useful even for smaller Organisations or for those that need communicate with a limited number of clients. In practice whoever has confidential data that wants to share with other authorised users can use an Extranet, never mind how much are data and how many are clients.

4. Evaluating benefits

Under the pressure of market competition, where users' behaviour decides consumption and prices, Firms/Organisations should reduce the cost of their production process if they want to keep their current market share. As they cannot give up the expansion of their assets they must lower operating expenses either reducing intermediate consumption and optimising labour resources. Intranet/Extranet may support both strategies: they may help saving money by reducing recourse to traditional facilities and may produce saving in term of time and labour as they can make time-consuming processes turn more efficient.

4.1 – Intranet benefits

Intranet enables employees to reduce recourse to traditional intermediate consumption, to increase their efficiency (by saving working time) and to smooth barriers among departments creating areas for inter-departmental collaboration.

This is mainly achieved through the facilities provided to internal users.

- Phone directories, manuals, information are directly available to all employees.
- E-mail helps reducing the time and paper waste necessary to photocopy and distribute document on paper; it helps as well reduce the use of telephone and fax.
- Training on line avoid the recourse to classrooms and teachers.
- Forms to submit (holiday, sickness, expenses, booking, travel) are given on line and can be send, always on line, to relevant administrative sector.
- Organised database are accessible for store and retrieve information.
- Discussion application allow users to debate topics without the need of meeting.

The measure of direct benefit, which may derive from Intranet, requires the capacity of making comparison (simulation models, direct check) among expenditure before and after the implementation of Intranet/Extranet systems. While, for measuring time and labour savings, it is necessary to outline existing work processes (simulation models, direct check) in detail and then compare with the flow chart of the same processes after the implementation of the Intranet/Extranet system.

4.2 – Extranet benefits

As it was already said, Extranet provides the same facilities supplied by Intranet to users grouped in different location. It allows safe transactional business-to-business activities and can help Firms/Organisations spare significant time and money.

Evidence of that is given, for instance, by the case of car industries which use extranet to cut down on their redundant ordering processes and to keep suppliers up to date on parts and design changes, receiving suppliers' proposals, submitting bids, providing documents.

A practical application is the Criminal Justice Extranet designed to interconnect police forces' network in England, Scotland and Wales using Internet Protocol (IP) standards. It helps Police communicate more effectively, while maintaining security and confidentiality, as it enables exchange data with other areas and sending messages quickly, easily and cost-effective.

Documents for certain legal matters which are standard forms, can be created dynamically on the site and, for certain legal services, the client information can be stored into database. This application is particularly useful when dealing with matters that are repetitive, such as real estate transactions or patent and trademark applications. The additional cost to the firm in hosting fees on the web server are minimal for the additional pages and functionality when compared to the other communication costs of phone or fax or postage. The system allow for close contact and monitoring of affairs while maintaining scheduling flexibility, providing relief from the phone, keeping the fax line free, reducing staff strain, saving file and even wasting less paper.

The system is easy to use and actually helps reducing the quantity of paper to circulate and the need of meeting: as a matter of fact, the facilities available range from e-mail to videoconference and the messages sent from any point of the system are received in real time.

5. Measuring benefits

The internal economies coming from Intranet/Extranet involve operating expenses: relevant benefits can be measured in terms of time and labour saving provided that the whole labour forces fully accept and apply the new technological tool. Existing literature separates the benefits provided by Intranet/Extranet systems into three kind of savings: the first one relates to direct reduction of intermediate consumption, the second one accounts for the shorter time necessary to complete tasks and the third one is an increase in labour productivity.

5.1 – Direct cost saving

According to examples provided by existing literature, almost 20% of operating expenses (80% are salaries) involve the recourse to all those facilities necessary to circulate documents and information. Great part of these expenses relate to telephone that allows informal contacts inside and outside the Firms/Organisations; remaining expenses concern office supply, paper and courier by which documents (internal phone book, manuals, requisition forms, marketing material) are printed, photocopied, distributed or mailed.

A tentative ranking of such intermediate consumption results as follows:

Telephone	77.93%
Paper	8.16%
Office supply	6.79%
Courier	4.42%
Mail long distance	1.39%
fax	1.31%

With the introduction of Intranet/Extranet system, part of traditional facilities are replaced by service on line. In particular:

- Reduced expenses for printing and circulating documents on paper support are obtained by sending the same documents through the internal network.
- Part of costs for telephone, fax, courier services can be saved by using internal e-mail.
 - Training expenses can be reduced by installing training on-line rather than organising classrooms and regularly involve trainers.
 - The discussion application helps saving travel and accommodation expenses for meeting as exchange of information, amendment of documents, development of project may be partly performed on-line

According to existing literature, direct benefit accounts for an average saving of 25%. In quantitative terms, whether the ratio between intermediate consumption and salaries keeps 20/80, this means that a reduction in intermediate consumption ranging from, say, 20% to 30% produces a decrease into total operating expenses from 4% to 6% respectively.

5.2 – Labour savings

Employees perform their work, part of the whole production process, according to standard rules to which they get used. Once Intranet/Extranet is introduced, procedures are simplified and/or unnecessary intermediate steps are removed, so that the completion of tasks is reduced. As a reference, the following table, derived from a simulation model¹, shows how the benefit can be measured, in quantitative terms, by comparing the same activity before and after the

¹ ASC Proceedings of 37th Annual Conference – University of Denver – Denver, Colorado (April 4-7 2001)

introduction of Intranet/Extranet. The saving, in terms of time and actions, is:

Items	Unit duration	Actions (duration)	Actions (duration)
Document production	20'	2 (40')	2 (40')
Document revision	15'	2 (30')	2 (30')
Document approval	20'	2 (40')	2 (40')
Document transmit	30'	1 (30')	1 (30')
Documents distribute	30'	3 (90')	1 (30')
Document filing	5'	1 (5')	1 (5')
Total actions/duration		11 (235')	9 (175')

The savings in percent can be estimate as $25,53\% = (235-175)/235$. When considering labour as one of the input variables in a production process, we assume that this resource is homogeneous in the sense that all workers are equally efficient. The number of hours per year worked by one man is fixed: no overtime is necessary. In this way we establish an equivalence between labour forces and man-hours available in a given period and for a given process.

The indicator refers, then, to spare of man-hours or to equivalent excess of labour forces.

The example cannot be taken as a general reference: labour saving should be explored case by case according to the specific production of Firm involved, as not all activities can get advantage from this particular saving. For Firms producing consumable goods or services the system may improve administrative process rather than the production process itself. Preparation of bids for construction or preliminary design of a new car, involving same or different sites of the Firm/Organisation, can instead take advantage from time saving; as well as it happens for research activity (Universities, Research Centres, design activity ...) where time assignment is essential for the completion of a project or the finalisation of a study.

Further, labour, as a factor of production, differs from other production factors in three main aspects. First, labour cannot vary in the short run because of social and political obligation Firms/Organisations have to respect. Second, labour is measured in terms of salary and salaries must be paid irrespective of the time actually worked by employees. Third, employees who are used to traditional procedures will oppose resistance to change their working activity; new incoming labourers may arrive with necessary new culture as to easily fit into the new working system but the extension of Intranet to total labour forces will surely take time.

Labour saving, even measured in quantitative terms, may increase labour efficiency but does not practically reduce operating expenses. Rather, labour saving could point out a redundancy of employees, so that a more reliable move for the Firm is to reduce the excess labour.

5.3 - Increase in productivity (Annexes 1 and 2)

As productivity is intended the amount of revenue contributed to total output by the production factors (capital and labour). To simplify economic analysis, it is currently accepted that labour is the only factor producing revenue, so that the net contribution to total revenue provided by labour is given by the difference between total revenue and capital expenses.

Whether labour is the only reference input, the production can be described by a mathematical function depending from labour as the only variable. The pattern of function should satisfy the principle that, when exploiting fixed assets (capital constant), labour productivity first increases as a function of labour resources used, reaches a maximum and, then, declines.

Whether Intranet/Extranet provides any benefit it should appear into the productivity curve.

To explain the case, let us take the example of a small telecommunication Provider (Annex 1A). In absence of Intranet/Extranet, the final balance gives a labour productivity of 29,78% and a labour efficiency (lines/employee) of 40,62. The production function (Annex 1B) shows that, under the reference situation, the optimum number of employees should be 2241 instead of 2919; under this condition, labour productivity would get the maximum (33,58%) and the efficiency of employees raises to 52,91. The example shows that there is a theoretical excess labour of 678 employees which correspond to a cost of almost 8500000 \$ per year.

When Intranet is installed (Annex 1A, column "Introduce intranet"), its costs (capital and operating expenses) add up to existing capital and operating costs of Provider; the benefit, deriving from reduced cost of intermediate consumption, adds up to total revenue. Total budget is slightly modified and the final labour productivity increases up to 30,55% (about 1% more than the reference indicator): this level of productivity can be secured by 2630 employees. The labour redundancy is 389 employees.

Let us, now, assume that the Provider decides to fire 389 employees. Introducing the changes into the budget (Annex 1A, column "intranet + adjust labour"), the labour productivity

becomes 44,32% (14,54% greater than the reference indicator), and the efficiency raises to 45,09. Whether it would be possible to reduce, at once, the personnel to 2630 employees, then the Provider could get significant benefits either in terms of productivity and efficiency.

6. Conclusions

Intranet/Extranet take into the production process of Firms/Organisations new technology that, according to current believe, produces a direct saving (intermediate consumption), a saving in labour (reduction of time-consuming procedures) and an increase in productivity. Such a conclusion, given as general and common rule to define benefits provided by Intranet/Extranet is unpractical; Firms/Organisations belong to different Sectors of Activity (Manufacturing, Trade, Services, Communications, Construction, Legal, Health, Education, Research) so they have different organisational structure and pursue different final objectives. The check of benefits, in economic terms, should be made case by case.

In particular, the only benefit that can possibly turn into an advantage to all kind of Firms/Organisations is the saving in intermediate consumption as great part of traditional communication facilities can be replaced by new ones at lower cost.

Labour saving involves a more complex concept: internal economies due to more efficient procedures may increase labour efficiency: this might be welcomed by Research Organisations, for which time is essential, but it may become an economic weight to Entities which operate under market competition. Being labour a human resource it is not always certain that greater efficiency gives more final product. Rather it may easily turn into redundancy of personnel. And the solution is not easy.

Productivity is associated, under current literature, always with time and labour savings: the interpretation used seems restrictive as cost and benefit relevant to Intranet/Extranet are compared over time considering the system as a stand alone one. The exercise might give answer under the condition the labour saving were a measurable entity. Which is not generally true. Again it is a case by case solution. Rather, labour Productivity measures the contribution to total revenue provided by labour as production factor; so that cost and benefit provided by Intranet/Extranet, adds up to total revenue expected and changes in total profit are measured as an overall result. Again as the final production depends from the structure and the objectives of Firms/Organisations they should be analyses case by case.