# The Philips corporate web as an internal manufacturing information exchange medium : a research into the possibilities of business information exchange based on hypertext

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# The Philips Corporate Web As An Internal Manufacturing Information Exchange Medium

*A research into the possibilities of business information exchange based on hypertext*

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*"Flying is an art. The knack is to throw yourself at the ground...and miss"*
The Hitchhikers guide to the galaxy - Douglas Adams

*"The trouble with our times is that the future is not what it used to be"*
Paul Valery

# Summary

This thesis is about the Philips Corporate Intranet which, for the rest of this thesis, is referred to as the Web. Use of the Web has implications for business communication especially in the field of information gathering. Its use can be roughly divided into two fields, marketing purposes and business process information. Effective use of the Web demands a change in the information gathering process by the users. Since the information resources are growing, the emphasis is on how the user can select significant information.

## The Internet And The World Wide Web

The Internet is the global collection of networks linked by the TCP/IP technology. Depending on the type of connection, it is possible to shield particular parts of the Internet from unwanted access. This is achieved by using a so called fire-wall so defining two types of internet. A public internet called the Internet and a private internet, referred to as the Intranet.

With the Intranet as information carrier additional services are available such as e-mail. Another growing service is the World Wide Web (WWW), which is based on hypertext. Hypertext combines two functions into one medium. The first is that it links different types of information. The second is that the user interface is integrated in the information. The ease of use and the possibility to combine different types of media (multimedia) is one of the major reasons of the explosive growth of Internet use.

## The Goal And Objects Of This Thesis

The main goal of this research is create a hypertext structure for research and development information. Emphasis of the research will be on structure and implementation of the hypertext information. Since this isn't a sharply delineated problem, the process of reaching the goals will be an iterative process. This thesis describes the initiation of this process and the actions needed to reach the goals set.

The object of this research is the Philips Centre for Manufacturing Technology (CFT), which serves as a support centre for other Philips divisions. It stores a vast amount of know how and related business information, with one of the primary processes to make this information available for Philips. One way of offering information is by using the Web. Currently there are no specific actions taken to concentrate the available information, contained by the CFT, in one central point of access. This means that information is diffused over the total organisation.

## The WWW Characteristics

Like any other medium the WWW has its own specific characteristics. Comparing the different communication patterns of different media types, the conclusion can be drawn that the WWW has the characteristics of a consultation medium. This also emphasises the power of the WWW as an information exchange medium rather than

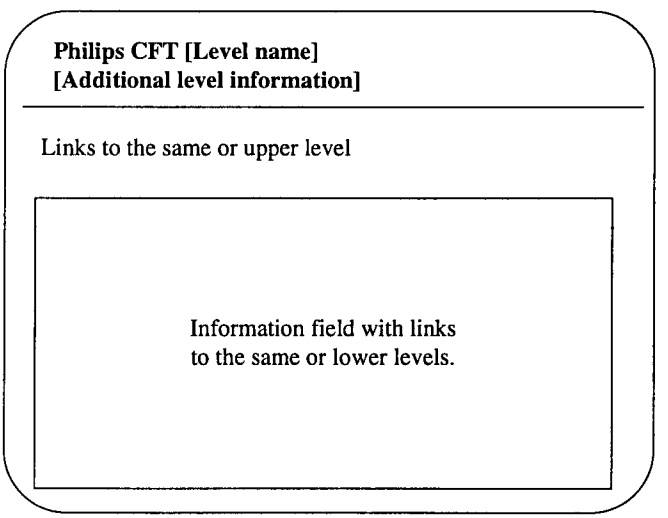
a marketing tool. Since the Web is used as an information exchange medium, the emphasis is on usability instead of the presentation form.

HyperText Mark-up Language (HTML) is the standard which is used for all Web pages. It offers a limited range of design options, since the output depends on the used browser and operating platform. A browser is the application used to access information on the WWW. For the CFT in specific we come across a number of constraints. Besides the constraints set by the browser, there are also constraints directly connected to network speed and capacity. Constraints related to the network lie beyond the scope of this thesis. For the different browsers these constraints are taken into account through the experiment on the layout of Web documents. The main conclusion of this experiment was that the use of a two column layout was rated slightly better than a one column layout. Whether or not this alternative layout is used in the Web documents depends strongly on the available time for implementing information into the structure.

## The Design Of A Hypertext Structure For The CFT

As information is diffused over the CFT, the structure design for the hypertext is based on a number of distributed information centres. Each information centre has its own contributing information providers. These information centres, the groups, are co-ordinated on the department level. Based on these information centres, clusters are formed. A cluster is a group of related information, in this case based on the organisational structure. By matching the virtual structure to the physical structure of the Web site, a more transparent maintenance plan can be devised.

Looking at the available time and effort, choices are made on the amount of information and the way this information is presented. Therefore a minimum set of information is selected, combined in a design that is both easy to use for the end user and easy to maintain by the information providers. This results in the layout of the Web documents in the basic design layout as presented in the following figure. Together with template files this is the proposed design for the total Web site.




A user evaluation in the form of interviews is used to assess the proposed design. Particularly the user demands concerning up to date information on activities and

reports is an issue that is mentioned by all the interviewees. To get a general impression of the CFT's activities the concept design is given a positive assessment.

## Web Site Maintenance

For the maintenance necessary to keep the Web site up to date, a plan is proposed. This plan is also based on the same clusters as used in the hypertext structure. On the different levels responsible people and procedures are needed to implement information. By using these procedures and placing maintenance information into the Web site it is possible to maintain information de-centralised.

The de-centralised Web management system is the best suited solution for maintaining a Web site at the CFT. To insure contribution to Web activities on a voluntary basis the initial emphasis should be on internal (CFT based) exchange of information. From this base a more elaborate user evaluation can be derived

## Conclusions And Recommendations

The main conclusions of this thesis are:
1. The de-centralised site set-up is the most suitable for the CFT at the moment.
2. The hypertext structure suits the user looking for an overview of CFT activities.
3. Although Web information was offered, it lacked overall usability.
4. To increase voluntary Web activity, a fast feedback system is needed.
5. A more user friendly design is available, when more time is available to implement this design over the complete Web site.

From these conclusions, a number of recommendations are derived:
1. To comfort the customers of the CFT a central easy accessible database with report information should become available.
2. At the introduction of the new Web site, put the emphasis on the use as an internal (CFT) information medium.
3. In order to keep the Web site up to date, agreements have to be made on maintenance and information provision.
4. To get more user feedback, a form should be integrated into the Web site.

# Table Of Contents

# 1. Introduction

This research is about the use of the Internet in general and particularly the World Wide Web for manufacturing related information. Historically the Internet was set up by the American department of defence to make distributed information through communication networks available. Later on the Internet was introduced into the research and university community.

Now the emphasis is shifting toward corporate use. In general there are two main reasons for this. The first one is the growing attention the Internet attracts in the media. As a result, companies feel that they have to connect to the Internet in order to keep up with future development. The second, more realistic reason is that the Internet can help to support corporate information exchange. In this case we look at the World Wide Web (WWW), a service on the Internet. One reason to support the Web is its capability to reduce unwanted information, since the user has to take explicit actions to retrieve information. Another reason is that the Web makes it easier to access digitally published material [Kib95].

The research is conducted at the Information Technology group of the sector Technology of the Centre for Manufacturing Technology. This report gives an example on how to structure information produced by the Centre for Manufacturing Technology (CFT) in order to publish it on the Philips Intranet, with the emphasis on maintainability. The CFT stores a vast amount of information on all kinds of technologies and processes. This thesis offers a guide on how to present and maintain information for the Web, making this information easier accessible for customers of the CFT. This reports also looks at a number of aspects related to the creation and maintenance of a Web sit.

# 2. What Is Internet?

As mentioned in the previous chapter, is the Web based on the same technology as the Internet. To understand how the Internet works, we first have to look into the question of what is the Internet? The answer to this question seems very simple. The Internet is the global collection of networks linked by the TCP/IP technology [Van94]. TCP/IP stands for Transmission Control Protocol/Internet Protocol, and is the basis of the Internet services. Technical background information on TCP/IP is given in appendix 1: Internet A Technical Overview.

This chapter looks in a more general way at the Internet. First of all a general overview of the construction of the Internet is created. From there we look at the World Wide Web (WWW) and HyperText, and their use in business processes at the moment. This gives an insight in the possibilities and power of the Internet as a business communication tool.

## *2.1 The Two Types Of Internet*

It is possible to run the TCP/IP protocol over a number of different LAN's (Local Area Network). This means that these LAN's can be connected to the Internet. It doesn't mean that per definition all computers of such a LAN are directly connected to the Internet. That depends on whether or not such a network computer runs the TCP/IP protocol. These LAN's can be connected to the global Internet by gateways.

This gives us the possibility to distinguish two types of Internet:

1. Public internet, known as the Internet.
2. Private internet, called the Intranet.

Public Internet is the part that can be accessed by users without constraints on location (the IP address) or identification (User ID). This is a typical anonymous network structure. The Web service, is a service over a private Internet. A private Internet has constraints on who has access to the private Internet. These constraints are derived from the IP address and the User ID.

The private network can be linked to a public Internet by gateways that are equipped with a fire-wall. A firewall is a program running on a gateway that checks IP addresses. The IP addresses that are in the firewalls database have access to a gateway connection. This works both ways, the firewall checks the incoming as well as the outgoing connections. The Philips corporate Web is an example of such a private Internet. Access is restricted to divisions of Philips, which are spread all over the world. Information presented on the private Internet is therefore globally available to all these divisions.

Another example of a private Internet is a LAN which isn't connected to the public Internet by any means. This creates a fully shielded private Internet, this type of Internet is especially of interest of medium size companies in need of a cheap and easy to use internal communication medium.

## 2.2 How Is Internet Constructed?

The structure of Internet can be divided into two groups, the networks and the providers. In the Netherlands for example there are two physical Internet networks. The first is the NLnet that is the oldest existing network run by the NLnet organisation. This organisation was founded by the Centre of Mathematics and Software Engineering (CWI) in co-operation with the Netherlands UNIX Users Group (NLUUG). The NLnet infrastructure consists of nodes throughout the country called Points of Presence (POP's) which are linked by high-speed rental lines.

The second is the SURFnet the network for research and higher education in the Netherlands. This net is run and controlled by the SURFnet organisation. On a European scale there is the EUnet that connects the nation-wide networks into a European network. Each contributor in EUnet manages a central computer system called the backbone.

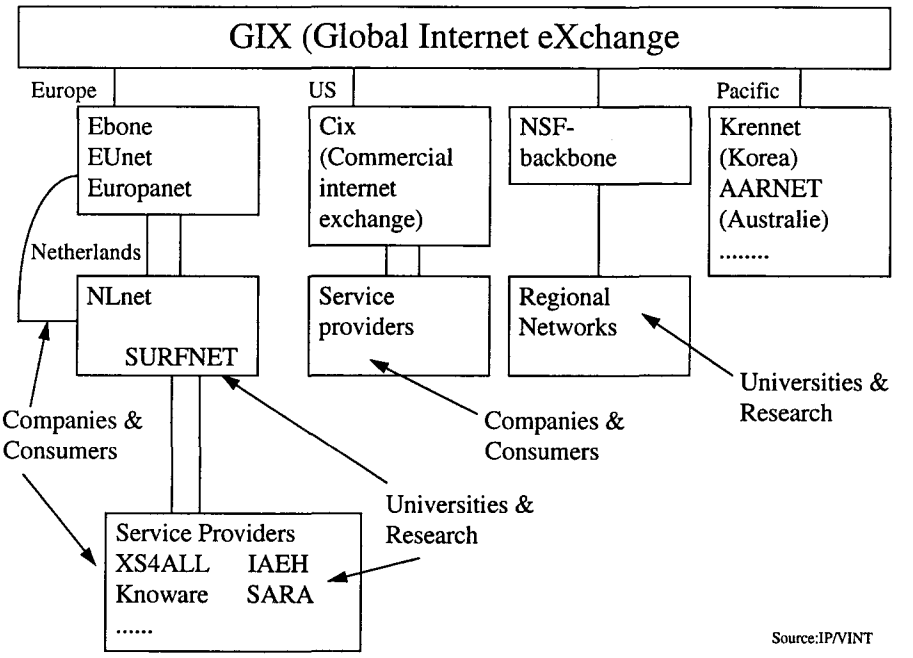



*Figure 1, Internet structure*

The backbone in the Netherlands is controlled by NLnet. As shown in Figure 1 this network and other European networks are connected to the global Internet. In the Netherlands EUnet and NLnet are the two main Internet providers, meaning that they offer access to third parties onto the Internet. There are other providers offering access to the Internet without having their own Internet infrastructure. For access to the Internet they depend on others like NLnet and SURFnet. Providers for research and development institutes are for example IAEH and SARA. For the private market there are providers like XS4ALL and Knoware. Along with EUnet there are other European backbones for example European Backbone (Ebone) with nodes in Amsterdam, Stockholm, Paris, London, Geneva, Bonn and Vienna. This is an initiative of a number of European network providers to create a overall European infrastructure. The Ebone is a high speed data connection (the digital highway)

which connects the different European networks. Another backbone is Europanet that supports TCP/IP as well as OSI based protocols.

## 2.3 What Is The WWW?

The World Wide Web (WWW) is the name for the collection of sites on Internet using the HyperText Mark-up Language (HTML) standard and HTTP (Hyper Text Transfer Protocol) as a service over TCP/IP. These sites can be viewed using a user interface called a browser. There are different browsers available today and most of them can present graphics as well as text. Examples of popular browsers are the Netscape browser from Netscape communications, the Internet Explorer by Microsoft and the Mosaic browser from NCSA. An example of a text oriented browser is the Lynx browser, developed by the University of Kansas.

The use of hypertext has the advantage that one can link information from one document to another. These documents may be on the same computer, but it is also possible that this document is on the other side of the world, so the name distributed information base. In this context there are two problems linked to hypertext [Fos87]:

1. the embedded digression problem: this occurs when looking for a certain item one comes across another item of interest, which distracts from the initial item. In English 'distraction' both refers to 'amusement' and to 'confusion',
2. the art museum phenomenon: all the information that is available makes it hard to concentrate on one object of interest. To learn something it is important to plan your objectives.

Although the WWW is often referred to as a distributed database, it isn't a database in the strictest sense of a database. A database is structured in such a way that it is possible to use a query language to retrieve data. Although search engines are available for use on hypertext, they are mostly based on text search routines and not on database query languages.

### 2.3.1 Structures Of Hypertext Documents

On the web one can find multiple examples of different structural types of hypertext. Some are easier to navigate through than others. This originates in how easy it is to form a conceptual model of how the hypertext is constructed. If it is easy to construct a conceptual model the navigating through the hypertext is enhanced [Kom90]. There are many different forms of structures. Most of these can be reduced to a number of basic forms of which some examples are shown below.

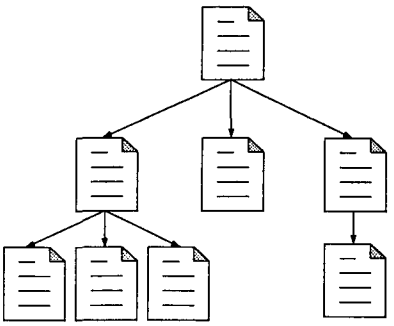


*Figure 2, hierarchical structure*

The hierarchical structure is build like a tree as shown in Figure 2. This structure is extremely suitable for guided tours for instructing or learning. An example is the scheme used for locating and repairing defects in televisions. The individual parts of the hypertext, here represented as pages, are called nodes. Each node can contain a combination of different information types such as text, sound and pictures. The connection between the nodes are called hyperlinks, or in short links. These links make it possible to access other nodes.

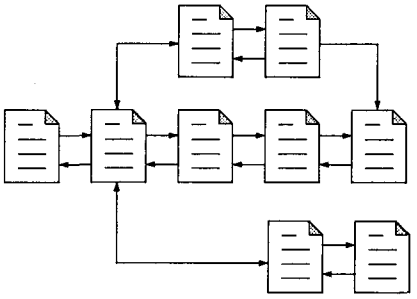


*Figure 3, linear structure with alternative routes*

The second basic form is the linear structure as shown in Figure 3. This can be compared with the way you read a book. The alternative routes can indicate the skipping of more than one page or looking something up in the table of contents. An example of a combination of the previous two forms is shown in Figure 4.

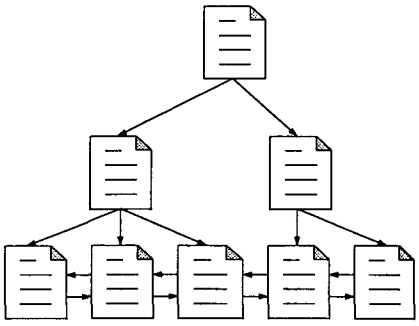


*Figure 4, hierarchical with linear structure*

### 2.3.2 The Power Of Hypertext

The power of hypertext lies in the fact that in combination with a browser it incorporates different Internet services in a single tool. Another point to note is that the programming of HTML documents is simple compared to other programming languages. The advantage of this is that almost everybody can create hypertext documents. An advantage over e-mail is, that the Web reduces the amount of unwanted e-mails [Kib95].

The hypertext itself is a base for a user-interface. Information can be accessed without the prior knowledge about keywords in order to start a search [Fis89]. Access of information is done by point and click methods. This results in a user-interface that is still usable, even when the objectives of a search aren't set at the start of the search.

By linking information through hyperlinks the relationships between pieces of information can be displayed. In this way, hypertext offers the possibility to access documents in a non linear way. This brings on the problem of how to let users navigate through documents. When programming the documents, one has to take into account the non-linear access and information gathering.

## *2.4 Current Value*

At CFT several investigations were conducted to research the possible use of the WWW. One of those researches was to see in which way the WWW was usable for product developers. The main field of research was to see what kind of information is already on the net and how to get access to this information. Some problems that occur when using external information sources are that the information is:

- inaccessible (the site may have moved or closed),
- irrelevant (sites reported by the search engine may have information that is not related to the topic, due to structural differences),
- access time (related to the amount of graphics used in the document and the traffic on the net).

Another pilot project was the publishing of CFT information on the Web. This CFT web site was set-up by the Information Technology group, to gain experience in providing information for a web site.

## *2.5 The Web In Business*

Roughly speaking, the use of the web in business can be divided into two areas. The first area is that of marketing, here the main objective is to promote product and company information. The second is to use it as an information exchange medium for distributed knowledge centres. For example information exchange between different

departments inside a company. This is mainly business process information. The type of information depends on the goals and the selected groups.

There is still a discussion going on about the effect of the web as a marketing tool. This is related to the fact that marketing depends on representation forms, such as visual and audio effects. Currently sending high quality pictures, video clips and audio files can take up a large piece of communication time. For example a video clip of just 15 seconds can easily take up to 15 minutes to download, depending on traffic and speed of available links [Kle95], thus making communication less effective. In a corporate network these problems still remain, but are easier to control.

For internal information exchange the emphasis is on the contents of the information while the presentation form is less important. Compared to other software packages, such as Lotus Notes, offers the Web a cheap and easy to use information medium.

The question that results from this information is what do you want to present to the user? The second question is what is the maximum time a user wants to wait for his information? For example if a user wants access to written data he does not want to wait for high quality graphics he does not need then. Points of interest for the user are access time and the quality of the presented information.

### 2.5.1 A Change In Information Gathering

The number of connections to the Internet has doubled every year since 1988 [Roc95], this means that a growing number of individuals have access to an almost unlimited amount of information. The way individuals collect and select information becomes more and more important. There is already a shift in the education system, where the emphasis is now to teach children how to find and select information. Here the emphasis is on the decision process, instead of teaching facts. A problem when developing a web information site is that the present generation is not yet used to handling the amount of information presented to them [Fri96].

One way of tackling this problem is to limit the amount of information presented to the user. This is possible with the use of an Intranet, such as the Philips corporate Web. Because this limits the amount of information combined with a higher relevancy of this information, a more efficient use of the network is feasible. Although it is possible to limit information to a specific scope, the amount of information will still be growing. Therefore a part of the acceptance of this medium relies on the way users can cope with fast growing information resources.

## 2.6 Conclusions

The Internet offers a global communication medium accessible to anyone with a modem or LAN connected to an Internet provider. In this thesis a distinction is made between public and private internet. The public internet is the Internet open to the general public. A Private internet is a shielded part of the Internet accessible to a limited number of people. Usually these private are corporate networks only accessible from within the organisation. The Philips Corporate Web is such a private internet.

The WWW is a service based on the Internet and the Web is a service based on the Philips Corporate Web. In other words, the Web is a WWW service based on a private internet, in this case the Philips Corporate Web. Programming Web information is done using HyperText Mark-up Language (HTML) [Lem95]. Hypertext makes it possible to link different documents (nodes) by so called hyperlinks. By combining nodes and links a network of information is created.

By using the WWW an extensive source of information is available. The problem remains how to filter relevant information. For businesses the question remains how to use the WWW or Web to improve their information retrieval and offering. This thesis concentrates on the offering of information using the Web.

# 3. Main Goal

The main goal of this research is to create a structured hypertext model for research and development related information. The main purpose of this model is to evaluate the information that is needed to create a web site, which has to serve as an information provider towards and between related departments. The question resulting from this goal is:

> *What is the best structure of a hypertext when using an internal web as an intermediary for research and development information exchange?*

This main problem can be divided into three sub domains. The first domain describes the structure of the model. The second domain is the added value of the hypertext on information exchange. The last domain is about the implementation of the model. These domains can be divided into different sub questions, starting with the first domain:

1. What is the type of information that should and can be published on the Corporate Web?
2. How must web documents be structured, to make a web site user-friendly in terms of consistency, navigating, remembering, and retrievability?
3. What is the group you want to reach and what are their demands concerning web documents?

The sub question resulting from the second domain is:

4. In what way can the web support the function of associative searching for wanted and relevant development information?

The following questions can be derived from the last domain:

5. In what way must hyperlinks be imbedded in the hypertext documents to enhance navigating?
6. What measures need to be taken to keep a web site up to date?
7. In which way must references to external information be integrated into the CFT web site?

Emphasis of this research will be on the first and third domain of sub questions. The fist domain is of importance because it describes the structure and functions of the Web site. Question number 4 refers to information obtained from other sources on the WWW. This lies outside the scope of this research, a pilot study on this subject is described in [Pen96]. In the third domain the most important questions related to the main goal are the questions 5 and 6, these refer to the maintenance and management of the web information. In chapter 4, the research strategy is described with references to the related chapters in this thesis. Conclusions and recommendations of this research are discussed in chapter 12.

## 3.1 Structured Design Problem

The main practical goal of this research is to design a web site containing technical information. Solutions to design problems have to meet a set of requirements, with interactions existing between these requirements [Law90]. Depending on the number of requirements design problems can be complex problems [Vri94]. For this specific problem the requirements are set by two groups. First there is the information provider, which is the CFT Production Systems department. Requirements from this group can accurately be charted, because the group can be characterised. The second, larger, group consists of the future users of the interactive information system. Although an overall consensus from this group can be achieved, the final solution will not be the best solution. This lies in the fact that for design problems there is no right or wrong solution, only better or worse solutions [Vri94].

In general two problems exist in design processes, the ill-structured and the well-structured problem [Ree95]. Information analysts define well-structured design problems as problems in which the problem space contains representations of:

- All possible states (initial state, intermediate states, goal states)
- All possible or considerable transitions between states
- All knowledge about the problem [Vri94]

An example of a well-structured problem is: someone who wants to check the balance of his bank account. The possible states are:

| | |
|---|---|
| Initial state: | the need for information about the account |
| Intermediate states: | entering account number, personal identification code, and request for account balance information. |
| Goal state: | Information about account balance. |

Ill-structured problems are defined as the problems that on one or more points don't correspond to the previous definition of well-structured problems. Now we take a look at the implications for hypertext documents that are presented on a distributed medium.

From a user point of view in most of these hypertext documents the different states are very hard to define, due to the great diversity in presented information. This is because hypertext based information allows alternative routes to access information. Associative access means that information presented on a page where requested information is found can point to pages with other information of interest, thus distracting the user. Problem here is that the start of the associative search, was initiated on a "random" page. So intermediate states of the request for information can be the initial state of another request for information. This renders it impossible to describe all corresponding states.

The context on how an individual has found and entered the site are also unknown factors. This means that different points of interest can lead to the access of a CFT Web site. For example the general interest for Philips departments, or someone with a specific problem involving a production process. Which context should be supported depends strongly on marketing strategy.

The diversity of possible future users, makes it difficult to give a definition which includes them all. As a result their characteristics are vague. As for the three points this problem can be classified as an ill-structured problem. The implications of an ill-structured problem are that:

- It is difficult to decide on the limits of relevant information.
- The problem space cannot be sharply delineated [Vri94].

The goal of this research is the design of a hypertext which can be seen as an ill-structured design problem. This has the following implications for the research strategy. First it is difficult to set the limits on relevant information for a Web site. Secondly there is no knowledge on potential users and therefore the problem space cannot be sharply delineated. The research strategy will therefore mainly focus on selected groups of information and users.

# 4. Research Strategy

This chapter describes the steps that are followed during the research. The main purpose of this research plan is to describe the different methods that are used for data collection. For each sub question, as presented in chapter 3, an appropriate instrument is chosen to collect the necessary data. The research is based on the conceptual model described in this chapter. The conceptual model gives an overview of the factors that influence the object of this research, being the users of a hypertext with information from and about the CFT.

## *4.1 Selecting The Data Collection Instrument*

To get an answer to the first sub question it is necessary to gain an insight into the information resources of the different departments. To collect the necessary data a survey is conducted at the different groups in the department. In this survey interviewing is chosen as data collection method. The interview is discussed in chapter 6. The reason for choosing this method lies in the fact that there are no previous reports summarising the information types available from the different departments. Initially the subjects of these interviews will be the group leaders of the departments. Depending on the available information, other members of the different groups can be interviewed. With these findings the information that is shared between different departments is mapped. This gives an insight on how and what information is already shared internally.

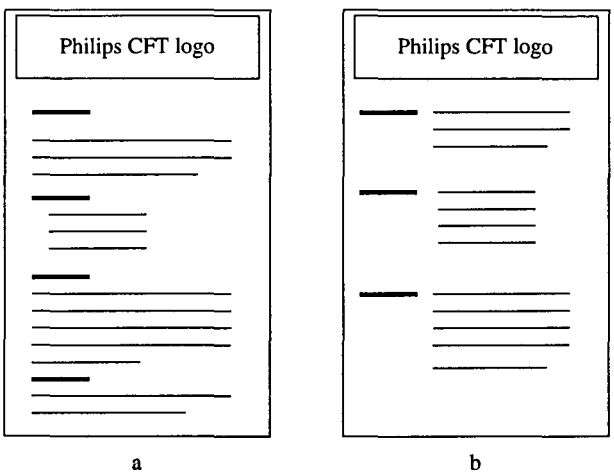



*Figure 5, page layout*

An answer to the second sub question is derived from the information collected with the first set of interviews and a literature study. Using this information, a test model is created. With this model an experiment is conducted. The reason for an experiment is to let different users react to the different presentation forms of a hypertext document. Different pages are made with variable contents, page-layout, and colour

use. With the results of this experiment, which compares the two models presented in Figure 5, a concept WWW site will be developed which will be used to get an answer to the third sub question.

The collected information will be processed to make an inventory of the available and needed information. Information that eventually will be published depends on the corporate policy concerning technical information. Corporate policy in this case can be viewed upon as rules concerning business secrets, and strategic information. A rough overview of the corporate policy concerning spread of information is available in chapter 5.

To get an answer to the third sub question, a second set of interviews will be conducted at a number of related departments. This is done to get an insight into what the need for information is at related departments. The subjects will be selected based on personal contacts existing inside the CFT. This is done to get information from a group of people already familiar with the CFT, since this is the group where the WWW site is being developed for. Results and methods of this interview are given in chapter 10. The future users will be the people who have access to the Philips corporate Web. As this is a large population it is almost impossible to device a valid test for the total population. Instead a non-random group of users will be selected to perform usability tests. These tests are designed using a literature study.

Results from these tests will lead to recommendations concerning layout and contents of the information. A second part of recommendations will include advise on how to manage hypertext information, and control the quality of a Web site. These recommendations will be discussed in chapter 12.

## 4.2 The Conceptual Model

In the development of a web site there are several inputs that influence the hypertext models. These inputs are represented in Figure 6. The block corporate policy is not an actual input blocks but serves as a filter for the other input blocks. Imbedded in this filter are the constraints concerning information that can be published and information only for internal use.

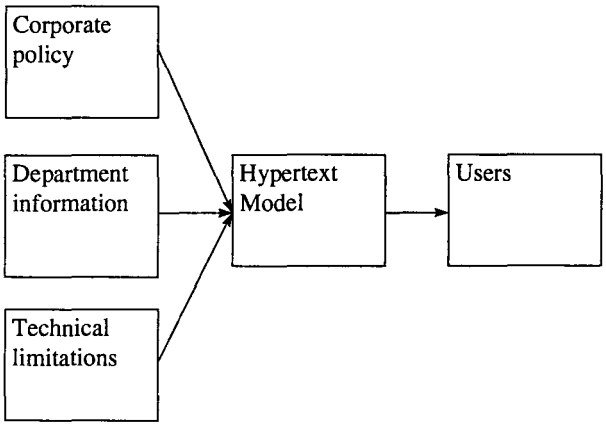



*Figure 6, conceptual model*

The different blocks are defined as follows:

**Corporate Policy:**
this is the set of rules, resulting from the demands set by the company. These rules concern, safety, confidentiality, and corporate image. Guidelines for the corporate policy on security concerning the Internet are described in [Bre95]. These guidelines apply to the internal as well as to the public Internet services. A description of the management goals and policy are given in chapter 5.

**Department information:**
information contained inside a company department, like reports, articles, human resources, technology, projects and experience. An overview of this information is given in chapter 6.

**Technical limitations:**
the constraints resulting from the used technology. These apply to the used technological means such as the network and the software for access to the Internet. These limitations are discussed in chapter 8.

**Hypertext model:**
this is the set of rules on how to structure information. This structured information is then converted into hypertext. Chapter 9 shows this initial process for developing a hypertext structure. Additional information on maintenance of the hypertext structure is given in chapter 11.

**Users:**
the group of people using the hypertext. This is the research unit with several characteristics and demands. The users can be split up into two groups. Information providers, the people who offer the information that is implemented into the hypertext. End users, the people who access the information provided by the information providers. For the first group information is gathered in chapter 11. For demands of the second group an interview is used, which is described in chapter 10.

# 5. The CFT Organisation

The first part of the research concentrates on mapping the available information from the Philips Centre for Manufacturing Technology (CFT). To see how this information is distributed over the organisation we will take a look at the structure of this organisation. This chapter also describes the processes and main activities of the CFT. This to give an insight in the information distribution in the organisation. The results of this chapter will be used to set up an interview which gives an actual insight in the processes of the CFT.

## *5.1 Structure Of Organisation*

The CFT consists of two disciplines, Technology and Engineering. Initially this research focuses on the technology side of the CFT in order to gain an insight into the used information types. To achieve this we take a closer look at the organisation structure. Figure 7 shows a graphical representation of the structure of the CFT organisation. In this representation the different organisation levels are indicated. On the top there is the CFT as a whole. Next on the sector level are the sectors Technology and Engineering, Support & Services. On the level below that the sectors are split up into departments, each containing a number of groups. Figure 7 also shows a more detailed structure of one of the departments, in this case Production Systems. This is just one branch of the total organisation tree, of which a part is represented in the graphical representation.

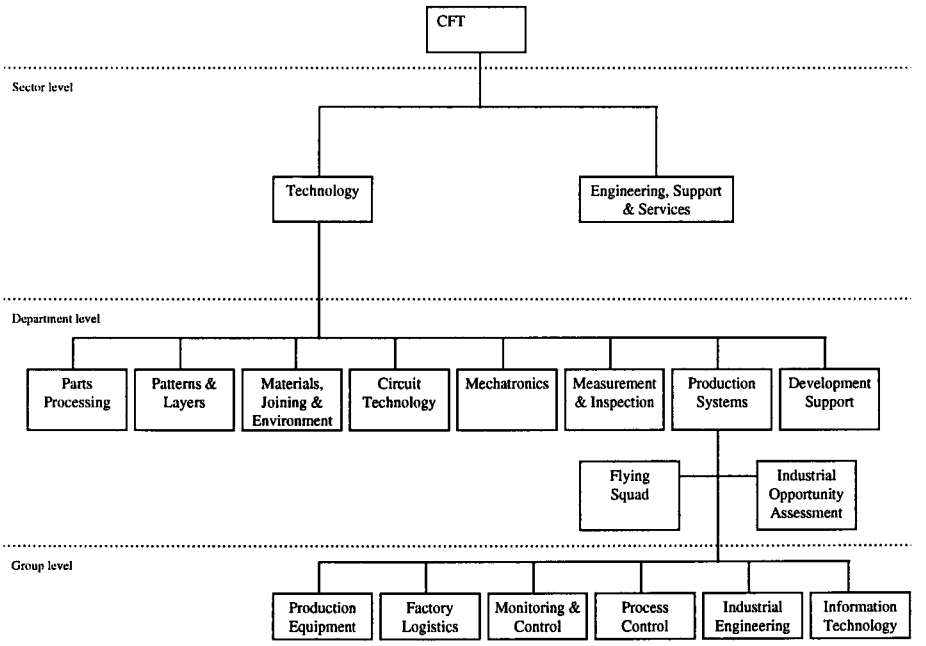



*Figure 7, the CFT organisation*

## 5.2 CFT Technology Mission

The mission of the sector Technology is to support Philips Production Divisions (PD's) and Business Units (BU's) in the field of manufacturing technology and its interaction with new products. The goal is to contribute to the profitability of Philips as a whole, by accelerating innovation and increase productivity. In order to accomplish this, the Technology sector concentrates on three objectives. One objective is to strive for improvement in existing technology. The second objective is to research the possibilities of new technological and technical developments. The third objective is to maintain information that is important for the synergy of the expertise inside Philips. Expertise is transferred in the form of specifications, software packages, modular systems, and documentation or direct product support for the customer.

## 5.3 CFT Strategy

Goals set by the CFT are achieved by operating as a centre for support of industrial activity. Support is given to business units in need of knowledge or capacity. Activities are characterised by a working method and quality that are tuned to the expectations of the customers. Results are directly available or at hand within three years. This position as a knowledge centre is maintained and expanded through research, financed from Philips knowledge development funds and projects. Furthermore, knowledge is built through co-operation between departments inside Philips CFT, institutes outside the CFT and regular contacts with other organisations.

## 5.4 Primary Processes

Primary processes inside the department consist of:

- Development, practical application, evaluation and maintenance of knowledge.
- Maintaining contact with customers. For instance to maintain application knowledge.
- Accumulating, organising, and executing projects.
- Transferring accumulated knowledge and experience to business units.

Spread of knowledge is achieved by applying gathered knowledge into running projects, through advise, giving courses and publication of material. The collection of information that will be published has to support these activities, in order to contribute to the strategy and mission of the department. The last point in the list indicates that communication to business units is part of the primary processes of the CFT.

## 5.5 Marketing Strategy

From a marketing point of view, the Web is seen as a supporting medium to inform clients on fields of knowledge and expertise's. In this context the Web serves as an extra service towards the clients. This service can be seen as a product of the CFT which is also stated in the primary processes of the CFT. In order to strengthen the communication towards the customers, new media should be tested and evaluated on their functionality and effectiveness. With the shift of potential markets towards the Asian Pacific region and other low-cost production regions, it is especially important to look out for a medium that supports global communication. The biggest advantage the Web offers here, is that it is time independent, as is the case with e-mail. An advantage over e-mail is that people who aren't directly addressed still have access to the information. More media characteristics are discussed in chapter 7.

## 5.6 Conclusions

The CFT is a centre for maintaining and developing knowledge. The objectives are to spread this information over other departments of the Philips organisation. Knowledge is gained by accumulating, organising and executing projects. The gained knowledge is transferred to business units by means of projects, reports or people. Results are either directly available or at hand within three years. The Web can contribute in this process by distributing knowledge gained in the various projects. As a marketing tool the Web can serve as a showcase for the executed projects and available knowledge. The advantage of the Web is, that it offers a global accessible source of information.

# 6. Current Standings

In what way is the information flow of CFT organised? The answer to this question offers an insight on how the Web can support this information flow. Information flow of the CFT is spread over a number of interaction fields. These fields can be described as follows:

Gaining knowledge:
: Information is obtained from sources. What are these sources?

Managing knowledge
: After gaining knowledge it is possible to record this knowledge and make it accessible to others. In what way does the CFT contribute to this process?

Applying knowledge
: One way of applying knowledge is to put it to use in projects. In what way does the CFT apply its knowledge?

Transferring knowledge.
: Applying knowledge is one way to transfer knowledge. What other means does the CFT use to transfer knowledge?

As described in chapter 4 an interview is used to answer these questions. The choice for these fields of interest is based on the CFT mission and strategy as described in chapter 5. A secondary reason for this interview is to see how the process of project acquisition and execution is handled on group level. We also take a look at the goals which are set for gaining and distribution of information. The results of these interviews are used to chart the available information and resources.

## *6.1 The First Set Of Interviews*

The first round of interviews is conducted at group level. For this interview five people where interviewed. The interviewees were group leaders of Production Systems department. Reason for choosing an open interview is to get a wide view on the group activities in the interaction fields. Open interviewing techniques also offer the chance of elaborating on the relation to the Web. Thus making it easier to anticipate questions and remarks from the interviewees. The interview consists of six questions which function as the main guideline, these are:

1. What are the main fields of expertise of the group?
2. For whom are projects executed, Philips only or also for external companies?
3. Who is responsible for project acquisition and what means are used to support this?
4. What information is generated related to projects, and in which form is it available?
5. Which part of this project information is useful for third parties, and how is it transferred currently?
6. How is external information handled, in what way is this knowledge spread over the group?

The result of the interviews is summarised in the next paragraphs. One section concentrates on the available information, the second section focuses on the spread of available information. In the final paragraph the conclusions of the first interview round are summarised.

### 6.1.1 Available Information

The description of the mission, strategy, and primary processes are available in the CFT ISO 9000 handbook [Phi96]. This handbook gives a description of the organisational structure and a guideline for uniform information handling inside the CFT. The main goal of the ISO 9000 is to guarantee a constant controllable quality on the handling of production procedures.

Information generated by groups of the CFT are in general specific to the field of expertise of the group. The projects are divided into three types:

1. Customer projects,
   initiated on a request by the customers. Deliverables are set according to the customers demands.
2. Knowledge projects,
   financed with the knowledge funds and comply to the CFT's strategy of doing research to create and maintain the added value of knowledge. Deliverables depend on the goal of the project.
3. Product creation projects,
   results are transformed in a way which makes them directly applicable in customer projects.

The above mentioned deliverable types are: papers, application notes, guidelines/working methods, reference models, product requirement analysis, software product manual, evaluation reports, and brochures. For more details see [Lam93].

Beside information resulting from projects there are other sources of information. Knowledge and expertise of other companies are sources of information used in two ways. One as a method to test the expertise and knowledge of the CFT. Another use is the gain of knowledge from external expertise. This information is gathered by visiting seminars, lectures and exhibitions.

### 6.1.2 Spread Of Information

The CFT creates two products, which incorporates the knowledge gained by the CFT:

1. Knowledge in the form of training people by the CFT.
2. Knowledge in the form of projects conducted by the CFT.

The activities related to the transfer of available knowledge can be split up into two main processes:

1. Delivering a working process at the end of a project.
2. Describing the project methods and results in reports.

Reports describing the various projects are available on request. The problem here is that it is difficult for outsiders to locate these documents. Even from inside the CFT it is difficult to create an overview of available knowledge, and expertise fields. The spread of knowledge over a group is done by means of informal gatherings. At these lunch sessions, current affairs are addressed and discussed.

The amount of time spent on making brochures and other secondary information such as the InfoTech focus publication and CAD-M bulletin vary per group. The main reason for not publishing this kind of information is the lack of available time.

### 6.1.3 Interview Results

Projects conducted by groups of the CFT are in a small field of expertise. Traditionally the information related to these projects were also limited to a small group of people. A result of this, the structure generated varies from group to group. With the introduction of the ISO 9000 quality standard, the documentation concerning projects and knowledge is becoming more structured. A direct result of this is that information generated on projects and knowledge sources is structurally registered. There is still no set standard on contents and structure of deliverables, the ISO 9000 merely offers a uniform method of filing and registration of project documentation. Though not the perfect tool, the ISO 9000 standard could serve as a base for structured information gathering.

When we look at structured information gathering at group level, we can conclude the following. There is no set standard for information publication on a general level. This is also true for information on group level. For publishing information it would mean that on a group level, it has to be decided on what information is of interest for publishing in a digital form. The influence on the structure of the hypertext is that on group level a certain degree of freedom has to be allowed on implementing information.

Secondary actions to spread knowledge vary per group. The most important reason for this is the lack of time for preparing information for publication. On a group level some activities are already taking place concerning publication of information on the Web. Support for these actions reside on the initiative of group members. One reason for a group not participating in these activities is the lack of time to transform available information into a publishable form. Another reason is the lack of knowledge on how to publish information on the Web.

## *6.2 Conclusions*

A general conclusion is that there is not an overall set of resources to create and sustain information sources on CFT level. On a group level this varies, depending on the amount of available time and interests of the group members. Since the publication of information still depends on initiative on a group level, it has the following consequences for the structure of an overall Web site:

1. The final structure of the Web site should be independent of the number of participating groups,
2. Adding groups in the future should be incorporated in the final concept.
3. The reason and purpose of a Web site should be emphasised to motivate people to put some effort in preparing material for publication.

To motivate people in contributing into Web activities a feedback system is needed [Von92]. The same system of feedback can be used as in the ISO 9000 project. This means that people participating in Web activities get feedback on user (CFT customers) likes and dislikes and the number of visitors to the Web site.

In general the goal of the Web site is a dualistic one. Firstly there is the possibility of gaining new clients. Secondly contacts can be kept up to date with recent information. A majority of the groups have a surplus of projects, and a resulting lack of time to deploy new activities not directly related to these projects. As a result the support of Web activities in terms of time and effort to set-up and maintain the information has to be kept to a minimum. Later on in the development more time could be invested in extending activities related to the Web. This has the following implications for the design of the Web site:

1. Time to implement information should be kept to a minimum.
2. The structure should show gaps in the information.
3. It must be possible to add new groups in time.
4. The structure should show expired information.

A reason for the lack of structured information diffusion is the lack of an information plan as described in [The87]. An effective and efficient use of data is achieved when the provided data is matched to the information need. This is shown in Figure 8.

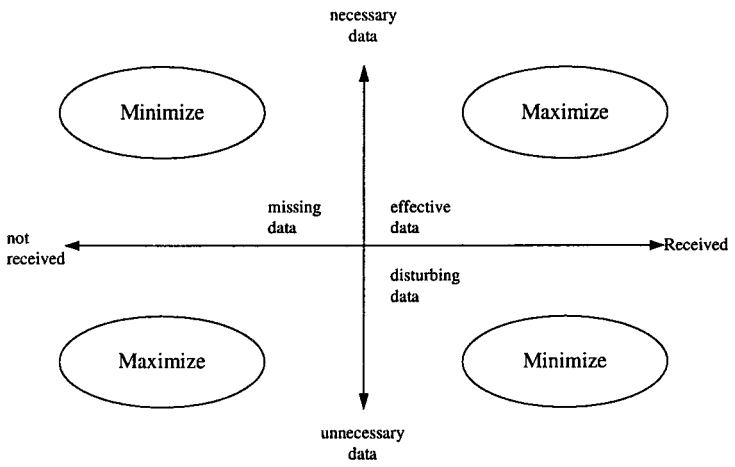



*Figure 8, effective data distribution*

Information provision can be implemented to achieve different goals in an organisation. Examples are [The87]:

1. Execution or support of business processes.
2. Management support.
3. Part of a product or service.

In this case the goal of information provision is part of product and services. As described in the previous paragraph is the product that the CFT delivers is knowledge. This knowledge is transferred to other departments of Philips using different transfer mechanisms. This transfer of knowledge can roughly be divided into three parts:

1. Knowledge transferred when executing a project, where accumulated knowledge is applied.
2. Transfer of knowledge by training people internally for a period of time (5-6 years) and then assign them to other parts of the company.
3. Externally training people by giving courses.

In order to achieve an effective and efficient information exchange the information offer has to be matched with the information demand and the type of medium over which this information is transported. In the next chapter the characteristics of the Web as a communication medium is charted.

# 7. Medium Characteristics Of The Web

The best way to structure information depends on the medium, the receivers of the information, and contents of the message [Hor89]. A schematic representation of this is given in Figure 9.

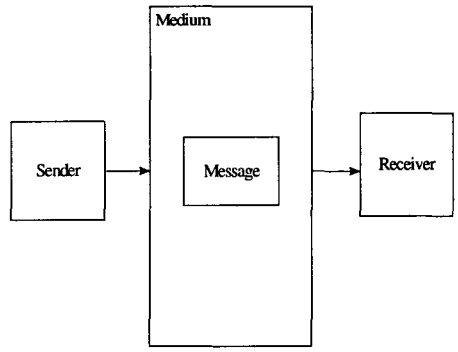



*Figure 9, simple communication scheme*

When we look at the Web the used medium is a global datacommunication network and the messages can consist of text, sound, and video. The actual contents of these messages are only restricted by technical standards for electronic communication. We now take a look at the advantage of information sharing by the Web. In order to make a list of advantages of the Web over other media, we need a list of characteristics of the Web.

## 7.1 Web Characteristics

A description of Web characteristics can be given by comparing the Web to other more familiar media types. To achieve this we first look at an information flow model of a web site, given in Figure 10. The line from the web is drawn thicker than the line from the users to the Web. The reason for this is that with standard Web information the main information stream is uni directional.

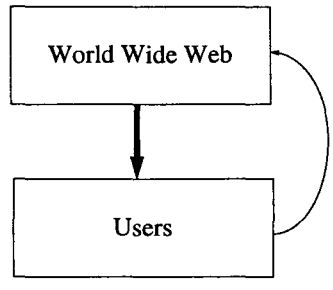



*Figure 10, communication flow on the Web*

Possibilities for feedback communication exist, for example through forms or e-mail, but are limited. In the near future though, the feedback options will become more

readily available in the form of Internet workgroup software. The concept of this workgroup software serves a complete different objective, and has its main focus on smaller selected groups.

### 7.1.1 Information Retrieval

The information flows from the Web to the individual users, meaning that all information does not automatically flows to the users. Information transferred from the Web to the users, follows on a request for information coming from the user. When we compare the Web to cable television the biggest difference is that although an user is "tuned" into a channel on the Web, he still has to make explicit requests for each block of information. As in contrast to the television, where, once "tuned" to a channel the information keeps flowing automatically.

### 7.1.2 Communication Patterns

Each type of medium has its own characteristics [Gas83]. The choice for a specific medium depends on the function of the message and the goal that should be achieved. One way of categorising communication patterns is given in [Arn83]. Arnbak distinguishes four communication patterns. In Figure 11 a description is given for each pattern.

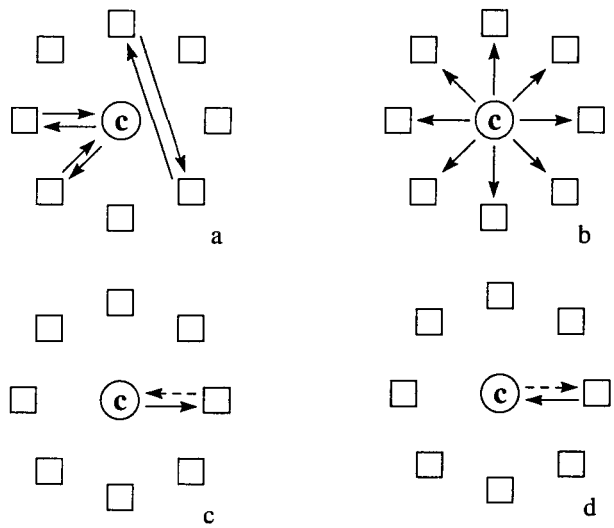



*Figure 11, communication patterns*

1. Conversation (Figure 11a)
   Exchange of available information by (two) individual participants on bases of a personally arranged time table. An example is a telephone conversation.
2. Allocution (Figure 11b).
   Synchronised information exchange to a group of individual users of by the information centre (C) compiled message, on a time table set by the information centre. An example here is radio and television broadcasts.

3. Consultation (Figure 11c).
   Selective information requests by individual participants of information residing at the information centre, whereby the individual participants set time table. Examples are telephone help desks and teletext.
4. Registration (Figure 11d).
   Collection of information by the information centre at the individual participants (sources), the time table is set by the information centre. Examples in this category are interview, security and administration systems.

## 7.2 Conclusions

From the previous definition we can derive that the WWW is a *consultation* medium. Instead of accessing one central information point, the user can access multiple linked information centres. This means that information can be accessed by a virtually unlimited number of individuals.

From this we can see that the WWW in contrast to other media offers a wide area of potential users. Potential, because in order to get the information to the individuals, these individuals have to take explicit actions to access the information. As with other consultancy centres, the weak point of the WWW is that it depends on supporting actions of other media. This is in order to bring the information to attention to the goal group. This can be achieved by using other media types.

To trigger a selected group, e-mail can be used to inform this group, that new information is available. Once a Web site is known, and found interesting by the users, the chance it will be visited in the future increases. The next chapters will describe the steps in the Web site creation process. First the constraints in the design process are described. From there a rough Web site is developed, which is tested using user feedback.

# 8. Designing Hypertext

When developing the hypertext pages it is essential to take notice of the constraints linked to the performance of the computers used on the network. Furthermore, different media have different demands on use of colour layout and typography. Some of the constraints are related to the contents of the information and others are related to the presentation of information. This chapter looks at the constraints of the available browsers, the network, and the form of presentation. With the results from these constraints, a concept design is made, which is tested using an experiment. Incorporated in the conclusions of this chapter are the results from the previous two chapters describing the available resources and medium characteristics. The results from this chapter will be used in the concept design of the new Web site.

## *8.1 Constraints Of The Browser*

When designing the hypertext pages the focus is on the intention to view them with graphical browsers like Netscape and Mosaic. The main reason for using these browsers is that developing a specific browser would take to long to develop. Another reason is, that these browsers are widely available and in use on the Internet.

When designing hypertext pages for use with one of these browsers, one has to consider two main constraints. The first constraint is that a browser uses only one window. Research done on learning systems usually involves the use of several windows. The advantage of this constraint is that it is not necessary to examine the use of information divided over several windows. The disadvantage is that every elaboration of a subject has to be on another page. The second constraint is the limited amount of information displayed on a VGA screen. The reason for choosing the VGA as a standard, is that this display system is used on almost all of the machines. The graphics and the amount of text should meet the performance of a VGA driver, which is 800x600 pixels with 256 colours. Some browsers, such as Netscape, use a standard colour pallet of 216 colours. Colours in a picture that aren't in this standard pallet are mixed from these 216 colours. This causes pictures that aren't designed with this standard pallet to show 'dithering'. The standard palette of colours is given in appendix 2, The Standard Colour Pallet.

Another constraint of the browser is the limitation of the possibilities of screen layout. The reason for this is, that all browsers use HTML as a standard. Different versions of HTML have been developed, not yet supported by all the browsers. This standard has limited layout commands, to enhance their use on different machines. It is important to take this in account when designing hypertext documents. New developments are browser languages as Macromedia, and HotJava. Macromedia has the advantage that pages containing Macromedia commands still work with browsers that aren't equipped with a Macromedia converter. This in contrast to HotJava. In order to use HotJava a separate converter is needed. Which of the new languages will become more popular cannot be determined at the moment.

## 8.2 Constraints Of The Network

The time it takes to exchange information depends on the traffic on the network and the data speeds supported by the network. For text only pages this will be not a big problem unless these pages get too long. In general the waiting time for loading hypertext pages is mostly consumed by loading graphical information contained in a hypertext page. For example, a small picture of 72x22 pixels with 16 colours equals a text of 300 characters. In order to reduce waiting times it is important to reduce the size of the images. The total amount of images and image size depends on what an acceptable waiting time for a page is.

## 8.3 Experiment With The Page Layout

Presenting text on computer screens has been investigated since the introduction of Video Display Units (VDU). An extensive comparison of different investigations [Dil94] show that no significant difference are found between reading short pieces of text from a page and reading from a screen. Differences occur when larger pieces of text are involved [Gou86]. General assumptions are that these differences reside in the manipulation needed when reading larger pieces of text from a VDU [Dil94].

This has the following implications for the layout of the hypertext pages. Since for smaller pieces of text the same conditions are true for VDU as for paper presented text, we can apply layout design guidelines for on screen text presentation. For manipulating the text we make use of the standard windows slide bars. This doesn't solve the problem for larger pieces of text. A way to anticipate to this problem is to put relevant information on one screen [Riv90].

With plain Hyper Text Mark-up Language (HTML) the width of the text lines is directly linked to the width the browser window on the screen. Since most browsers operate under Microsoft Windows the operating window can be set to any desired width, only limited by the width of the screen. One way to prevent the users of making the window too wide is to state an advise on the hypertext pages. As stated in [Nie93] guidelines should only be given when needed for the task at hand. Providing advise when the user already made the adjustments will only lead to distraction. Another more secure way of limiting the window width is to use tables with a specific set width. Tables are supported by HTML version 2.0 and upwards [Lem95]. Since these tables are treated in different ways by several browsers the code was adapted to work with the different browsers.

Another advantage of working with tables is, that these make it possible to structure text into columns. Since readability decreases with the length of the documents, measures have to be taken in order to enhance the overview on the general structure of the document. A test is devised to check whether the use of columns and the separation of structure information, such as headings, and the actual text improves the perception of the viewed page.

### 8.3.1 Perception

In order to measure differences in presentation forms, a reference is needed. In this case the reference is set by the standard HTML. Perception in this case is defined in the following way:

> *Perception is a rating given by the user on the presentation and layout of a page.*

In order to test the perception compared to standard HTML without the use of tables a number of test pages are created. The contents of these pages consists of available information previously used in HTML pages containing information about the Production System group. The standard page layout is shown in Figure 12a and is called model a. The new situation is shown in Figure 12b and is called model b.

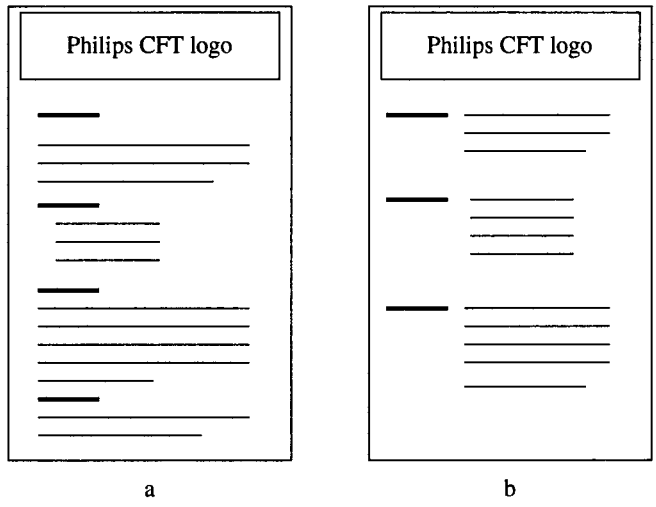



*Figure 12, page layout*

The test is devised to see which layout offers a better perception of the contents, with the same amount of text in a HTML file. The template files (layout commands and text) are given in appendix 3: Template Files. The used colours in the standard layout are black (RGB hex=#000000) text over a grey (RGB hex=#C0C0C0) background. Black text is also used in model b, while the background colour for the text blocks is set to white (RGB hex=#FFFFFF) and the background colour for the title column is yellow (RGB hex=#FFFF99).

### 8.3.2 Measurement Of Perception

In order to measure perception a definition of the term is needed. As indicated in the definition, perception is the impression the users gets when looking at the Web pages. Variables in the pages are divided into two main types,

1. The use of colour
2. The layout of the text

For the first point we measure the rating of the background, text colours, and total rating for the use of colours. For the second point we measure the ratings for spread of information over the screen, the placement of titles, and perceived consistency in the used format.

### 8.3.3 Set-up Of The Experiment

For this experiment, test layout types, described in the previous paragraph are used. The standard HTML format is called model a and the model using tables is called model b. Each model consists of two pages, one page fitting on one screen and the other one with the size of three screens, as shown in Figure 13. This is to see if the size of the pages has a direct influence on the perception.

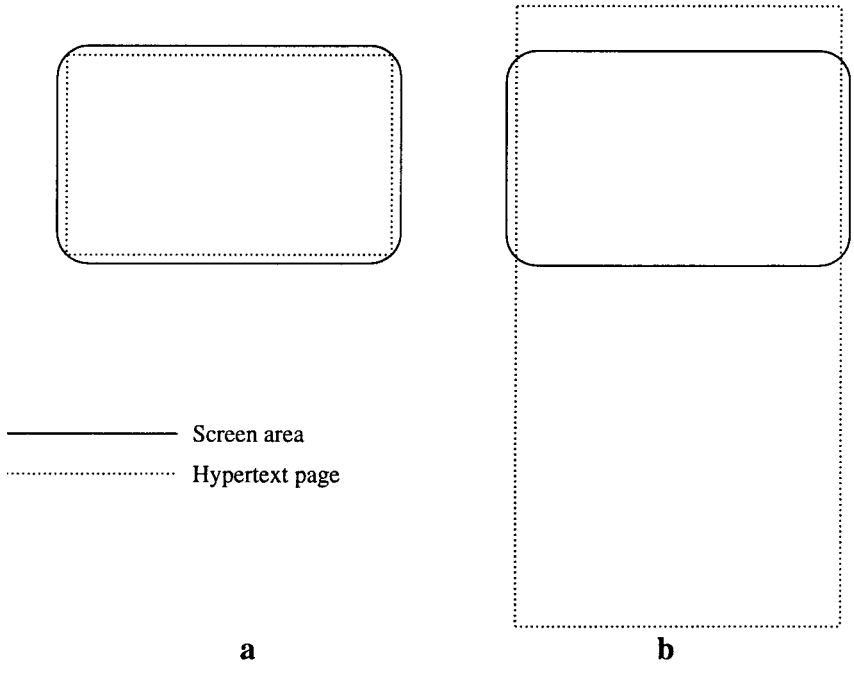



*Figure 13, page size*

Subjects of the test are people who work at Philips CFT and students from the Eindhoven University of Technology. They are randomly divided into two groups, one group works with model a, while the other group works with model b. In this way we get an independent rating and exclude the learning effect. The pages are all viewed using Netscape 2.0 under windows 3.1 using a Philips Brilliance 17A VDU with a resolution of 800x600 pixels. The Netscape settings and questionnaire are given in Appendix 4: Experiment Set-up.

### 8.3.4 Test Results

For the data analysis the Wilcoxon rank test is used, this because the result from the rating isn't a normal distributed function. We want to test whether or not model b is given a higher rating than model a, i.e.

$H_0$: model a = model b
$H_1$: model a < model b

Seven people worked with model a and eight people worked with model b, testing with $\alpha$=0.05 and $n_1$=7 and $n_2$=8 the rejection area is given for the lower limit $T_l$=41 [Men92].

We compare the ratings given for model a and model b. When we look at the total rating of model a and model b we see that no significant difference is found. The calculated test statistic gives T=49. There are some significant differences though, which relate to the layout of the second page, containing text which is spread over three screens, and the use of colours.

**Layout**

In the page layout the significant differences are found in the layout of page 2. Page 1 is rated the same for the two models. Layout as a whole is rated higher for model b (T=37.5). Layout in this case is described as the amount of text opposed to empty space. A high rating means that individual parts of the text are easy to detect, while the structure of the text is reflected in the layout of the page. This conclusion is supported by the rating given on the placing of the titles relative to the text (T=39). This means that the titles belonging to the text blocks are easier to detect, and thus contributing to the readability of the text. The alternative layout also contributes to a more consistent layout over the two pages (T=35.5).

**Colour**

When evaluated individually, the colours for the background (T=47) and for the text (T=47) are not rated any different over the two models. The difference in rating occurs when the colours as a whole are evaluated (T=40). This indicates that the combination of the colours contribute in the perception of the page, but that the colours themselves aren't rated any better.

## *8.4 Discussion And Conclusions*

From remarks given after the tests, some explanations can be derived for the differences found in the evaluation of the two models. Though no solid evidence can be given for these explanations, it gives an insight into the test results given in the previous paragraph. The remarks concerning the layout indicated that the amount of text spread over the three screens wasn't a problem for most of the subjects. Preferences for a certain page were influenced by the type of presented information. Several subjects noted that structural information should be presented in a form that fits on one screen with coherent information spread over several screens. An index is an example of structural information, where an article is an example of coherent information. Another indication that coherent information should be put into one page, is given in [Cha87]. These empirical studies showed that when readers are given the responsibility of selecting what text to read, they may sequence the information poorly or simply miss important information altogether.

It seems a paradox that although the individual colours aren't rated better the overall use of colour is given a higher rating for model b. Subjects indicated that the contrast in the used colours for model b was too high, but that the use of the colours supported the layout of the page, hence the better rating for the total colour use.

From this we can draw the conclusion that the use of layout model b contributes to the positive perception of the information presented in the hypertext pages. Although the overall rating isn't significantly higher, model b scores higher when it comes to the layout. The use of colour seems to be the cause of the overall equal rating. However this conclusion isn't proved by the test, remarks given by the subjects indicates that this could be the fact. For structural design indications are given that information that contains structure information, such as indexes, should fit on one screen.

When choosing a certain layout model, one has to take into account that using the layout of model b, takes more time and effort from the information provider. Although template files can be created, manipulating different text blocks takes more time than in the old layout format.

# 9. A Rough Web Site Model

In order to structure the information into a Web site for the CFT, it is necessary to look at the way this Web site should be constructed. For this purpose a graphic representation of the Web site is created. This chapter focuses on the available resources as well as on the structure and contents of the information. This results in a concept design based on the situation at the CFT. The concept design will be tested by using a user evaluation, as described in the next chapter.

## *9.1 The Model*

This model, as shown in Figure 14, makes it possible to detect and map the points where problems are likely to occur. These points indicate where and how information is changed and updated. Please note that this model refers to the maintenance of the Web site and not to the way information is accessed by the users. The information, presented here as one block, can consist of smaller blocks of information which can be spread over different Web servers. Solid lines indicate the requests of information from the users. The dashed lines indicate the information flow. Information providers are the people who contribute in the information gathering for the Web site. Information is then collected by the information agent and administered to the Web site. This information agent can be one person responsible for the total Web site or a number of people each responsible for a part of the total Web site.

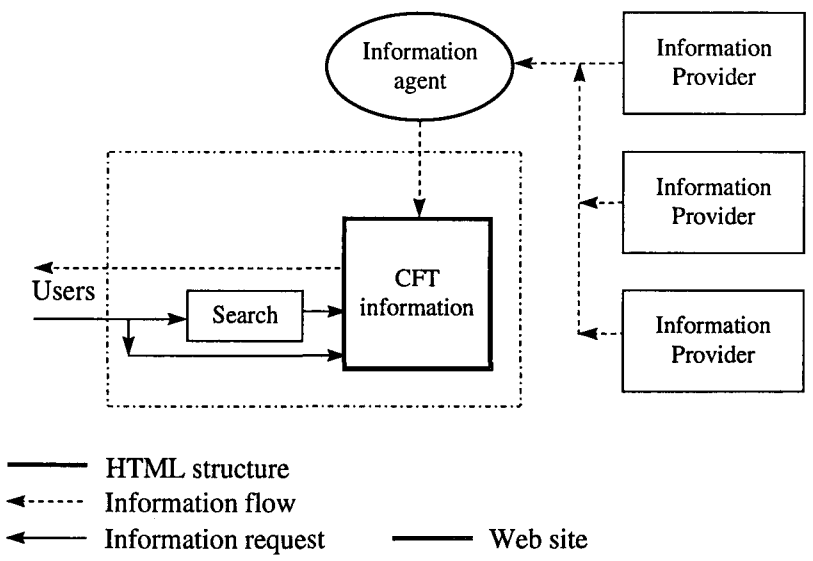



*Figure 14, a rough Web site model*

Information requests by the users can be accessed directly by following the links embedded in the hypertext, or indirectly by using a tool for information retrieval. Such a tool is a search engine. Search engines are programs that scan the hypertext

for certain keywords, thus making direct information retrieval easier. There are different types of search engines, all having their specific search algorithms and scope. In this case we make a distinction between two types of search engines. Firstly the local search engine, maintained on one Web server in order to access information restricted to that server. The second type is the search engine that also has access to information on other servers. Search engines of the last type are readily accessible through the WWW.

One problem of Web sites in general, is how to keep the links up-to-date. This problem occurs when an information page containing links is changed or when a page where links from other pages refer to is altered or even completely erased. The effects of this problem should be minimised. A way to prevent this from happening is to structure the Web site in such a way that the chances of loosing links are reduced to a minimum. A second measure is to give the information agents tools with which it is possible to check the site structure on broken or missing links. A more detailed description of the procedures for site management will be discussed in chapter 11. In the next paragraphs the basic design will be extended into a more detailed concept Web structure.

## 9.2 Goal And Objectives

The Web site is set up to serve a certain purpose. We can divide the purpose of the CFT Web site into two objectives; firstly gaining knowledge on Web activities and secondly to provide customers with additional information. The first objective is intended for the internal organisation, contributing to the primary process of the CFT by developing knowledge. The second objective is to provide customers with an extra service in the form of easy accessible information. From these objectives two goals can be derived. The first goal is to provide users with additional information and the second goal is more directed towards the future and is to attract new customers. Therefore the emphasis of Web activity will be on making available information more accessible.

## 9.3 Resources

To achieve the goal described in the previous paragraph a number of resources are needed. Resources are the means needed to create and maintain an operational Web site. To create Web information two types of resources are needed. Firstly the people, who need to contribute in the presentation of information. Since there is no official plan for updating and maintaining the Web site, contributions are on a voluntary base. This means that Web activity will be mainly supported by people who are already involved in Web activity.

The second group of resources are the tools which make it easier to convert the information to the HTML standard. In order to lower the threshold for people to contribute in Web activities, tools are needed that require a minimum of learning time. The best way to do this is to match the needed tools with the software already used at the CFT. The standard software that is implemented at the CFT consists of Windows 95 with Microsoft Office. The Microsoft Office package includes a word-processor, a spreadsheet program and a presentation program. For these programs

converters are available, so called internet assistants which can make the conversion to HTML.

Although in this case, these tools offer the best solution, they have one drawback, these converters don't offer full HTML command functionality. The concept design is matched to the possibilities that are offered by these converters. More complex editors exist, but they require more knowledge of the basic HTML commands to work with. These editors offering more functionality, could be used by more experienced users. With these tools it is possible to create and maintain the Web information.

## 9.4 Structuring Information

In the last year the CFT organisation has had a number of changes in the organisational structure. These changes should be incorporated into the concept design. Therefore the information structure should offer the possibility to add, remove and/or move organisation clusters. The structure of the information is based on two types of information structuring.

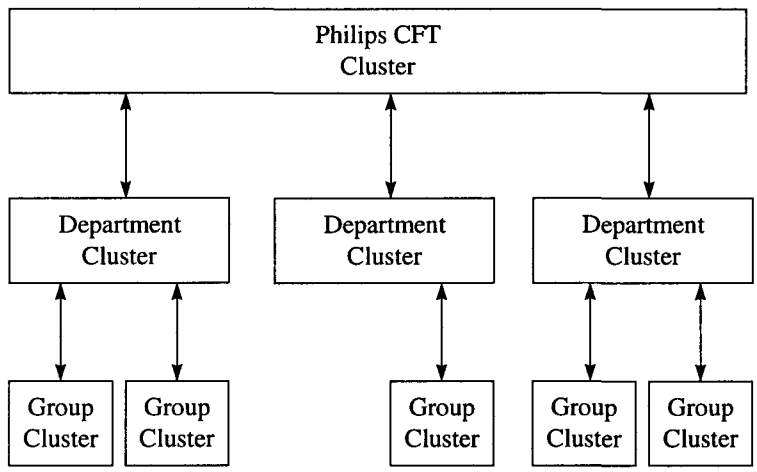



*Figure 15, physical site structure*

The first is based on the physical structure of the information being contained in the directory structure of the Web site. This is a fairly easy to manage structure, since there are a number of tools to create and maintain directory structures. The base for the directory structure is formed at group level. There are two main reasons to set the groups as base of the total structure:

1. It is the most elementary and stable part of the organisation.
2. The decision on participating in the project resides on group level.

Expanding this way of structuring toward the total organisation, results in clustering groups on department level and clustering departments on sector level. This creates a directory structure resembling a recursive tree with clusters down to group level, as

shown in Figure 15. A cluster is the collection of all Web information on a certain level.

The second is based on the virtual structure of information, contained in the hyperlinks. This is a more complex structure, since the hyperlinks are "hidden" inside the hypertext documents. To make it easier to manage this part of the total structure, these links should be made visible to prevent structural errors from occurring. There are tools that can check these hyperlinks, but they require more knowledge of the total structure to be used efficiently. In this case, where a minimum of overall co-ordination is available, it is better to structure information by a virtual structure that is reflected in the physical structure. The virtual structure is created using the hypertext links. For instance a virtual link from one group to another should be redirected via the department level. This results in a top down management system that only needs overall link maintenance down to lower levels. This kind of maintenance is for instance necessary when group or departments are moved, added or removed.

One way of applying a virtual structure is to use the organisation chart as the base for the information structure. For users browsing the CFT information, this structure is sufficient since all information is structured in the same way all over the Web site. A problem might be that users looking for specific information should be familiar with the total organisation and the placement of groups under certain departments. An alternative way to structure the Web site is to base the structure on the different fields of expertise available at the CFT. This embodies one major problem, for this the virtual structure should be disconnected from the physical structure. This results in more complex Web site maintenance procedures. Since the recourses to maintain this option aren't available at the moment, the method chosen is the first option.

In order to comfort the users that are looking for specific information contained in the Web site, other tools are needed. One of those tools is a search engine, a search engine is a program that can scan Web pages for specific words or sentences. In the future such a search engine can be implemented into the Web site, offering more functionality to the users.

## 9.5 Information Contents

The key factors in setting up and maintaining this Web site, are the people who are going to implement the information. It should take a minimum of time and effort to create a basic set of information on group level, in order to increase the level of participation. To achieve this a guideline has to be set up. This guideline consists of a list of items that reflects the minimum number of actions needed to implement information on each level.

Additional information is offered by the different groups of the CFT. The initiative for presenting additional information lies at the different groups. As described earlier, should the total structure be independent on the number of participating groups. With this in mind, a general guide through the Web site should be chosen. There are a number of ways to connect the different information clusters at group level. Since the organisation chart is the base of the physical structure of information we have to find a way to make a logical link between the information.

The minimum information is based on the available information as described in chapter 6.1.1. Since this is the information that is typically available, it is a solid base for the minimum information presented by the groups. From this a list of items is derived to come to a minimum of information to be offered per group. The items that form the minimal information set are:

1. General group introduction, describing the group activities and objectives in general.
2. Fields of expertise of the group, describing what the specific expertise's of the people in the group are.
3. Project examples, describing a number of recent projects conducted by the group.
4. Publications, a list of reports and other printed material offered by the group.

These four items give a general overview of the group activities and available information. Since the construction of the Web site is based on the organisation structure, it offers an advantage in allowing the use of standard templates for a complete branch. The template consists of, the directory structure, the information needed for each level and a description on how to implement links. With the Microsoft Internet Assistant for word, template files are created. Template files contain the basic layout of the Web pages. Since consistency is a part of total quality, an overall layout should be used. In order to do so standard template files are made. These files contain the standard layout used for the Web site and are presented in Appendix 5, Standard Layout Templates.

## 9.6 Usability

The design of the layout depends heavily on the demands of the users of the system. Such rules are described in several references, such as [Hix93] and [Nie93]. We have to keep in mind that these guidelines are based on interface design in general. With the design of a user interface for HTML we have one constraint which other interfaces don't have. With HTML, the information itself forms the interface. In [Hix93] a description of usability is given in terms of:

1. Learnability, make the system easy to use.
2. Efficiency, make a minimum of changes to the screen. And organise the screen to manage complex information.
3. Memorability, take notice of the limited user memory allow the user to recognise instead of remembering.

Learnability is inherent to the use of Hypertext. The user interface is based on the hypertext, different browsers translate the hypertext in a common layout form that is included in the hypertext standard format. This means that the way links are described and organised form the base for the user interface. Learnability of the system is therefore decreased to a minimum.

To make the system efficient a standard layout for the screen is developed. In the description given in [Hix93] we can derive that efficient layout is based on a consistent layout. A consistent layout prevents that the user has to search for standard information on each page, thus making the system more efficient. When designing these screens we have to take into account the limited availability of layout commands in HTML. Since the length of the Hypertext pages are variable the best

option is to put the consistent part on top of each page. The consistent part consists of the page title and the links needed to navigate to information on the same or upper level. The links inside the page refer to information on the same or lower levels. This creates a consistent look over the complete Web site, which increases the usability of the design.

## 9.7 Conclusions

A basic layout form of the templates is given in Figure 16. In this design the constraints described in chapter 8 are taken into account. A more detailed representation of the design of these pages is described in Appendix 5, Standard Layout Templates. This design is also matched to the possibilities that are offered by the Internet Assistant for Word.

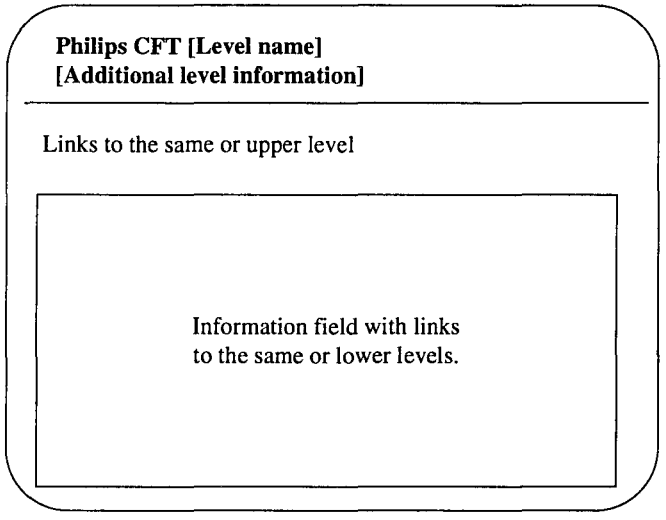



*Figure 16, Basic Design Layout*

For the memorability we also depend on the description of the links. When the descriptions are clear, the chance of remembering what information lies behind the link increases. It is favourable to implement the same link descriptions that apply to the same types of information over the total Web site. With the design rules described in the previous paragraphs, a concept Web site is created. In this appendix 7, the total structure is described. For each level a number of standard files is created. The standard layout consist of a description for the page titles and the implementation of the Hyperlinks. Applying these layout templates to the available information results in a concept design.

Next step is to introduce the concept Web site to the end users and measure the users evaluation using an interview which is described in the next chapter.

# 10. Web Site Design Evaluation

The purpose of this interview round is to evaluate the Web site from a user's point of view. In this case the end-users are customers of Philips CFT. The appreciation for the Web site by these users is related to the difference in the users expectations and the presented information. The presentation of information is based on two components:

1. Contents of the presented information.
2. Structure of the presented information.

These two components are the cornerstones which form the basis for evaluation of the total Web site.

When looking at the contents, it is essential that the presented information offers a good base for adding information in the future. A prerequisite for this is that the offered information should be clear and comprehensive to the users. Essential information lacking from this base should be added before additional information is added in the future.

As for the structure of the presented information, it relates to the way information is connected by hyperlinks. Are these links consistent and are the link descriptions clear and in direct relation to the linked information.

## *10.1 Set-up Of The Interview*

Since the contents of the Web pages are purely developed for the end-user, we want to evaluate the user point of view on the contents of the pages. Using the concept Web site, we want to test whether or not the information needs of the end-user are met by the presented information. In order to create an effective Web site, presented information has to be matched to the needs and expectations of the end-users. This contributes to the effective distribution of data, which is also described in paragraph 6.2.

The goal of these interviews are to get an answer to the question:

> *Is the concept Web site a good base of information provision, seen from a user's point of view?*

In order to get a clearer description of the problem, this question is divided into three stages. In the first stage the emphasis is on the expectations of the user. In other words, we want to know what the basis is of these expectations. The second stage focuses on the structure of the Web site. Can the user retrieve and/or find information based on his knowledge in a specific field of expertise? This serves two purposes, the first is to evaluate the concept structure. Secondly the user is stimulated to use the presented information. In the last stage an evaluation is made based on the information and reaction on the previous two stages. The complete questionnaire is

given in appendix 6: The Second Set Of Interviews. The interviews are processed and the results are discussed in the following paragraphs.

## 10.2 Interview Results

The interview was conducted at four co-workers of different Philips companies. Three of them were personal interviews at companies in Eindhoven, while the fourth was an interview by e-mail at a company in Taiwan. The interview results are grouped according to the structure of the interview. First of all the information needs are examined. Then the users are presented with the concept design with which they have to execute some assignments concerning information retrieval using the concept design. After that an evaluation of the concept design is made with the users. The results from the assignments and the final evaluation are grouped into one paragraph because of the close relationship between these two parts of the interview.

### 10.2.1 Information Needs And Expectations

The interviewees indicate that it is difficult to obtain an overall view of information available from the CFT. This is mainly caused by the idea that apart from the personal contacts no direct entrance to specific information is available. Although these general contacts are available at the CFT, it is still difficult to get specialised information.

This means that information retrieval depends mainly on personal contacts with the CFT. Other information is obtained by information sent by the CFT such as the CFT info, InfoTech focus and CAD-M bulletin. Usually this information is read only once. A specific demand for information is an up to date overview of expertise's and running projects at the CFT. An overview of the running projects gives the customers a better overview of the possible solutions that the CFT can offer for their present problems.

The interviewees are all familiar with the World Wide Web, and the present Web site of the CFT. At the moment the WWW is used to keep up with the latest technical developments and to keep track of the progress of companies in the same field of expertise. Interviewees expectations range from a general overview of the CFT, which can be compared to the printed version of the annual report to specific project information.

A specific point mentioned by the interviewees is the demand for project information. This information is divided into two types. First of all the project reports, containing accumulated knowledge. And secondly an up to date project and activities overview. The first gives an overview of the knowledge residing at the CFT while the latter is an indicator of the current attention fields in the development of knowledge at the CFT.

The interviewees give a number of characteristics on which they base their assessment of the quality of the presented information. These characteristics are:

1. Information has to be up to date, expired information confuses and irritates the user.

2. Where possible, dynamic information is expected. For instance on group level, information concerning the recent activities.

### 10.2.2 Evaluation By The Users

In this part, the users are presented with the concept design of the Web site. Questions related to information in the concept design have to be answered. The assignments are set-up in such a way that navigating a large section of the concept design is required. Point of interest is to see whether or not there are discrepancies between the information needs, expectations and the evaluation given by the interviewees.

The efficiency of the basic design depends completely on the demands of the user. The design suits the demands of users looking for general information available from the CFT since it offers users the possibility to get an overview of the activities of the CFT. Users looking for specific information need to have other ways to access information. For these users a search engine is needed to comfort their needs. Some Web site software already includes search engines for use on local information, opposed to search engines that cover the global Web. These local search engines can be put to use in the search for specific information requested by the user.

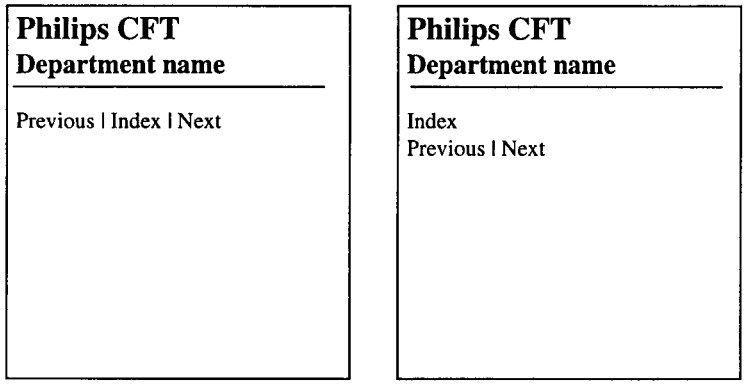



*Figure 17, link placement*

As for the topic of layout and consistency, interviewees agree that using the standard layout contributes to a consistent and therefore clearer view on the site structure. Some link descriptions were still unclear though. For instance the link named Sector guide is altered in Organisation because the term sector wasn't associated to the organisation structure. Other links stated on the top of each node should reflect the physical structure. For instance the situation as shown in Figure 17 a should be changed to the situation shown in Figure 17 b. This to show the relation between the links and the position in the hypertext.

## 10.3 Discussion and Conclusions

Since all interviewees were already familiar with the CFT, it is difficult to get an objective view on the information needs of new users. Although the interviewees can relate to users who aren't able to rely on personal contacts for information gathering, they still give a subjective opinion on the demands of other users. In order to get a more reliable evaluation of the users opinions on the use with the Web site a feedback form could be integrated into the site. This offers the possibility to collect data at users who have no personal relations with the CFT at the time. Therefore they rely solely on the information presented in the Web site. This offers the possibility to get a clearer picture on the gap between information needs and offered information.

The main conclusions of this set of interviews are:

1. Keep information up to date.
2. Integrate a search facility for users looking for specific information.
3. The concept design is, with some small alterations a good basic design for presenting CFT information.

Keeping information up to date can be achieved in two ways. The first is to use static information which demands little maintenance. The second is to provide maintenance for dynamic information on group level, with clear communication lines to implement the information into the active Web site.

The search facility is offered in some server software available at the moment. The search facility can be used to look for specific information, from where it is possible to access additional information by following links up or down in the hypertext structure. This is possible by applying the bi-directional links to the hypertext structure.

The concept design offers a base for users looking for general information about the CFT. Especially for directly contacting people specialised in a specific field of expertise is an option that is helpful for the users. From the providers point of view the concept design is a flexible base on which future additions can be made. Providing additional information can be easily integrated in the normal working process since this is based on the tools already used for information processing.

# 11. Detailed Web Site Design

One of the major problems when running a Web site is that if one node (a page containing HTML information) is moved or deleted, links pointing to that node have to be altered too. Since information is provided at different levels, guidelines are needed to prevent nodes from being deleted while links from other nodes are still pointing to the deleted or changed node. This chapter describes the procedures for site maintenance. These procedures are based on the basic tools used at the CFT for information processing.

Utilities to monitor and repair these links are becoming more readily available. But because we want to limit site maintenance at lower levels to a minimum, these utilities won't be used by the individual information providers. Since the need for maintenance is a direct result of altering nodes, a system is needed which limits the chance on faulty links when nodes are changed or updated. The maintenance of the information will be based on information clusters. A cluster is a collection of related information.

## *11.1 Cluster Based Maintenance*

For the maintenance at cluster level we use the concept design of the Web site, as described in chapter 9, and visualised in Figure 18. Since the physical structure represents the virtual structure the same clusters can be used to form the base for the maintenance system for the Web site.

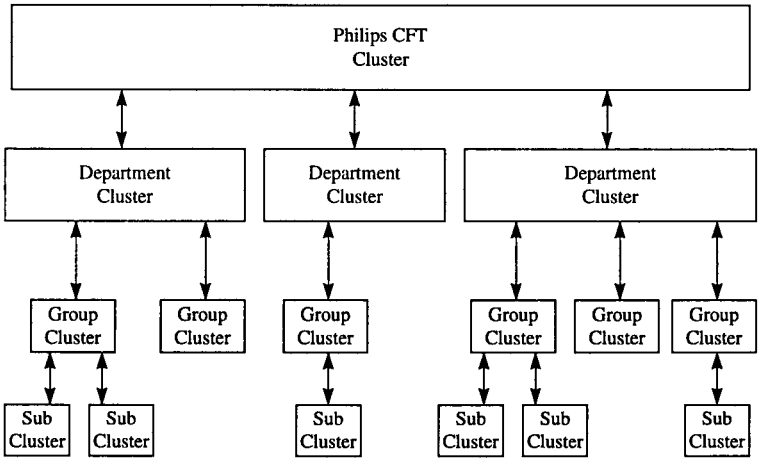



*Figure 18, clustering information*

Maintenance is required when information in the Web site is changed. Depending on the place of the information a number of actions are required to update the information on the Web site. Information contained in one cluster only needs maintenance in that cluster. Information related to the interface between clusters requires a more extensive maintenance plan. The cluster interface is formed by links

originating from one cluster pointing directly to another. An example in which this type of maintenance is required, is when a cluster is added, moved or deleted. An example of adding information is when a new group is founded or when a new expertise is introduced by a group.

### 11.1.1 Cluster Managers

Where alterations to the cluster interface are concerned, communication between information providers of different clusters is required. Since each cluster can be maintained by a number of providers, communication between them can be a complex and time consuming process. To limit the extra time and effort needed for maintenance a cluster manager is appointed for each cluster. This cluster manager has the responsibility for all links in and originating from his cluster. Information on errors in links or nodes should be directly reported to the cluster manager. The cluster manager is then responsible for updating the links in his cluster.

It is possible for one cluster manager to be responsible for a number of clusters. This is for example the case when all group clusters of one department are maintained by one person. Manually updating and checking links is a time consuming activity, and complexity increases when more nodes are involved. To accomplish this, cluster managers should have access to additional tools which offer functionality to check and update links. Actions related to checking clusters are performed off-line. Once the cluster is fully checked and error free it can be transferred to the on-line Web site.

### 11.1.2 Server Managers

For the transition between off-line to the on-line state a number of actions are required. These transactions are executed by people who have access to the Web server. These people are called the server managers. Activities directly related to the on-line Web site are channelled through these server managers.

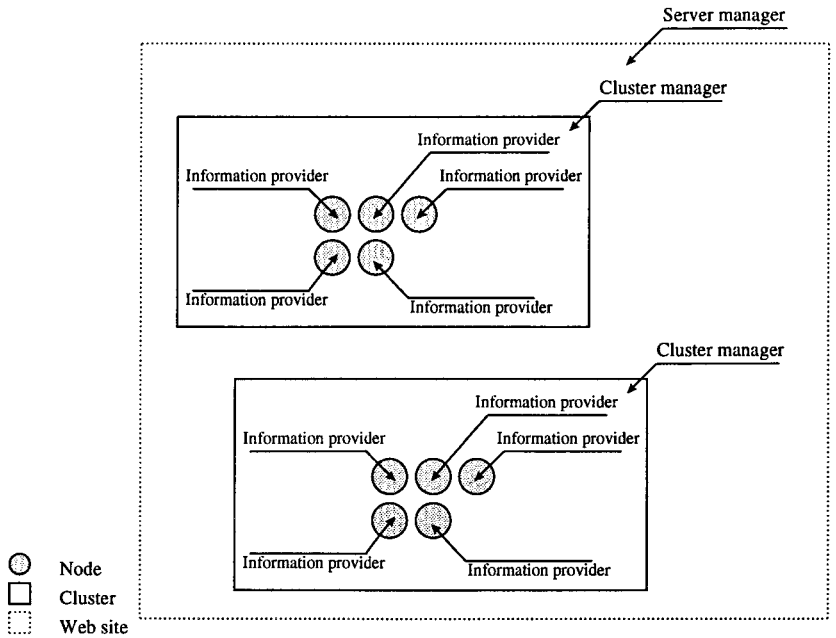



*Figure 19, relationship between nodes, clusters and server*

To ensure transition of information in a set time, agreements on the time schedule for delivering and updating the information has to be made. The involved parties are the cluster managers and server managers.

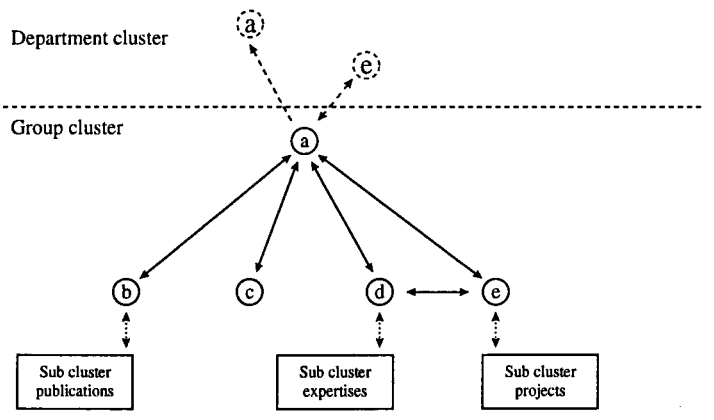
As can be seen in Figure 19, each node in a cluster has an information provider being the person responsible for the information in the node. A number of nodes are packed into one cluster, with each cluster having its own cluster manager.

### 11.1.3 Site Management Information

Since maintenance depends on communication between the different providers and managers there has to be a method to locate these managers. One way of keeping track of all information providers and cluster managers is to register them in a central database. This has the disadvantage that another management function has to be created, namely a person responsible for maintenance of this database. A more favourable option is to decentralise the responsibility of updating this information. This is done by applying information about the information provider and cluster manager into each node. In that way the Web site management information is available to everyone without extra effort.

## *11.2 Guidelines For Information Providers*

Since the activities of the individual information providers have to be co-ordinated, guidelines are needed. As discussed previously, the Internet Assistant for Word is a possible tool which is going to be used to edit Web information. A direct consequence is that while editing, only the links originating from the node are visible to the information provider. This means that first of all the guidelines should provide a description of the Web site structure. Secondly a description of the procedures to update, add or delete nodes from the structure are needed.




| | | |
|---|---|---|
| a | index.htm | Introduction file |
| b | publicat.htm | Index of group publications |
| c | informat.htm | Additional information about the group |
| d | projects.htm | Index of projects conducted by the group |
| e | expertis.htm | Index of expertises of the group |

——— Cluster
------- Cluster interface
..... Sub cluster interface

*Figure 20, group cluster structure*

We start to make a structure description at group level, since this is the base of the Web site and also a base cluster. Looking at the basic information available for each group we get the following structure for the group cluster. The nodes of the group cluster as shown in Figure 20, form a base for additional information per group. This additional information can be placed in sub clusters. Basically one sub cluster contains the same type of information. Therefore a number of sub clusters can be attached to one index node. An example is the node containing the index of the group publications. This can contain links to group reports and on-line publications. The reports are placed in a separate sub cluster. The same goes for the on-line publications.

### 11.2.1 Creating A Sub Cluster

In order to create a new sub cluster a number of actions are required:

1. A sub cluster structure has to be designed.
2. The interface with the parent cluster has to be defined.
3. The structure of the sub-cluster has to be tested for errors.
4. The interface with the parent cluster has to be established, by contacting the cluster manager.
5. The cluster manager contacts the server manager to implement the sub cluster into the on-line Web site.

The first step in creating a sub cluster is defining the structure of the cluster. To make it possible to distinguish the different sub clusters in the physical structure, each sub cluster is given its own physical directory. Two examples of a sub cluster containing the same type of information are given in
Figure 21.

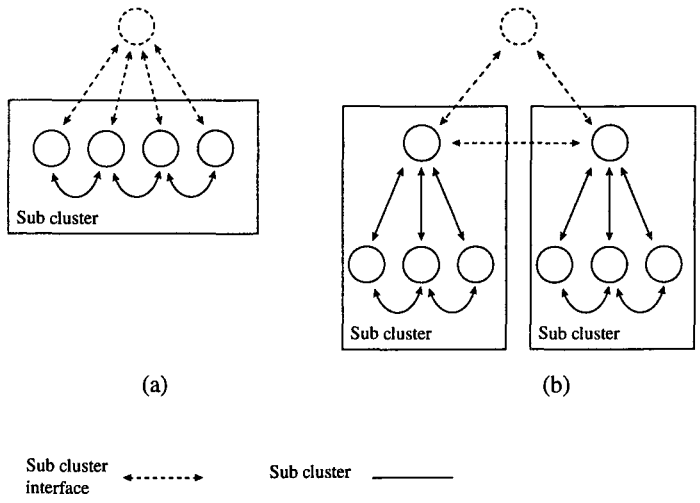



*Figure 21, sub cluster structure*

Example (a) shows a sub cluster with individual nodes directly linked to the index node in the parent cluster. In the cluster the nodes are also linked in a linear way. An example of the use of this type of sub cluster are the project descriptions of a number

of projects. Each node contains a description of a specific project. Example (b) shows an index node which points to multiple sub clusters. An example of such a cluster is an on-line publication with multiple issues. Each issue has its own sub cluster with an index node for each issue and the other nodes containing the individual articles. The next step is to define the interface between the sub and parent clusters. In Figure 22, two screen layouts are given for a sub-cluster. The first (a) is an index node while the second (b) is a node with a description of a project.

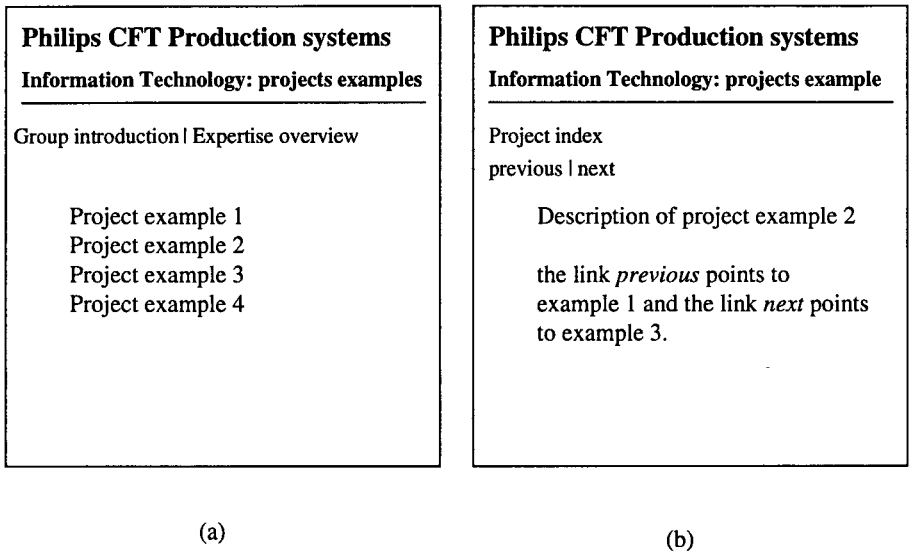



*Figure 22, example screens*

The directory structure of the Web site together with the domain form the Uniform Resource Location (URL). When the URL contains no filename, the Web server software scans for a standard file in the given directory. Since this file is used as the entry point in the sub cluster, its function is the same as the top node of the cluster. Therefore the standard file is typically equal to the top node in the cluster. To make the interface bi-directional, a link is made from the top node in the sub cluster to the interface node in the parent cluster. Please note that these links should be relative links. This means that instead of using the full path of the parent node, the position relative to the top node is given.

### 11.2.2 Implementing A Sub Cluster

Once the sub cluster has been created, the interface has to be established. This is done by the manager of the parent cluster. The sub cluster structure is handed to this cluster manager. He then tests the sub cluster on errors and updates the nodes forming the interface to the sub cluster. Then the server manager is contacted, who implements the updated nodes on the Web server. To delete a sub cluster from the Web server, another procedure is needed.

First of all a check is needed to see if a cluster is liable to be deleted. This depends on agreements made by the information provider and cluster manager. The main reason for deleting a sub cluster is, that it contains outdated information. To detect this information an expiration date has to be set, which is contained in the hypertext documents. This expiration date can be set by the information provider or by the cluster manager. After this expiration date, the cluster manager has to notify the information provider who then has to update the information if necessary after which a new expiration date is set.

Another case in which a cluster is deleted occurs when the initial information provider is no longer viable for the presented information. This occurs when the information provider changes from function or is transferred to another department. In this case there are two options, firstly to appoint another information provider. In this case the information about the information provider in the sub clusters have to be updated. Secondly the information relies solely on one information provider. In this case when no new information provider is available the information should be deleted.

To delete a sub cluster the interface nodes have to be updated. This is done by removing all links pointing to the sub cluster. Then the server manager is contacted who updates the nodes which form the interface to the sub cluster after which the complete sub cluster is deleted by the server manager.

Moving a sub cluster is a combination of deleting and adding a sub cluster. The interfaces with the parent clusters are off-line updated by the cluster manager, after which the sub cluster is moved by the server manager who also changes the updated interface files on the on-line Web site. Information needed to update the interface nodes is handed to the server manager by the cluster manager.

Since the group clusters and sub clusters are the clusters containing the more dynamic information they require more maintenance. The clusters on higher levels such as the department and sector level, are of a more static nature and thus requiring less maintenance.

## *11.3 Management On Department Level*

Procedures for updating and changing information in the higher levels are similar to those for the sub clusters. There are a number of differences between maintenance of group information and department and sector information though. Since information maintenance on department and sector level is more based on the overall organisational structure a more centralised maintenance function is possible. This means that it is possible for one person to update and maintain information for a number of departments. The information requiring more expertise is situated at the lower levels of the site structure and is provided by the people of the different groups.

The same as for group information a basic structure of the department information can be constructed. This basic structure as shown in Figure 23, is a basic structure which can be expanded according to the available information. A number of group clusters can exist beneath the department level.

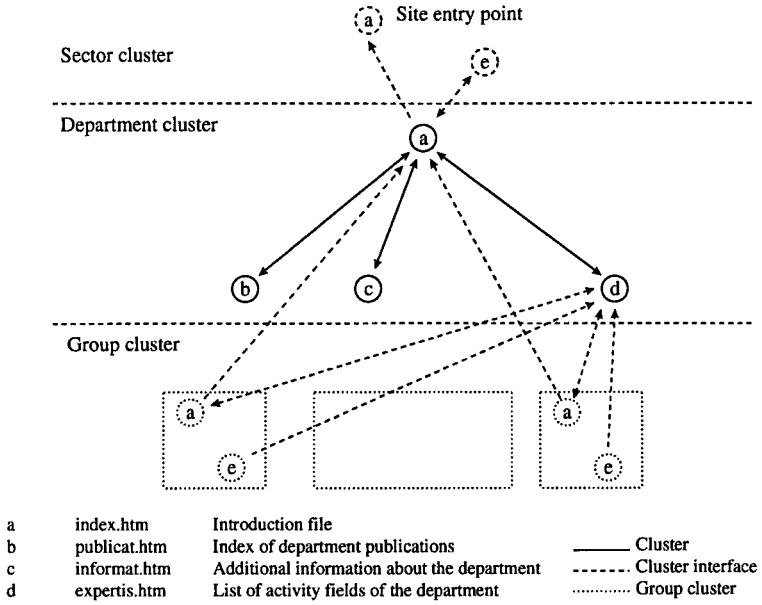
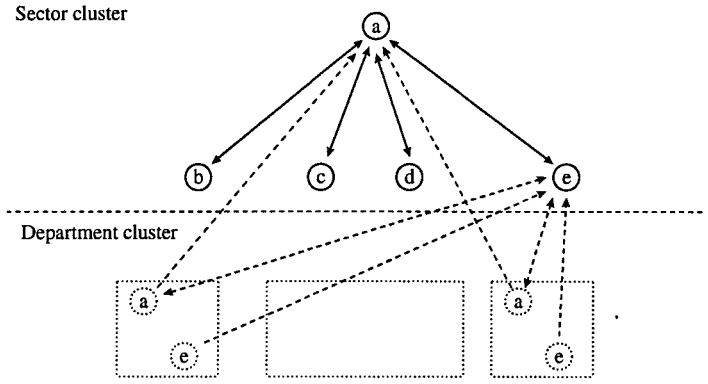



*Figure 23, department cluster structure*

To make maintenance easier these diagrams should be available when structures are changed added or moved. One way of updating documentation containing these diagrams is to mail them to the involved group cluster managers. Another option is to integrate them as graphic files into the Web site. Which one is favourable depends on the number of participating cluster managers and the familiarity with graphic packages which can handle the required file format (GIF or JPEG). A reason to incorporate these files into the Web site is that users a clearer impression of the construction of the Web site. This also enhances the navigating the structure by the users, since a mental model of the Web site can be obtained [Kom90]. When users can form a mental model the chance on 'getting lost' in the hypertext are reduced. This means that usability of the Web site will be increased. And therefore the appreciation of the Web site by the users is also increased.

## 11.4 Management On Sector Level

Since this is the highest level, the best option is to give a server manager the responsibility for maintenance of the sector information. The only really dynamic information here is the file containing the most recent additions and changes to the complete Web site. There are already tools which can be used to set an expiration date on the presented information. After this expiration date the link from the parent node to the file containing this information is deleted. In Figure 24 this node (b) is depicted as having no links to the other clusters, but of course this is not true. It merely indicates that there are no links pointing to this node from the lower levels and therefore this node can be changed without giving notification to other cluster managers.




| | | | |
|---|---|---|---|
| a | index.htm | Introduction | |
| b | recent.htm | Recent changes made to the Site | |
| c | informat.htm | Additional information about the CFT | Cluster |
| d | publicat.htm | On-line publications and central reports | Cluster interface |
| e | expertis.htm | List of activity fields of the CFT | Department cluster |

*Figure 24, sector cluster structure*

Changes in the lower levels, such as the addition of a department are accordingly changed in the interface nodes. From this level a global check on the whole of the Web site can be made. A software package that supports total site management is FrontPage from Microsoft. Besides checking the structure it offers also authoring and additional functionality. An example of extra functionality is a search engine that can be implemented in any part of the Web site, preferably integrated at site level.

## 11.5 Conclusions

Maintenance procedures are based on the responsibility and actions at group level. Providing information is done at group level, while the actual maintenance of the Web site is organised on higher levels. The procedures for providing information are so that the need for maintenance is limited to a minimum. This is achieved by setting standards for the information providers. Since this system is based on the software already in use at the CFT a minimum of learning time is required.

Evaluation of the system is only possible after the introduction. This evaluation should consist of the time needed to implement information and the time needed for maintenance. With these results modifications can be made to the maintenance plan.

Summarising we get the following notes on practical site maintenance:

1. It is possible to combine different functions, an information provider can also be a cluster manager.
2. Make a diagram when a new type of cluster is created. This makes maintenance in the future easier.
3. Empty clusters are available as templates, this makes the creation of new clusters easier.
4. Appoint cluster managers and make agreements on the time between presenting information to the cluster manager and the implementation on the Web site.

5. Information providers are responsible for the contents of the information, while cluster managers are responsible for the maintenance of the structure.

# 12. Conclusions And Recommendations

This chapter describes the results of this thesis. First an overview of the most relevant conclusions are given. These conclusions are based on the results presented in the previous chapters. With these conclusions a number of recommendations are made. These recommendations are a base for future development and expansion of Web activities at the CFT.

## *12.1 Conclusions*

1. The de-centralised site set-up is the most suitable for the CFT at the moment.
2. The hypertext structure suits the user looking for an overview of CFT activities.
3. The provided Web information, lacked overall usability.
4. To increase voluntary Web activity, a fast feedback system is needed.
5. A more user friendly design is available, when more time is available to implement this design over the complete Web site.

**(ad. 1)** From the analysis of the CFT organisation (6.2), it can be derived that at the moment a de-centralised Web site management system is most suitable for the situation at the CFT. This results in a de-centralised set-up of the hypertext structure. This suits users who are orientating and want to get a general overview of the CFT (10.3).

**(ad. 2)** Although the new hypertext structure is useful in getting an overview of the CFT, tools are needed to satisfy the users with more specific demands. A specific demand of the users (CFT customers) is to have access to an up to date overview of project and report information (10.3).

**(ad. 3)** Some information is already updated on a regular basis for use on the Web. For instance the CAD-M bulletin by the CAD-Mechanics group and the InfoTech Focus by the Information Technology group. For these activities fixed funds are available. Since each group initiates and co-ordinates their own actions, there is no overall consensus on layout and design of the hypertext structure, which is a prerequisite for usability (9.6).

**(ad. 4)** Offering information specific for the Web is an additional service provided by co-workers at the CFT, which isn't incorporated in the primary processes of the CFT. As a result, actions related to Web activities will be on a voluntary basis. Therefore feedback on results of likes and dislikes of the customers will be essential for continuation of these activities. Especially in the beginning when feedback from external users will be minimal and therefore the relation between effort and effect unclear, other means of feedback to stimulate Web activities are needed.

**(ad .5)** When more time becomes available for Web related activities another layout and design could be used to present the information. The layout, as described in chapter 8, needs more time to implement and edit then the concept design as described in chapter 9. The advantage of the more complex type of layout, is that it

offers a more user friendly design. To save time and therefore stimulate participation, we choose to use the second and simpler design.

## 12.2 Recommendations

1. To comfort the customers of the CFT a central easy accessible database with report information should become available.
2. At the introduction of the new Web site, put the emphasis on the use as internal (CFT) information medium.
3. Agreements have to be made on maintenance and information provision, to keep the Web site up to date.
4. To get more user feedback a feedback form should be integrated into the Web site.

**(ad. 1)** Although a central storage of reports at the CFT is available, request have to be accompanied with the full report title and project number. This makes it difficult for people without a clear insight in the CFT organisation to retrieve general information on a specific topic. A solution to this problem is to make a central database with project and report information which is accessible through the Web. By using a query on this data base information could be retrieved. However, since the central database isn't available at the moment another solution to this problem is needed. A solution is offered by using a search engine on information presented by the groups. Using this option means that a consistent description of the information is needed. For example, nodes containing project information should have the word project included in the title of the node. By using the template files as described in appendix 5, the use of a search engine becomes feasible.

**(ad. 2)** Lacking of feedback towards the information providers will result in less effort put in Web activities because of lack of motivation. This means that eventually information won't be up to date, reducing the quality of the Web site. This results in negative feedback and a further drop in the participation level. Two solutions to reduce the effects of this problem are:

1. Keep dynamic information at the start of the project information provision to a minimum. Expand activities as the feedback and therefore the effort/effect relation becomes clearer.
2. Put the emphasis at the start on internal (CFT based) information diffusion. This allows a faster feedback communication.

The first option depends on the feedback by users outside the CFT. Furthermore it doesn't use the advantages of the Web, like dynamic content of information, to its full potential. Since the Web site maintenance is de-centralised, it is difficult to collect and process all feedback information. An option is to collect feedback information on department level and present them on a regular basis to the information providers and management teams. For this the same feedback mechanism as in the ISO 9000 project can be used.

The second option is more favourable. Since the CFT new standard software for the CFT includes a Web browser, the Internet Explorer for Windows 95 from Microsoft., and all computers are connected to the internal network, a large group of potential users can be reached. This has another additional advantage, information inside the

CFT is easier accessible through the own organisation. By supplying this information to the internal organisation it becomes easier to redirect new customers to the appropriate departments, thus increasing the service towards the customers. By using the site management information the feedback can also be sent directly to the relevant people reducing feedback times.

**(ad. 3)** To guarantee maintenance on the Web site in the future, agreements have to be made on the tasks needed for continuation of Web activities. Some departments are already reserving time and effort to be used for Web activities. Web activities could be tuned to demands set by the users of Web information. This research includes user feedback by means of an interview.

**(ad.4)** To get a more extensive user input, a feedback option can be implemented into the Web site. In that way a more broader view on the ideas and comments on the presented information from a user point of view becomes available. To put this feedback to use, further research is needed to improve the Web site according to facilitate this feedback. Depending on the availability of such a commission the user feedback can be put to use.

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# Appendix 1: Internet A Technical Overview

The Internet started life as a network used by the US Defense Advanced Research Projects Agency (DARPA) in the 1970's. This early DARPA Internet called ARPANET was used to interconnect university and research sites, from there the introduction of LANs to the Internet has given it another boost forward. At the basis of success of Internet is the protocol stack used on the Internet. This protocol consists of two parts:

1. Transmission Control Protocol (TCP)
2. Internet Protocol (IP)

The construction of this protocol stack is shown in Figure 1. The protocols on the lower levels depend on which type of network is the application is connected to. On the top levels there are applications like e-mail and WWW browsers. All the TCP/IP specifications are publicly available, as a result of which the Internet is by far the largest currently operational Internet based on open standards. At a lower level there are different protocols in use, depending on the network supplier and the type of network.

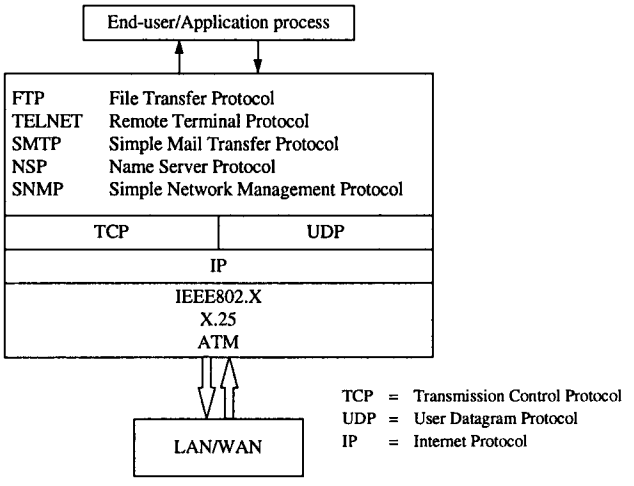


*Figure 1, protocol stack*

## *Address Structure*

To get the information to the right computer an address has to be included into the data package to make sure that each host has a unique address identifier. This identifier is called an IP address and consists of a 32-bit number. There are three different address formats defined, to allow different network sizes to which the host may be attached. Each of these formats is known by an address class. A single network may use addresses from all three classes.

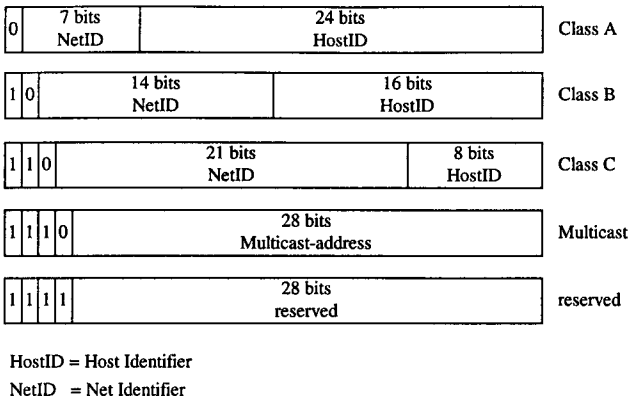


*Figure 2, address structure*

In Figure 2 there is a overview of the different address classes. As shown is the address class determined from the first zero bit in the first four bits. The remaining bits specify two subfields, a Network Identifier (NetID) and a Host Identifier (HostID). Class A addresses are intended for use with networks that have a large number of attached hosts (up to $2^{24}$) while class C are intended for a large number of networks with each a relative small number of hosts (256). ARPANET for example is a class A network while a single site-wide LAN is a class C network. The 32 bit address is broken down into four bytes, in order to make IP addresses easier to communicate. These four bytes are converted into an equivalent decimal form, called dotted decimal. Examples are given below:

00001010 00000000 00000000 00000000
is in decimal dot format 10.0.0.0 Class A and represents a NetID_10 (ARPANET)

10000000 00000011 00000010 00000011
s in decimal dot format 128.3.2.3 Class B and represents a NetID_128.3, HostID_2.3

11000000 00000000 00000001 11111111
s in decimal dot format 192.0.1.255 Class C and represents all hosts broadcasting on NetID_192.0.1

From the IP address can be derived to what type of network the contacted host is connected.

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# Appendix 2: Color Pallet

Netscape uses the following colors:

| #000000 | #003300 | #006600 | #009900 | #00CC00 | #00FF00 |
|---|---|---|---|---|---|
| #000033 | #003333 | #006633 | #009933 | #00CC33 | #00FF33 |
| #000066 | #003366 | #006666 | #009966 | #00CC66 | #00FF66 |
| #000099 | #003399 | #006699 | #009999 | #00CC99 | #00FF99 |
| #0000CC | #0033CC | #0066CC | #0099CC | #00CCCC | #00FFCC |
| #0000FF | #0033FF | #0066FF | #0099FF | #00CCFF | #00FFFF |

| #330000 | #333300 | #336600 | #339900 | #33CC00 | #33FF00 |
|---|---|---|---|---|---|
| #330033 | #333333 | #336633 | #339933 | #33CC33 | #33FF33 |
| #330066 | #333366 | #336666 | #339966 | #33CC66 | #33FF66 |
| #330099 | #333399 | #336699 | #339999 | #33CC99 | #33FF99 |
| #3300CC | #3333CC | #3366CC | #3399CC | #33CCCC | #33FFCC |
| #3300FF | #3333FF | #3366FF | #3399FF | #33CCFF | #33FFFF |

| #660000 | #663300 | #666600 | #669900 | #66CC00 | #66FF00 |
|---|---|---|---|---|---|
| #660033 | #663333 | #666633 | #669933 | #66CC33 | #66FF33 |
| #660066 | #663366 | #666666 | #669966 | #66CC66 | #66FF66 |
| #660099 | #663399 | #666699 | #669999 | #66CC99 | #66FF99 |
| #6600CC | #6633CC | #6666CC | #6699CC | #66CCCC | #66FFCC |
| #6600FF | #6633FF | #6666FF | #6699FF | #66CCFF | #66FFFF |

| #990000 | #993300 | #996600 | #999900 | #99CC00 | #99FF00 |
|---|---|---|---|---|---|
| #990033 | #993333 | #996633 | #999933 | #99CC33 | #99FF33 |
| #990066 | #993366 | #996666 | #999966 | #99CC66 | #99FF66 |
| #990099 | #993399 | #996699 | #999999 | #99CC99 | #99FF99 |
| #9900CC | #9933CC | #9966CC | #9999CC | #99CCCC | #99FFCC |
| #9900FF | #9933FF | #9966FF | #9999FF | #99CCFF | #99FFFF |

| #CC0000 | #CC3300 | #CC6600 | #CC9900 | #CCCC00 | #CCFF00 |
|---|---|---|---|---|---|
| #CC0033 | #CC3333 | #CC6633 | #CC9933 | #CCCC33 | #CCFF33 |
| #CC0066 | #CC3366 | #CC6666 | #CC9966 | #CCCC66 | #CCFF66 |
| #CC0099 | #CC3399 | #CC6699 | #CC9999 | #CCCC99 | #CCFF99 |
| #CC00CC | #CC33CC | #CC66CC | #CC99CC | #CCCCCC | #CCFFCC |
| #CC00FF | #CC33FF | #CC66FF | #CC99FF | #CCCCFF | #CCFFFF |

| #FF0000 | #FF3300 | #FF6600 | #FF9900 | #FFCC00 | #FFFF00 |
|---|---|---|---|---|---|
| #FF0033 | #FF3333 | #FF6633 | #FF9933 | #FFCC33 | #FFFF33 |
| #FF0066 | #FF3366 | #FF6666 | #FF9966 | #FFCC66 | #FFFF66 |
| #FF0099 | #FF3399 | #FF6699 | #FF9999 | #FFCC99 | #FFFF99 |
| #FF00CC | #FF33CC | #FF66CC | #FF99CC | #FFCCCC | #FFFFCC |
| #FF00FF | #FF33FF | #FF66FF | #FF99FF | #FFCCFF | #FFFFFF |

# Appendix 3: Template Files

These are the template files, used in the first experiment. The template file for the standard HTML layout model a looks like this;

```
<HTML>
<HEAD>
<TITLE>Philips CFT</TITLE>
</HEAD>
<BODY>
<IMG SRC="fotos/cft-logo.gif" ALIGN="BOTTOM" >
<H1>Chapter title</H1>
<P><!- start of paragraph ->
....Text....
<UL> <!- start of list ->
        <LI> <A HREF="file_name.htm" >Link description</A>
        <LI> <A HREF="file_name.htm" >Link description</A>
        <LI> <A HREF="file_name.htm" >Link description</A>
        <LI> <A HREF="file_name.htm" >Link description</A>
</UL><!- end of list ->
<P><!- next paragraph ->
...Text...
<ADDRESS>
For questions and comments on these pages please contact:
<A HREF="mailto:name@domain" >Name@Domain</A>
</ADDRESS>
<P>
Last modified: dd mm yy
</BODY>
</HTML>
```

This is the template file for model b.

```
<HTML>
<HEAD>
<TITLE>Philips CFT introduction</TITLE>
</HEAD>
<!- start of standard page layout ->
<BODY BACKGROUND="gifs/philips.gif" BGCOLOR="#ffffff"
TEXT="#000000" ALINK="#ffffff" VLINK="#0000ff" LINK="#ff0000">
<!- setting background color to white, text to black, links to red, and visited links to
blue ->
<TABLE BORDER=0>
<TR VALIGN=top>
        <TD><!- first column ->
                <IMG BORDER=0 SRC="gifs/cftl.gif"><!- logo in first column) ->
        </TD>
        <TD><!-second column  ->
                <H1>Philips <I>CFT</I></H1><BR>
                <H2>Centre for Manufacturing Technology</H2>
        </TD>
</TR>
</TABLE>
<!- end of standard page layout, next sections are optional text blocks ->
<TABLE BORDER=0>
<TR VALIGN=top>
        <TD><!- first column -><B>
                Header text</B><BR>
                <IMG BORDER=0 SRC="gifs/sline.gif">
        </TD>
        <TD><!-second column ->
                Text block<BR>
        </TD>
</TR>
<TR VALIGN=TOP>
        <TD><!- first column -><B>
                Header text</B><BR>
                <IMG BORDER=0 SRC="gifs/sline.gif">
        </TD>
        <TD><!- second column ->
                Text block<BR>
        </TD>
</TR>
</TABLE><BR>

<!- begin of signature line ->

<TABLE BORDER=0>
<TR VALIGN=top>
        <TD><!- first column sign off -><B>
                Contact</B><BR>
                <IMG BORDER=0 SRC="gifs/sline.gif"><!- sign off line ->
        </TD>
```

```
        <TD><! second column  sign off text ->
                For questions or suggestions about this page please contact
                <A HREF="MAILTO:USER@HOST">USER@HOST</A><BR>
                This page was last updated on:  Month Day Year
        </TD>
</TABLE>
</BODY>
</HTML>
```

# Appendix 4: Experiment Setup

In the experiment Netscape 2.0 was used. The Netscape window setting, which can be found in the netscape.ini file, that was used is:

y=0
x=173
height=600
width=630
left=140
top=0
right=778
bottom=602

The questionaire is as follows:

The difference in page 1 and page 2 is the ammount of presented text, page one fits on one screen while page two consists of three screens. Which page do you prefer?

Page 1 OOOOO Page 2

Layout of the text, what is the distribution of text over the page, what do you think of the balance between the amount of text and free space?

| | | | |
|---|---|---|---|
| Page 1 | Good | OOOOO | Bad |
| Page 2 | Good | OOOOO | Bad |

Overview during scrolling, this goes for page 2. Are the separate text blocks distinghuisable during scrolling?

Good OOOOO Bad

What do you think of the use colors, are they soothing for the eye? Give a rating for the colors of the

| | | | |
|---|---|---|---|
| Background | Nice | OOOOO | Ugly |
| Text | Nice | OOOOO | Ugly |

Do the used colors contribute to the readability of the text?

Good OOOOO Bad

At the beginning of each text blocks a title is given. Are these titles distinguishable from the text blocks?

| | | | |
|---|---|---|---|
| Page 1 | Good | OOOOO | Bad |
| Page 2 | Good | OOOOO | Bad |

Do the two pages form a consistent image?

Good OOOOO Bad

Give a end rating on both pages

Good OOOOO Bad

# Appendix 5: Standard Layout Templates

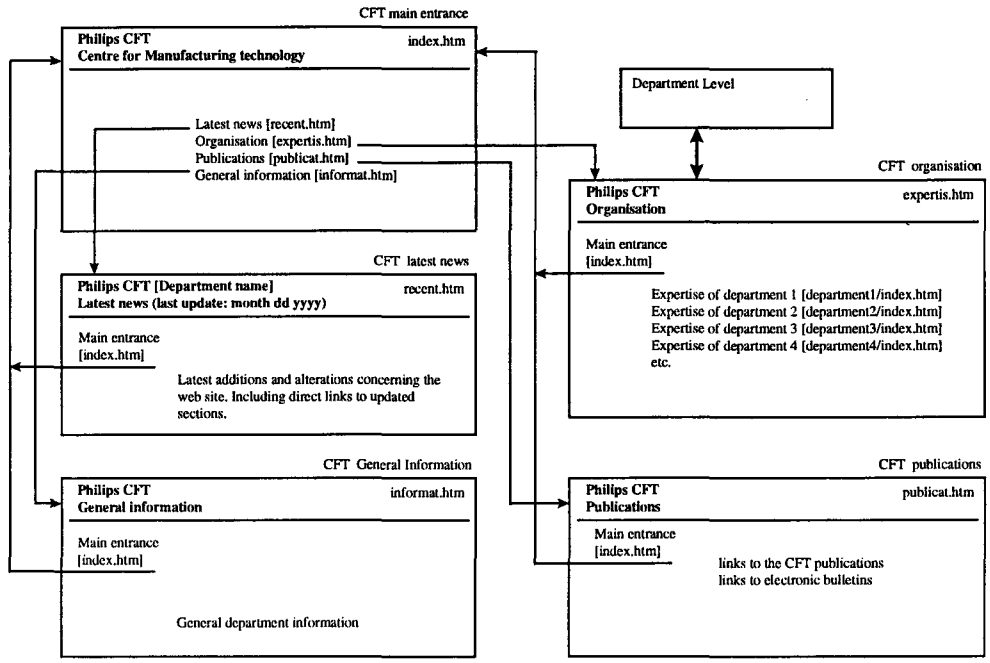


*Figure 3, sector level template layout*

**Philips CFT**
**Centre for Manufacturing Technology**

Welcome to Philips CFT Technology main entrance.

This is the starting point of the CFT information pages. Information is available on the following topics:

•Latest news
•Organisation
•Publications
•General information

```
<HTML><HEAD>
<TITLE>CFT Main entrance</TITLE>
</HEAD>
<BODY>
<H1>Philips CFT</H1>
<H2>Centre for Manufacturing Technology</H2>
<HR>
<P>
<H3>Welcome to Philips CFT Technology main entrance</H3>
This is the starting point of the CFT information pages.
Information is available on the following topics:
<UL>
<LI><A HREF="recent.htm">Latest news</A>
<LI><A HREF="expertis.htm">Organisation</A>
<LI><A HREF="publicat.htm">Publications</A>
<LI><A HREF="informati.htm">General information</A>
</UL>
</BODY></HTML>
```

*Figure 4, example screen with HTML code*

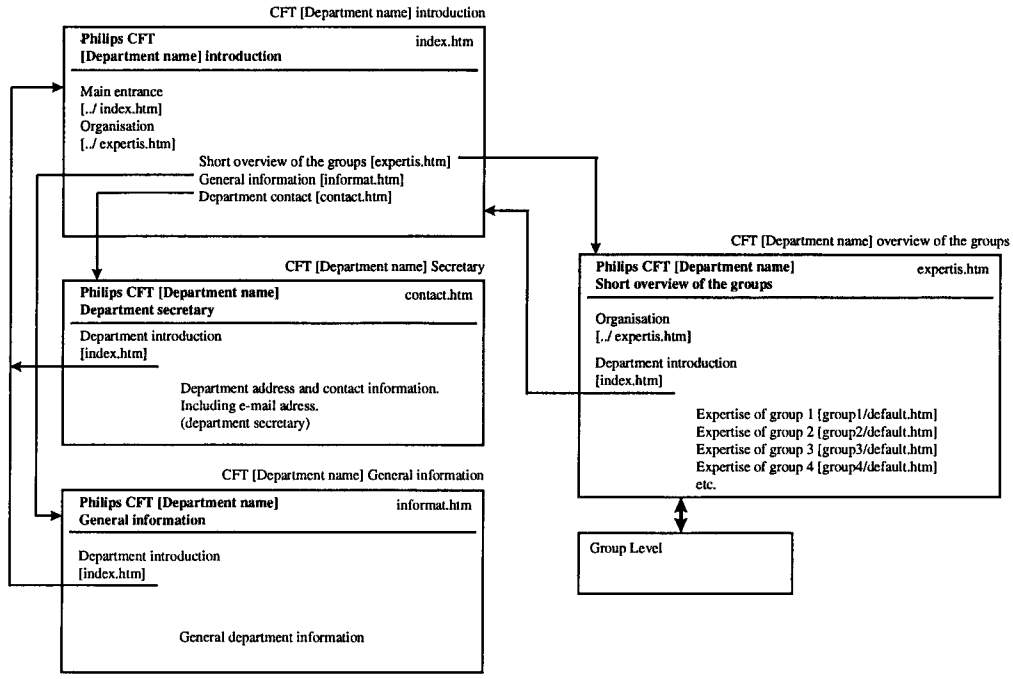


*Figure 5, department level template layout*

**Philips CFT**
**Production systems introduction**

Main entrance
Organisation

**Welcome to the Production Systems department**

The following topics are available on the production Systems department:

•Short overview of the groups
•General information

```
<HTML><HEAD>
<TITLE>CFT Production Systems introduction</TITLE>
</HEAD>
<BODY>
<H1>Philips CFT</H1>
<H2>Production Systems introduction</H2>
<HR>
<P><A HREF="../index.HTM">Main entrance<BR>
</A><A HREF="../expertis.htm">Organisation</A> </P>
<H3>Welcome to the Production Systems department</H3>
<P><img src="welcome.gif" align=right> </P>
<P>The following topics are available on the Production
Systems department </P>
<UL>
<LI><A HREF="expertis.htm">Short overview of the groups</A>
<LI><A HREF="informat.htm">General information</A>
</UL>
</BODY>
</HTML>
```

*Figure 6, example screen with HTML code*

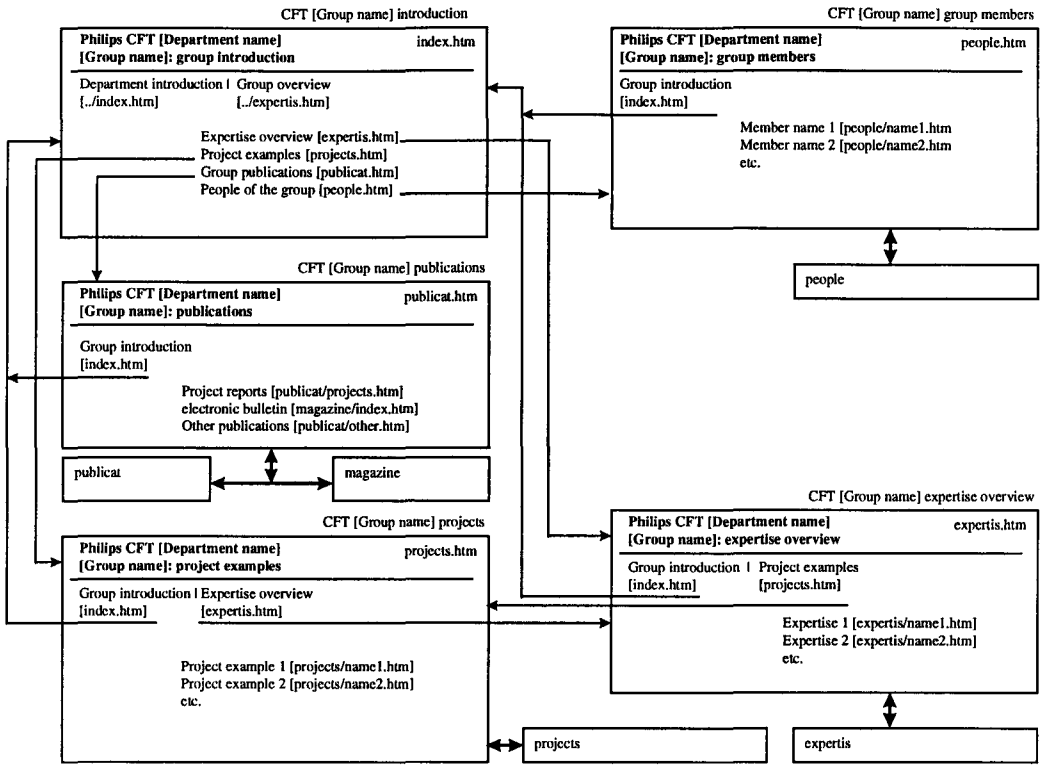


*Figure 7, group level template layout*

**Philips CFT Production systems**
**Information Technology: group introduction**

Department introduction

The following topics are available on the Information Technology group

- Expertise overview
- Project examples
- Group Publications
- People of the group

```
<HTML><HEAD>
<TITLE>CFT Information Technology introduction</TITLE>
</HEAD>
<BODY>
<H1>Philips CFT Production Systems</H1>
<H2>Information Technology: group introduction</H2>
<HR>
<P><A HREF="../index.HTM">Department introdcution</A>
</P>
<H3>Welcome to the Information Technology group</H3>
<P>The following topics are available on the Information
Technology group
<UL>
<LI><A HREF="expertis.htm">Expertise overview</A>
<LI><A HREF="project.htm">Project examples</A>
<LI><A HREF="publicat.htm">Group publications</A>
<LI><A HREF="people.htm">People of the group</A>
</UL>
</BODY>
</HTML>
```

*Figure 8, example screen with HTML code*

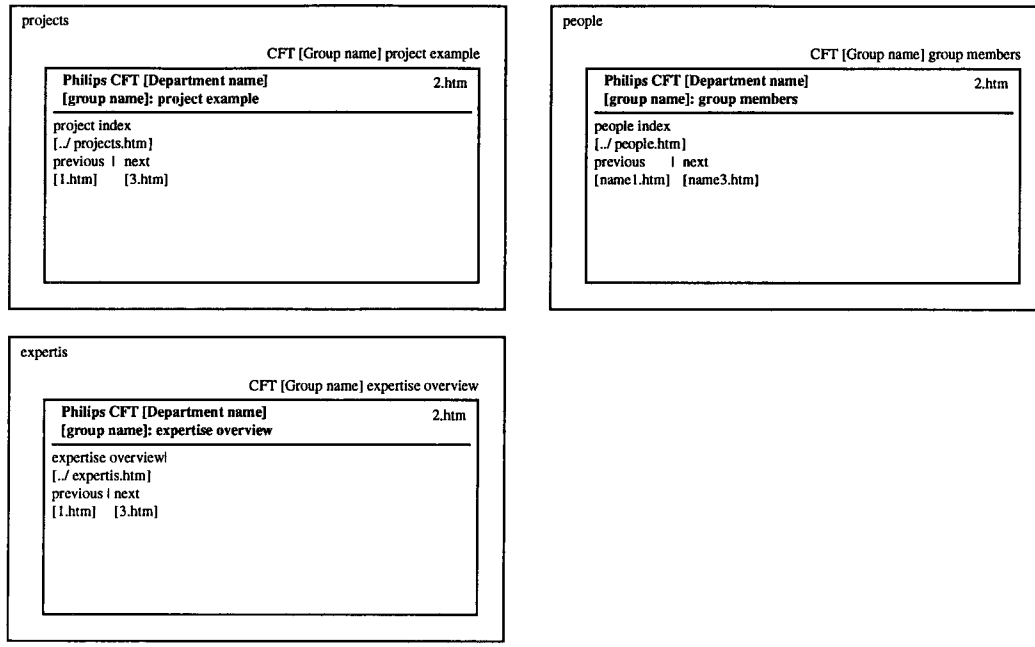


*Figure 9, sub cluster, group level template layout*

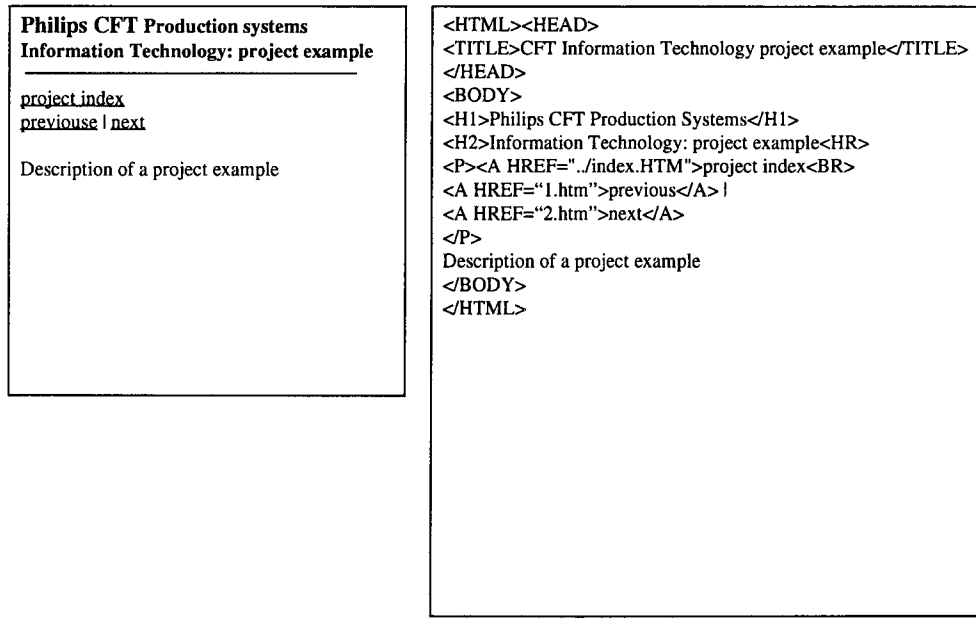


*Figure 10, example screen with HTML code*

# Appendix 6: The Second Set Of Interviews

This interview is used to evaluate the concept Web site design from a users point of view. The interview is divided into three parts. The first part focusses on the users expectations and demands on electronic information. Introducing the concept Web site to the users is the second part. A number of excercises have to be executed by the interviewees with the hypertext structure. Evaluation of the concept design is done in the third stage. In this stage the interviewees can give their opinions and remarks on the concept design.

A short explanation is given as an introduction to the first part of the interview. Since this is a person to person interview, this introduction is a summary of the story that is told. Before the start of the interview parts that aren't clear in the introduction can be explained in more detail:

This interview is part of my master thesis for the Eindhoven University of Technology which is an assignment from the Philips Centre of Technology (CFT) in Eindhoven. The results of this interview will be used to expand and improve WWW information presented on the Philips Corporate Intranet. This interview consists of three parts. The first part concentrates on your opinions and ideas about the present information service by the CFT. For the second part of this interview a demo version of the concept Web site is used. With this demo a number of assignments have to be carried out. Afterwards in the third stage a total evaluation is made in which remarks and comments can be given on this concept design.

**Interview questions**

1. Can you give a list of available information by the CFT?
2. Where do you obtain this information?
3. Is the information used on a regular basis? (once, twice a week, once a month....)
4. What kind of information is of interest to you?
    - Reports
    - Brochures
    - Project descriptions
    - Calculation tools....
5. Did you ever look for information from the CFT you couldn't find in the end?
6. Are you acquainted with the World Wide Web (WWW)?
7. If so, how do you know the WWW?
    - Commercials
    - Personaly
    - Colleagues....
8. If the interviewee knows the WWW personaly, how often do you use the WWW to find information?
9. If so, what information is of most interest to you?
10. What are your expectations on the information presented by the CFT?
11. Can you give an estimation on the total amount of information present on the WWW site by the CFT?
12. What information will be available from the different groups?

13. What information do you expect to find on the WWW site?

**Concept design introduction**

The next part of the interview is a small experiment. For this a portable computer is used, on which the concept design can be viewed using the Netscape browser. The screen resolution of the used portable is 640x480 with 250 colors. A number of assignments will be given, which the interviewee has to perform. These assignments consist of a question to which a answer has to be found, using the Web site. The interviewee is encouraged to give feedback, by giving comments on why choices are made. This feedback together with the errors made will be used to make an evaluation of the concept design. Afterwards there is also the possibility to give comments and remarks.

**Tasks**

1. Who is the contact person for the CAD-M group?
2. Which group is specialized in data communication?
3. Navigate through the project and expertise section of the Information Technology group, under the Production Systems department.

**Evaluation**

This final part of the interview concentrates on the assessment of the previous two parts. In this stage your personal opinions are of interest, especially your suggestions on improvements and alterations are welcome. Some sugestions on topics related to this part are:

1. What did you think about the complexity of the WWW structure?
    - Navigation
    - Contents of the information
2. Are the hyperlinks descriptions clear?
3. Are the page titles clear?
4. What did you think about the amount of information?
5. Did you miss some specific topics in the offered information?