This chapter is devoted to outline the SwissCast push service. In order to accomplish this task, it will offer, first of all, a general presentation of what push services are.

To do so, two main issues need to be stressed: information relevance, and the main differences between search services and push services. These differences are the very basis upon what it seemed wiser to develop a specific strategy for the push system, quite different from the firstly tested search and push system (a brief discussion of its test is presented).

Once those issues are discussed, the SwissCast system is presented in detail from the graphical and the technical point of view.

2 Push services. General issues and references

2.1 Pull & Push: a short history

Until now, the Internet communication metaphor for information access has been mainly that of browsing information on the World Wide Web. Here, the user searches actively for information s/he needs by browsing among the Information Provider sites,generally with the help of an Internet Information Search Engine (as Hotbot,Altavista, and so on) or by leafing through the Internet Directory Services (like Yahoo).The concept of browsing for information,on which the World Wide Web (WWW) is built, was functional to a usage of the Internet restricted to a relatively small community of people, essentially the academic one, for whose needs the Internet was built,where it was well known to the Information Providers whose contents and information format were sought.

During the last few years, with the spread of the WWW, the Internet moved from being a communication medium for a specific social community and very specialised uses to being a generic public-domain medium, accessed by a great variety of users and used in order to supply generic information, ranging from scientific to commercial information,news and sports.

Thus, the limits of the concept of browsing are becoming more and more apparent: firstly, the search for information becomes increasingly inefficient, a problem that frustrates users and leads to bottlenecks in the network;secondly, if the user needs time-critical information (like news,stock quotes,traffic info) s/he is forced to check the same Information Provider periodically, even when information is unchanged.

The paradigm of information casting (also known as *WebCasting, PushCasting, Channel Broadcasting, etc.*) could be an answer to these problems. Information casting,wich we will subsequently refer to as push,is the term used for the automatic delivery of content to the computer desktop over the Internet.

Push products'success comes from their capability of delivering information to users' desktops (in almost real time), without any need for them to have to search for it. For example, instead of keeping the latest information on a static World Wide Web page that the user has to access and constantly reload, the information is automatically downloaded to the user. The user chooses the kind of information s/he wants to receive: e.g.: sports, stock updates, news, etc. Push can be an efficient way to distribute information, data, entertainment and even software directly to the end users who need it,as soon as it's available, and in due time. Push relieves the end user from the retrieval and filtering burden.Because of the ever greater quantity of information for Internet users to track, the advantage of push technology has become more evident.

A push service can be carried out by an Information Provider itself, or by a third party, with the role of an *information broker*. The broker receives data from various publishing sources, then selects and prepares data exactly to suit the users'needs. To do this it has to select appropriate content from the repository, then download it to the user according to a personal profile, which each user has provided to the broker.

Data is broadcast down to the user, much like television or radio programming.Information is pushed into the user PC's Hard Disk, which means that users can view it whenever they like, and not just at the moment that it's broadcast.

In this way, the meeting of information offer and demand over the Internet is made much easier, leading to a communication scheme that is closer to the traditional mass media (TV, newspapers, magazines,etc.) but with the whole set of advantages given by the digital medium. Moreover, the recipient of information has a much greater opportunity of interacting with the other active bodies in the information chain.

At present, unlike television broadcasting,where all users receive the same information according to the profile defined by the broadcaster on the basis of market analysis,information casting systems on Internet leave important room for customisation.

Thus, the problem of defining target groups, and of selecting relevant information for them, acquires a new dimension and can be solved only by an intelligent use of the tools offered by the information casting systems: leaving wide customisation possibilities to end users is a fundamental contribution in this direction.

2.2 A definition of Push

In order to avoid confusion among the different interpretations of push present in literature, we here report the definition of push technology's systems most encountered among information technology'professionals (IT),according to the definition mentioned in the introduction:

Push is the automatic delivery of content to the user's computer desktop; content is organised by topic

defined by a publisher and the user receive information according to his own pre-defined profile.

Some IT professionals, like Lee Fleming (Fleming, 1997), argue that push is only the automatic delivery of content to users,without any reference either to the topics of the messages or to the user's profile.We don't agree with this idea,because we think that both topics and user profile are key factors in order for push to be accepted among Internet users.

Push is not a new technology, in fact the classic mailing list service is based on e-mail.There are content providers who push content directly to their end users in the form of e-mail.This E-mail is often in the format of headlines with summary paragraphs linked to a Web page on a Web site, or an HTML page complete with advertising and links.The topics of the e-mail message are defined in a user pre-defined profile established when the user subscribes to the service. These products include Netscape In-Box direct, Diffusion intraExpress,Eurospider.

On the other hand, many products erroneously classified as push are in effect truly off-line browsers (Storm,1997),among which WebEx of Traveling Software.We are talking about tools which periodically visit a Web site, check to see if the content has changed,and download the modified pages,if any to the user. From this point of view, channels are nothing more than sites that are downloaded periodically to users' hard disk. In our analysis, we omit these kinds of products.

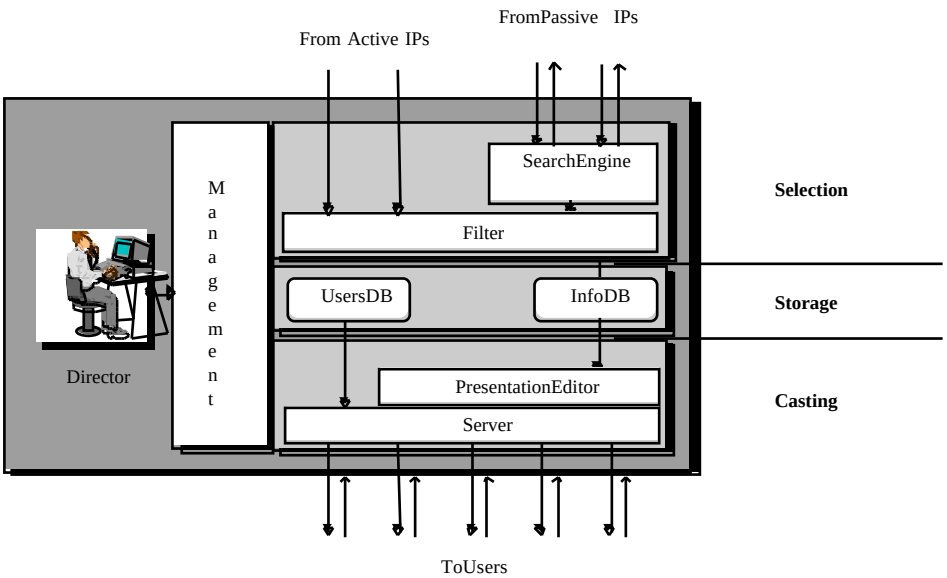
2.3 System architecture

We report the following figure, included in the first Scientific Description[1] of the project.

This figure represents,at a high level of description,the basic layouts of the architecture of the SwissCast project. Blocks represent the logical unit of information processing, while arrows represent the flow of the information within the system.We can see in the figure that can be 3 identified stages where the flow of information travels:

- Selection:at this stage information items (we call also them 'documents') are inserted by active providers through web forms, got from passive providers through a search engine (also know as a gatherer).The task of the search engine is to gather information from a set of web sites and html pages on the Internet,to provide the Director with a tool (filter unit) for retrieving new information, discarding useless information and putting useful items into the database (db) in a comfortable and efficient way;
- Storage: at this stage documents are inserted into the db: user profiles are also stored in a specialised db;
- Casting: at this stage information items are matched against user profiles, and users can browse throught documents using a common web browser. In addition, users are notified via e-mail when new documents match their profile.

For further details, see the first Scientific Description of the SwissCast project. Now we will see some details about the realisation of each module in the figure above.



3 Delivering the "right information": the push concept and implementation

3.1 Information brokerage

Information,its quantity, quality and updating are among the main issues of the "push"story. But all those things are just the material side of the story, the other side - the most interesting indeed - is that of people producing those information items,and consequently interacting.Both the characters and the framework have to be taken into consideration when devising a scientific search in the field.Hereafter a brief sketch of the plot is offered.

3.1.1 A question of people

The main purpose of a push service is that of meeting end-users'needs,conveying to them all the information items they want to get, and only those items.This paragraph will be devoted to further discussion of the issue looking at it from different points of view.

If we consider the activity of a push service as being that of an information broker, we have to take three main elements into account: information providers, information receivers and the available information the broker has to manage. Let us consider these elements in detail.

Information Providers. Over the Internet the number of information providers grows at an astonishing rate.The vast majority of them – given the newness of the medium – does not have a clear idea of their target over the net ("everybody"is not a clear cut definition,although it is true from a purely hypothetical point of view).

Many information providers don't analyse their visitors' statistics and don't engage in dialogical exchange with their clients, missing the reshape or – at least – focuse their own structure to meet the users' needs.First e-commerce experiences are showing how this effort to know one's clients better is seminal when one comes to sell something.Nonetheless information could also be considered as something to be sold:this explains the proper struggle websites engage into gain better ranks on search engines.

Knowing the market entails a continuous analysis of what others offer over the net,which is not an activity many providers are equipped for – because of a lack of both resources and awareness.This turns into redundant information as well as into poorly or unplanned site updating.

Information users. Many people use the Internet, but not many do so in an effective and efficient way. Superficial knowledge of the tools they use, and their capabilities,as well as at available information are among the reasons why the web is far from being used by professionals as an everyday tool.

The new medium is faced with conflicting psychological attitudes. Sometimes the difficulties of navigation software are perceived as being too big an obstacle to overcome; sometimes their (apparent) accessibility hides more advanced functionalities, and hinders study how to use the electronic medium itself better. Sometimes the lack of physical borders gives a sense of fainting,sometimes a good-enough service is perceived as the state of the art,and the professional loses interest in looking for new and better services (a kind of a "hic stabimus optime" protected area).

Website structures are often not well organised, thus hindering people from staying and looking for the information they need; this lack of well engineered websites' is what mainly gives net surfers that common feeling of getting lost and of having lost their time in a dream experience.That is why so many say:"I don't know why and how I got there","I wouldn't be able to get back there again","I surfed around for ages but I haven't a clue where I went",and so on.

Moreover, laymen surfers are ill at ease having to cope with websites whose information quality doesn't grow much, but whose effort to implement new, strange and not always useful technologies does grow each day. New technologies,tested by and developed for specialists are very often a big obstacle for non computer-addicted people, who tend to escape them, defending themselves by thinking "anyway, I'm not a computer specialist".

SwissCast's choice of adopting a mix of webpages and e-mail is thus based on evidence from the experience of users, who know how to read and send e-mail and how to browse through simple pages, and feel comfortable when doing so.

Technological competencies are not well mixed with communicational ones in website developing teams. Too many links, in particular, side track surfers, offering them an overwhelming number of choices to make when reading.This situation – together with the fact that adults are not trained to learn from the electronic (hypertextual and hypermedial) medium – could bring to a poor consideration of information available on the

net,or to a poor use of it.

Not exactly knowing where to go, and how to efficiently surf,often turns into an unbalanced rate between time and gain advantages: finding something which is really relevant could be too time demanding,and thus perceived as being not economical at all.Let us think – for example – of the frustrating experience of looking for something with a search engine, trying to find something useful out of millions of items.

There are two main issues regarding the use of the net by professionals:getting relevant information (not garbage) and getting it in an economical way, which means neither having to become computer specialists,nor having to spend too much time surfing around to get information that could be had in an easier – or, at least, better known and more secure – way.

3.1.2 A question of information quality

Available information. Quantity and quality of information available through the net are the main issues an information broker meets in his bridging activity.

The web offers a continuously growing quantity of information, both originally published for the electronic medium, or made available through it although originally published and developed for different media.The technical accessibility of it – just sitting in front of a computer – promotes conflicting feelings of having everything in front of you (just click an' go), and of being impotent, not knowing where to go and what to pick.

Internationally agreed quality standards for web based information are not yet available – although a number of proposals have been proposed on the issue – and this means,due to the nature of the electronic medium itself, that just about anything could be found over the net, and can strive to become a standard.

Moreover, available information is accessible often accessible in quite different formats, and this is a big obstacle to usage, asking people to become familiar with different technological tools.

Information overwhelming asks for new tools to cope with.Among them,an information brokering activity.With this frame in mind, an information broker has to develop strategies and tools to help their clients – both information providers and users – to reach relevant information in an economical way.

3.1.3 A question of bridging

The broker. First of all:brokers have to know their clients and their information needs, especially those of information end users.

Secondly: they have to identify relevant information sources according to their clients and collect them.

Thirdly: the broker works as a translator. Indeed, available information must be semantically mapped following a subject-oriented schema.This mapping is of the main importance because it is a kind of shared language between information providers (brokers themselves as well acting also as active information providers) and clients. On one hand it helps classify information, on the other, to better define one's own user profile. Only if keywords are shared, and adequate for the subject area, a good communication exchange can be granted.

Fourthly: information brokers have to build up a platform where their clients can easily access the information they are interested in.

Lastly: clients have to be notified – following precise guidelines concerning method and time – when something matches their profiles.

3.1.4 A few ending lines: adopting and adapting Algirdas-Julien Greimas's narrative frame

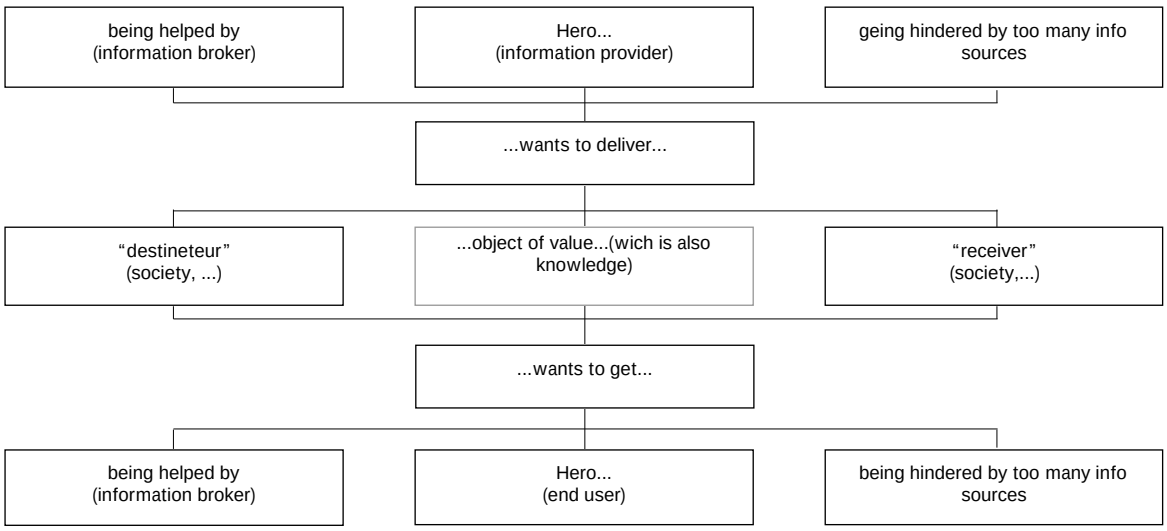
Push activity seems to be interpretable as a novel,to which the semiotic frame proposed by Greimas (1970, cf. also Caprettini 1997) could be applied.

As it is well known,Greimas proposed the following macro structural interpretation of the narrative plot: someone (the main character) wants to reach something (an object of value), in his quest he is helped by someone/thing (helper),and hindered by someone/thing (opponent);two more elements are on the stage:the "destinateur":who or what pushed the hero towards his goal,and the receiver: who or what receives the object of value once it has been conquered by the hero.

The plot of the information pushing could thus be rewritten — using these categories — as being the crossing of two mirroring and partially overlapping stories.The information broker works as the helper of the end user in his/her quest towards (getting) the knowledge s/he wants,and the information provider in his/her

attempt to deliver the information s/he wants.

What makes the whole story particularly challenging is the fact that — beside having some common opponents: mostly shortcomings in available time and resources — both end user and information provider work to a certain extent as opponents (and usually feel themselves to be opponents most of the time).This is because their object of value is slightly different:having and delivering (sharing) information for them are not their final goals, but only instruments, means by which to reach their own goals.The goals of the broker will be — in this case — to help them realise that they need to share knowledge in order to reach their ends,and move a forward in this direction.



3.2 First version of the push service

A first version of the push service in the R&D field was installed on the server of the USI during the Summer of 1998.

The service was based on a push module developed by Eurospider AG on the basis of the Eurospider search engine, a full text probabilistic search engine developed and sold by the Eurospider company (http://www.eurospider.ch/).

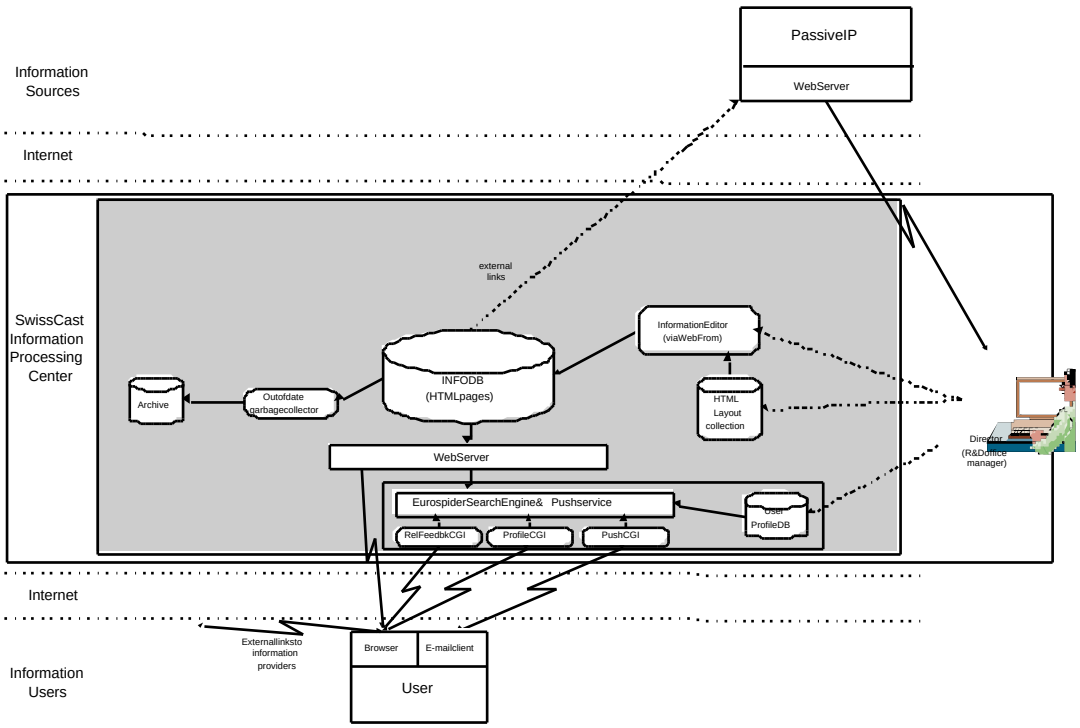
This system periodically searches a web domain,which can be controlled by the Editor, for new or modified web pages (on the basis of their date recorded by the server) it then indexes the pages and matches the result against user profiles.When the relevance of document is higher than a given threshold,the document is assigned to that profile and the user gets a notification via e-mail; the user then accesses a web based ranking list,where relevant documents are presented either in order of relevance or of date.

Moreover, the system has a relevance feedback mechanism, i.e. the profile content is modified according to the documents that the user indicates to be relevant or non relevant.The threshold is also dynamically set according to the user interacting with the system through the relevance feedback.

Thus,this version of the push service had the following very interesting features:

- The system could directly search and index external websites,which do not match standard formatting and indexing standards;human intervention for classifying the information was thus not necessary;
- The user could define full text queries,without being bound to a fixed list of keywords;
- Relevance feedback enabled to refine or redirect the query according to the results of the first search phase.

The user interfaces and the user management interface – e.g.,accounting – were developed specifically by the SwissCast team and are, in fact,almost identical to the final service version.



Once the software was mounted, the system underwent an in-house inspection phase. Five SwissCast researchers tried it out in order to fix the main bugs and to optimise its performance.

The R&D website was indexed by Altavista Personal®, and queries were compared using both systems. The head of the R&D University Office verified its outputs,checking it against his own knowledge, and suggested due improving activities,which concerned the website itself as well as the tuning of the system.

This phase was concluded in November 1998 and led to a good technical functioning of the service.

Test with external users

A second phase involved six researchers, all computer (and Internet) experts or at least good users, who had volunteered to partecipate on receipt of an e-mail request.They received a short document with the main guidelines, and had a twenty minute briefing with two SwissCast researchers, who presented the service, its functioning and the purpose of the testing activities.

They were asked to subscribe to the service, to set at least one user profile, and to monitor it.

A very simple feedback tool was offered, consisting of a form to be completed on-line, when accessing the service.

After five weeks all of them were interviewed (at about 45 minutes each) on their impressions and suggestions.The interviewer tried not to be directive at all, but to follow the interviewees own way of representing their experience.

Assessment of the results & outcome

The following table gives a detailed summary of the results of the assessment, and the observations of the information editor and project team,who used the service intensively.

In brief, the results,showed a good level of functionality of the service, but did not demonstrate its professional relevance in this phase; at the same time, the need emerged to discuss some basic questions about information retrieval and indexing which created some problems for the end-users (e.g., the non-deterministic handling of keywords).

What became much more clear, during those test activities, was that:

(1) users needed more relevant information items, and this couldn't be achieved with certainty through an automatic procedure (relevance feedback), although very sophisticated,

(2) the service could not rely only on full text searches: information items needed a semantic mapping (through keywords added by the authors themselves, or by a human editor);moreover, those keywords had to be the very backbone of the push mechanism,

(3) service end-users should be given only a short set of choices,easy to be understood and directly matching their needs, too many choices,instead of helping them, were side-tracking.

Since at the same time Eurospider AG decided not to support anymore this version of the push software, the SwissCast push was completely remodelled along the lines of a db and on human-made indexing with keywords.

Feature	Main observations	Outcomes & Comments
Professional relevance of the service	Some of the interviewees found it of good professional relevance, others said they didn't have enough time to assess it	The professional relevance of the service will be the main issue for the assessment of the new version of the service.
System behaviour and functionality	Many observations as well as suggestions were given, concerning both general aspects and very particular ones. We list here the more general points:	
	• The user has to be given a clear explanation of the scope of the service and of the information sources	The first observations require a better definition and explanation of the scope of the service (see sections ***).
	• it should be explained how the system deals with free key-words, and how to separate or to compound them; in particular, the "information type" items don't work in a restrictive way, which is counter-intuitive and turns them into useless opportunities. More in general, quite often a deterministic behaviour of the system would be more acceptable	The other points deal with inherent problems of a system based on a full-text search of web-pages, i.e. the chance of sometimes getting odd results or the absence of "real" keywords (using a Boolean logic). These remarks were transmitted to the Eurospider team in Zurich.
	• Sometimes users found that the service outputs non irrelevant/ strange items	
	• The functioning of the relevance feedback was not clear to the test persons; more explanation and some changes were required (e.g., deleting non- relevant documents from a profile shouldn't mean deleting their consideration as such by the profile definition).	
	• For some of the procedures (in particular looking and updating the document list) the response time was found to be far too long.	
Interface	• All users underlined the fact that the interface was good and professional; users asked for many small changes.	The concept of the interface, based on a personal web page which lists all profiles, proved to be quite user-friendly. These changes are implemented in the new version of the service.

It could seem that automatic indexing tools could be enough in order to help people get relevant information. Unfortunately, it is not that easy. Natural human languages don't allow any precise automatic analysis that could semantically map a text.

Let us take a couple of examples. Good writing style recommends not repeating the same word too many tomes in a text, even if it is a key word; but a search engine will use just that word, and its frequency, to detect if the text is or is not relevant. E.g.: texts against Bill Clinton, or in favour of him…

Research in this field is growing very fast, trying to close the margin between human searches and automatic one. Full-text search, enabling people to find out if a given word-form is present in a text, is being equipped with many additional features. Let us have a look at some of them.

Boolean operators together with *contextual indices* are used to narrow the scope of the found material: e.g.: electronic and commerce retrieve only texts with both these lexemes. Moreover, *frequency analysis* helps find more relevant documents. A corpus is analysed, and word frequencies calculated. When one or more documents display an abnormal frequency of a given term, it is likely that they show some special content of the given document. Frequency can help when analysing documents taken from specialist areas, where many terms are shared (but are useless when performing a search).

The morphology of natural languages is considered, in order to cope with different forms stemming from the same lexical item (e.g.: finding "mice" when searching for "mouse"). Word order is taken into consideration when morphology or syntactical structures require it (e.g.: when searching for "aussteigen" retrieving also "steigen sie aus"). Also *cross-lingualism* matters: perhaps a query is provided in a language, but documents should be retrieved in different languages; this means different activities: recognising the language or languages in which a text is written, and providing thesauri with cross-lingual items. Thesauri seem to work only when used in very narrow subject fields.

Search engines - besides natural language features - also study documents' layout (mainly of web pages), paying more attention to specific items; in doing so they are helped by html tags, which provide specific marking for titles, pictures, etc.

Also embedded elements - the reader is not supposed to see, and not always tagged by html tags - are taken into consideration: the name of pictures and files, host name, last revision date, etc.[2]

The quest for a better semantic mapping is the reason why many projects aim at offering meta-data to describe the content of a given html page: here is the human writer who provides semantic elements, according to given standards[3]. In fact, only the human writer, or a human reader, can understand a text and correctly classify it from a semantic point of view. This explains why, beside full text search engine (e.g.: AltaVista) there are directory organised search engines, like Yahoo, where information is classified by people. Another example of this is the Open Directory Project (http://dmoz.org/about.html), whose data are used by sites like Netscape, Lycos, HotBot, and others. (it has also a Swiss edition: http://www.dmoz.ch/).

A full-text search, as sophisticated as it can be, can – in any case – be helpful, offering a first discrimination, but can't take the responsibility of saying that everything found is relevant nor that there is not anything more on the subject. Here we can find a quite popular misunderstanding – due perhaps to the name of "search engine" itself. Search engines, properly speaking, don't perform the search itself, but are just a tool to search some forms, wich are probably connected with what is being searched: the actual search activity is done only by the human people who use them. From among millions of documents search engines can rapidly harvest, where something having a given form can be found - provided by the person and/or manipulated by the search engine itself. This is their strength.

They can't go forth, implying that those documents are those the searcher was looking for. This is the everyday experience of people using search engines: having something to search, judging which forms could possibly be in relevant documents, and judging again, among documents offered by the search engine, what is relevant and what not. This is their weakness. It thus emerges that "searching" in a technological sense means looking for identical or similar forms, in human language it means much more: finding out knowledge, information, one is looking for to answer their question. That piece of information/knowledge can indeed be represented by lexical items – as well as by pictures, sounds, videos – but it does not consist in those material things.

A push service should not aim to help people by only providing a number of document among which there must be something relevant; it must provide them with only relevant documents, in a relevant format.

Human intervention is thus required twice: to select where to search, and to analyse and classify what one or more automatic searches produces.

2 A number of research and monitoring activities are done on this issue. For a first look, see http://searchenginewatch.com/, http://www.webpromote.com/. Because of their affecting site visibility and e-commerce, search engines usually don't publish their search strategies, and change them quite often.

3 Dempsey L., Heery R., Hamilton M., Hiom D., Knight J., Koch T., Peereboom M., Powell A., A review of metadata: a survey of current resource description formats, Work Package 3 of Telematics for Research project DESIRE, march 1997 (http://www.ukoln.ac.uk/metadata/desire/overview/).

3.4 Selecting relevant information sources & information

Human intervention is required first of all,to narrow the scope of information sources.It isn't enough to have a website to be reckoned among reliable information providers.Of course, this selection activity can't be done once and for all:at this point the broker-editor has to be an expert of the information market in a given area. Given the speed of development of the Internet, this activity entails a continuous monitoring of information flows, to update the scope of selected information sources.There follows an important quotation by the DESIRE Project,which built up a similar concept, called Subject Gateways:

> In the traditional information environment human intermediaries,such as publishers and librarians, filter and process information so that users can search catalogues and indexes of organised knowledge as opposed to raw data and disparate information. Subject gateways work on the same principle — they employ subject experts and information professionals to select,classify and catalogue Internet resources to aid search and retrieval for the users.Users are offered access to a db of Internet resource descriptions,which they can search by keyword or browse by subject area.They can do this in the knowledge that they are looking at a quality-controlled collection of resources.A description of each resource is provided to help users assess very quickly its origin, content and nature, enabling them to decide if it is worth investigating further. [4]

After the editor has chosen the information sources,agreements with them are required,if possible, as well as technical activities in order to interface different standards (e.g.:db structures).

The SwissCast service foresee two different ways:having AIPs,who do the indexing activity explained in the following paragraph, and an activity done by the editors themselves, who search the web over a definite scope using automatic tools,choose those pieces of information which are relevant according to their clients' needs and index them.

3.5 Information indexing with keywords

Once a given piece of information has been chosen,it must be inserted in the document DB, where it is reshaped in a pre-defined format. Only human actors can summarise it properly, and map it according to a given set of keywords.Here we can envisage an important added value:selected information is re-told in a way SEUs find more suitable and less time demanding.The original piece of information is indeed reachable through a hyperlink, but readers will follow it only if they really need it.

Building up – or adopting – a specific way of semantically mapping information is one of the most delicate editor's activities. It must be done in a close relationship with SEU's and IAP's, taking the state of the art in a given field into account.

Nowadays the quest for better instruments for finding a document over the net is offering many intriguing suggestions, but we are far from a widely shared general solution. From a technological point of view, meta-descriptors are being proposed and used (e.g.: the Dublin core; SGML, and a number of others). If for technologies it is mainly a problem of standards, for communication it is an issue of knowledge management and communication,which can't have a once-and-for-all definite solution.It must be content and user dependent.

Moreover, indexing by using a given set of keywords helps overcome cross-language troubles:where giving a one to one translation of texts is not at all possible, it is possible to translate defined, self-consistent set of keywords,where "tout se tien",and developed to map just a narrow field of human experience and activity.

Once a piece of information is selected and stored into the info db, after it has been indexed and summarised, it is ready to be delivered to interested SEUs, and the Director can take full responsibility for its relevance.

The above does not imply the end of fulltext search engines.They maintain an important role mainly for searching for very specific things, in pre-selected domains,or for narrowing a corpus wich is too big where a pre-selection is not available. Because of that,SwissCast includes the operforming of fulltext searches inside the document db, and/or in a pre-selected corpus of websites. In addition, it is possible to query the db to find relevant documents already stored before a SEU's subscription.

4 http://www.desire.org/html/aboutus/background/nrin/nrin.html .

3.6 The user role: multiple choices to reach relevant information

When designing the service structure a major effort was made to in allow SEUs to concentrate on their professional interests (and not on the interface or technological solutions), avoiding ir relevant questions and offering only really useful choices.Three main customisation areas were distinguished: subject related, communication/format related and time related. SEUs are asked to define, through a series of multiple choices, which subject(s) they are interested in (e.g.:virus diseases or cardiology),which kind of information or event connected with that subject (e.g.:conferences or scientific literature),and how often they want to be notified if new information items matching their profiles are found by the service.

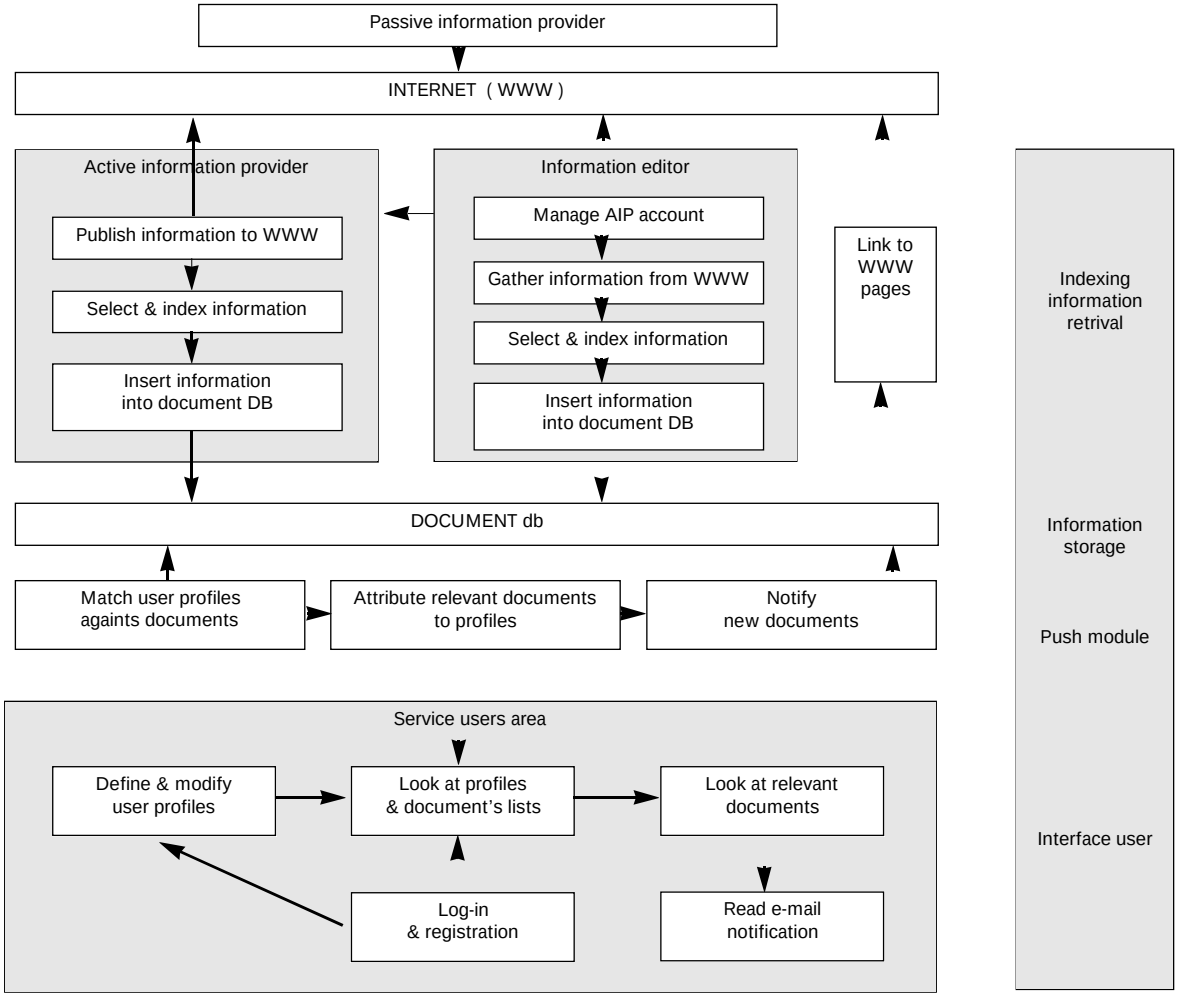
SEUs can set many different profiles,and modify them,according to their needs.SEUs can send the director feedback on their satisfaction with the service;moreover, many tools will be provided to the directors to help her/him track SEUs' behaviour and reshape the service to better suit their needs.

4 SwissCast push: main concept and system architecture

The SwissCast push has been designed as a system that retrieves information from various information providers and information sources, classifies information according to a pre-defined indexing system and diffuses it automatically to end-users according to their interests,as defined in their user profiles.

4.1 Information flows

From the point of view of the information flows, the system contains the following main elements (see the figure):



4.1.1 Information retrieval & information indexing

Information is in part directly inserted into the push service by the AIPs or is retrieved by the IE (e.g., from the WWW) and inserted by the IE in the information storage.

All information items must be classified according to a standard keyword scheme and formatted along a pre-defined structure;this is done either by the information provider, or by the IE with the assistance of technical tools.While the need to classify all the information items seems to be a serious constraint,first test results showed that actually it is the only possibility to offer a reasonably good push service and that, if this work is suitably assisted with tools, it can be done without a disproportionate effort.

4.1.2 Information storage (document db)

The document db is a key element in the system, because it contains what will be pushed to SEUs in a standard form.

Thus, the main function of the documents db is to neatly separate between the information retrieval & indexing module and the push module, so that the two modules can be realised and run separately and that the information to be analysed by the push module respects given formatting criteria (e.g.,having a clear-defined creation date).

Moreover, many records in the document db will contain a reference to a WWW page that gives more information on the subject.

4.1.3 Push module

This module matches periodically new information items inserted in the document db against users' profiles and attributes new relevant documents to the corresponding profiles; relevant documents are stored on an internal db the user can read with the system interface (personal Web page approach).Moreover, this module contains an agent that regularly checks for new documents and sends notification to each user via e-mail.

After two weeks of displaying in a (at least once visited) profile every document is removed, unless SEU checked it to maintain it.This activity is performed due to the "push"nature of the service, and in order not to have too big - and thus useless - document lists.

In this system version the push system is completely deterministic, i.e. it functions according to a pre-defined set of keywords shared by both the document side and the user profile side.The choice of mixing the two far most popular ways of "using"the net - browsing and getting e-mails - is not by chance.

As far as e-mail is concerned, among specialists in computer mediated communication and virtual communities there is a wide recognition that this "humble"service is a proper "killer application".It is easy to use, truly personal:at least, every message I get was addressed to me, not very intrusive:I can check my e-mail when I want,and I can decide whether to read it or not, and not that expensive:I can download my e-mail messages and read them off-line, and usually their format doesn't entail too large files.Almost all recipes for building up a good e-commerce service underline the seminal importance of e-mailing.

The SwissCast service takes advantage of the wide experience matured in the field of mailing-lists, it is opt-in: nobody can be subscribed by the service director; double opt-in: the service performs a check to find out if the person who subscribed is the owner of the e-mail address which was typed-in during the subscribing procedure; and opt out: in any moment every service end user can unsubscribe through an automatic procedure [5].

4.1.4 User interfaces

The user interfaces enable the user to register and log into the service, define interest profiles and check for new relevant documents;it also provides access to the annex services.

User interface is completely Web-based, so that SEUs and AIPs can access the system with a common Web-browser.The design of the user interfaces is explained in chapter 2.

Although the general SwissCast philosophy is to provide an easy to learn service (as similar as possible to the so called walk-up-and-use systems), an on-line help will be provided to all the SwissCast users.

4.1.5 Annex services

A key result of the first assessment phase was that not all informational needs can be satisfied by a push system, but that it is interesting for the user that other informational services are offered on the same platform, focusing the push on providing new information items.Thus,the SwissCast interface will give access to annex services, e.g.search facilities either on the document db or on external web sites and access to other relevant dbs and information services.In parts II and III, we will comment more on this important issue, that has far-reaching consequences for the realisation of a push system.

5 A large literature is available on-line on the subject. A quotation from the home page of a service which hire opt-in mailing lists could be interesting: «The Most Effective marketing technology available! That technology is e-mail. More than 40,000,000 people have e-mail. It's the oldest and most effective "push" technology available. E-mail is a proactive marketing communications method and it WORKS.» (http://www.targ-it.com/, last visited April 1999).

4.2 Actors and their roles in the service

In our view, a push service is not a technical device, but an information management system that is based on a close integration between human skills and competence on one side, and technical tools on the other side.

The first test phase confirmed on one hand that in some critical steps in the information management process human intervention is far superior technical tools, in particular for selecting and indexing relevant information. On the other hand, it confirmed that intelligent use of technical tools can assist human work effectively and substitute it in tasks that have to be executed many times and in a systematic way, e.g.in sending notifications to users or in periodically searching dbs.

Moreover, the system must be designed according to the actor's skills, competencies and habits and thus the use and management of the system cannot require excessively demanding operations because of technical reasons, e.g. making multiple choices on document lists or classifying documents without a pre-defined keywords set; otherwise, the service would be used only by extremely motivated people who are also interested in its technical novelties, but could not function as an information system for a wider audience.

Thus, our push service can be at best defined as an information management and diffusion service, built around human skills and knowledge assisted by technical tools; much of this knowledge is embedded in the system architecture and design – e.g., at the interface level, in the choices of the information sources, in the definition of the keywords –, but much expertise is actually inserted directly in the day to day running of the service by the information providers, the information editor and by SEUs themselves.

A consequence of this philosophy is that we need to carefully define the functions of the different actors in the service, and also to assess their behaviour during the test phase; thus the realisation of push services, as in general for other information services, is more a problem of engineering – or re-engineering according to new market needs and technical possibilities – the whole process of searching, selecting,classifying and bringing information as a business process to interested people.

In our service, we identify the following main roles:

4.2.1 The information editor (IE)

The IE is a specialist of information in the field covered by the push service; for example, in the case of the R&D push realised by SwissCast, the information editor is responsible for the R&D office at the USI, is in charge of the overall co-ordination of research activities at the USI and provides information on all new research programmes and funding opportunities.

The IE has detailed knowledge of the information structure in the field covered by the push service and the specific needs of its potential users.

The IE has a key role in the definition of the structure of the service, in particular in setting the classification scheme for the information and in defining the scope of the service, in the identification of the information sources and of the information providers and,finally, in defining the target audience of the service and in getting in touch with it; ideally, the information editor will be a person or structure, whose competencies and affordability are well known and thus help get confident towards the service. If necessary, the IE can be assisted in her/his work by a scientific board of known specialists in the field covered by the service.

During the run phase of the service, the IE has the following main functions:

- The selection of the information providers that are allowed to input information and the follow-up of their work (frequency of information updates; quality verification);
- The gathering of information from passive providers – mostly from their Web-sites, but also from other information sources –,the classifying,abstracting and inputting of pieces of information into the document db;
- The assistance to the end-users, in case of difficulties in using the service, and,most importantly, the deli vering of specific services (e.g., detailed information and consultancy);
- The overall follow-up and assessment of the service, as far as information delivery and quality, users' satisfaction,and its technical performance are concerned.

To do this job, the IE is assisted by a series of tools,that can be administrated via a standard WWW interface.

4.2.2 Active information provider (AIP)

AIPs input new information items into the document db directly; thus, they can decide which information is relevant and they appear directly as the authors of the information and have complete control on information they input (e.g.,they can decide to modify the inputs or to clear out some items).

In a standard case, AIPs publish new information on their website, then access the SwissCast service with a personal account and fill-in a web form,where the new page content is described and summarised.However, the service will also be opened to AIPs that don't have a website and that wish to publish new information directly in the SwissCast service. If an AIP has already recorded information in a dedicated db, ad hoc modules are developed in order to interface those db with SwissCast document db (a db interfacing module is already working in the pharmaceutical service for the ActaMed service).

AIPs are bound to the SwissCast service via a standard agreement defining their rights and duties;admission of new AIPs can be decided by the information editor or by a scientific board, just as their disabling in case of trouble (e.g., an AIP that inserts irrelevant information or doesn't respect formatting guidelines).

4.2.3 Passive information provider (PIP)

PIPs are simply organisations that publish relevant information in the domain of the push service but are not partners of the SwissCast service;thus, this information has to be retrieved,selected and published by the IE: this work-flow is very similar to the functioning of a conventional press agency.

We start from the assumption that most of the relevant information is already available via the WWW and, thus,that the work needed is simply to abstract and index the information sources and to give the URL reference, so that the service user can quickly have an insight into the information content and,if he finds it relevant,go directly to the website where the information item is hosted.

4.2.4 Service end-user (SEU)

A service end-user is everybody who accesses the service (via the WWW interface) and subscribes to it. In order to use the service, an SEU has to perform the following operations:

- Register with the service by giving some basic personal data and personal e-mail to be notified of new information items;
- Define one or more user profiles;
- Access the service (either from the service log-in page or from the notification e-mails) and read the docu ments; possibly, modify the profile definition to get better results.

The detailed architecture of the interfaces and their functions will be explained in the following chapter.

SEUs can be asked to freely collaborate with the service to assess and to improve it (e.g.,suggesting new potential AIPs or PIPs,filling in questionnaires,etc.).