Zeitschrift: Studies in Communication Sciences : journal of the Swiss Association of Communication and Media Research

Herausgeber: Swiss Association of Communication and Media Research; Università della Svizzera italiana, Faculty of Communication Sciences

Band: 2 (2002)

Heft: 1

Artikel: Push communication services : a short history, a concrete experience and some critical reflections

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DOI: https://doi.org/10.5169/seals-790902

Studies in Communication Sciences 2/1 (2002) 149-164

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PUSH COMMUNICATION SERVICES: A SHORT HISTORY, A CONCRETE EXPERIENCE AND SOME CRITICAL REFLECTIONS

This article presents some reflections on the development of push services and technologies over the Internet, based on work done by the authors in the Swisscast research project from 1997 to 2000 (www.swisscast.net[1]). About five years ago push services were seen as a major trend in Internet communication. Users - so it seemed - would simply have to subscribe to a series of these services; then, they would receive all new information "just in time" on their computer in a suitable format. However, the actual development has been quite disappointing: despite some initial success, almost all of these services and software tools have been discontinued (see section 1). While one could simply dismiss push as a short-lived fashion, our experience in developing a push service (see section 2) and theoretical reflections (see section 3) show that services that organise contents and deliver them to subscribers may correspond to a real need of communication on the Internet and, thus, may have a real market opportunity.

Keywords: Internet Communication, Push Technologies, Relevance, Information Brokerage

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[1] All online references have been checked in July 2001.

1. A short history of push technologies

In the middle Nineties the wide diffusion of the web promoted the development of a new form of communication paradigm: information casting (also known as "push" or "webcasting"[2]). The basis of push was very simple: instead of keeping information on a static web page, forcing users to check the page and periodically reload it to discover if new pieces of information were available, push technologies allow news to be automatically delivered to the users' computer over the Internet. To use a more fashionable slogan of that period, "information finds you" (Spangler 1997).

Push services can thus be defined as "the automatic delivery of content to a user's desktop computer; content is organised by topic defined by a publisher and users receive information according to their own pre-defined profile" (Decina et al. 1999). Information generally is pushed by information providers or by an information broker, a third-party who is able to:

- collect pieces of information from various publishing sources;
- select and classify them into a set of some predefined "channels" or subject areas;
- deliver information to users according to their needs and wishes, as defined in suitable user profiles.

This paradigm of communication over the Internet was much closer to that of television or newspaper, but could add to those mass-media all the advantages provided by computer-mediated communication: namely customisation and interaction features.

The first and most widely adopted push product was PointCast. The PointCast client application was distributed free-of-charge starting in 1996, and soon reached one million users (Bullock et al. 1997). The success of this product resulted from the fact that the content of the information delivered was customisable, based on a user-specified profile. Moreover, users received content using multimedia format in a very fashionable way. Due to the significant success of PointCast, similar products followed shortly thereafter, and in 1997 we identified at least 30 different push products (Cantoni et al. 1998). Internet browser producers (Netscape Communications Corp. and Microsoft Corp.) also delivered new versions of their browsers with built-in push features.

[2]A similar paradigm, developed before and outside the extensive use of the Internet, was named "publish-subscribe" (Cheng and Loizu 1998). "Webcast" refers sometimes also to the delivery of audio and video data over the Internet (OCDE 1997).

With these browsers, users did not need to install a separate third-party product in order to receive pushed information and browse the web at the same time.

Now, about five years after the appearance of the first push product, we can affirm that push products lived a very short life. As a matter of fact, almost all the push software products existing in 1997/98 are no longer available, including the extensions that were created for the browsers. Only a few of them (such as Backweb, at http://www.backweb.com) have converted their products from a mass media target-oriented product into a dedicated corporate product[3].

Push services share a major feature with mailing lists: that of delivering contents directly to the user's desktop. This is a system widely used by providers that want to push content directly to their users. However, mailing lists are not usually considered as a kind of push technology in its proper sense, because (usually) users cannot customise the type of information they want to receive or, in other terms, they cannot create a proper "user profile"[4].

In any case, many mailing list services now offer some customisation features: for instance Medscape MedPulse (www.medscape.com), which delivers medical information via e-mail, and allows subscribers to specify their areas of interests. A notification service is also offered by Yahoo News (http://alerts.yahoo.com), where the client can define a set of criteria that elicit an alert sent via e-mail. The ListBuilder service (before named ListBot, run by Microsoft bcentral: www.listbuilder.com) has recently implemented the possibility of targeting messages according to subscribers' demographic data. The distinction between push services and mailing lists is then becoming much less clear than at the beginning of the push history.

2. The Swisscast project: insights and achievements

The Swisscast project was set up in 1997. Based on the assumption that suitable software tools were already available, it had the objective of developing and assessing a push service against real use in given fields. Major

[3]However, the Pointcast technology has been resuscitated by the US company Infogate, which still sells the service. Infogate claims to have more than 1,5 mio. subscribers (www.infogate.com).

[4]Mailing-lists have an implicit filter that is the coverage of the list. However they usually don't allow a more fine granular filtering.

research issues were the assessment of the (informational) needs of the users, the choice and selection of information sources and contents, and finally the development of a suitable user interface[5].

The underlying idea was that the quality of communication on the Internet could be improved through "information brokerage" services. Lacking a metadata structure to classify information and a rating mechanism to qualify it, the World Wide Web has quickly become host to an exceedingly large quantity of information, where each provider publishes according to its own criteria and, very often, without paying attention to a specific target public. These information brokerage services would then gather, select and classify information on a specific subject according to given criteria. At the same time, they would gather information on the interests and information needs of a specific target audience and, finally, match available information with user needs.

However, an evaluation of available push technologies led to the conclusion that no existing system could satisfy those requirements (Cantoni et al. 1998):

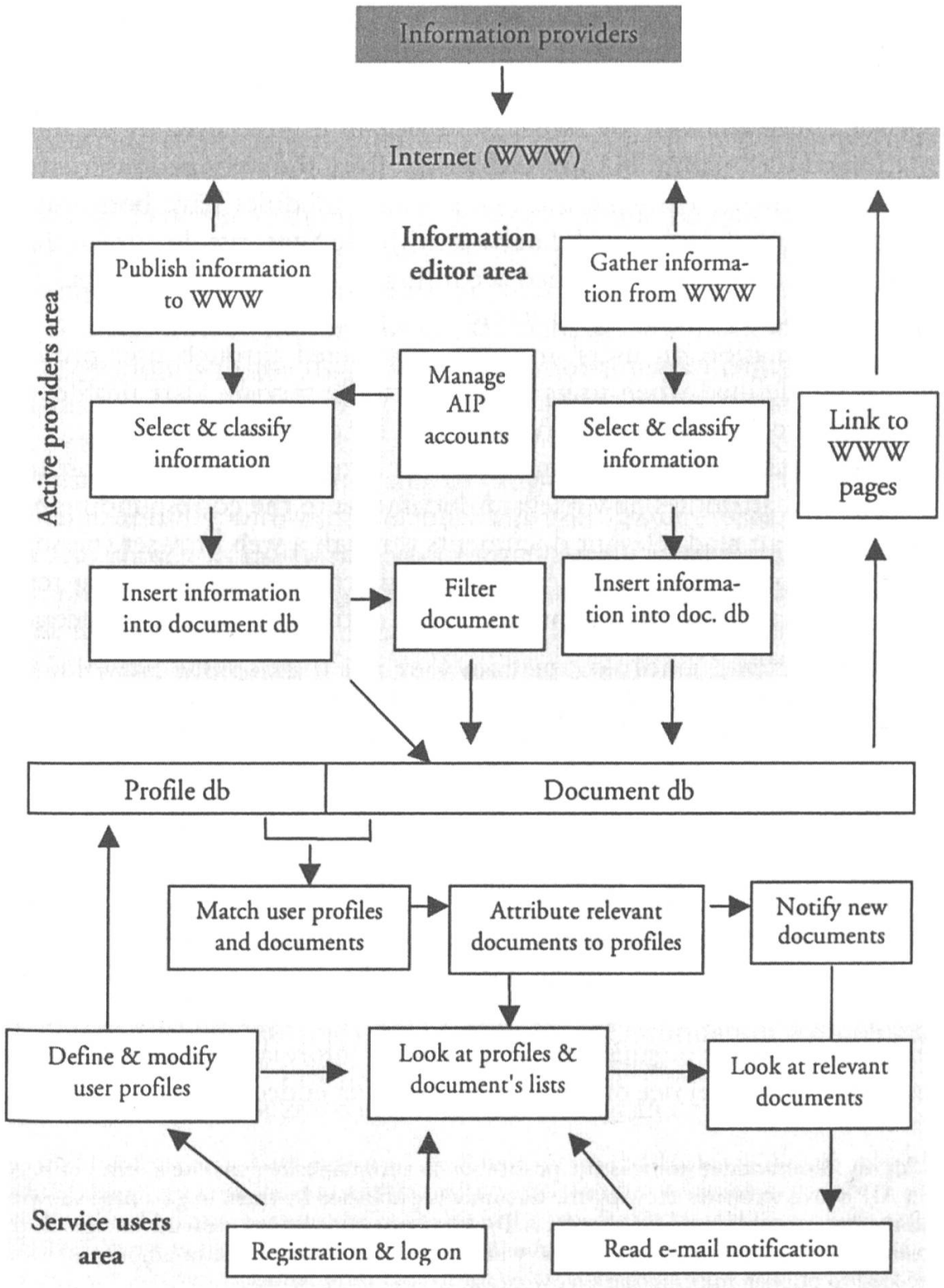
a) firstly, push software was mainly concerned with the problem of getting information from existing channels (e.g., weather or stock quotes) and then distributing it efficiently to the subscribers (who, of course, could choose among different channels). The underlying model was that of TV broadcasting, led by the idea of the convergence between television and the Internet (hence also the name "webcasting"; see OCDE 1997);

b) secondly, most push software required the installation of specific software on the user's computer and were very disturbing, e.g. with pop-up windows often appearing on the screen. Thus they entailed a change in the habits of the users and, most importantly, they didn't leave users the choice when (and whether) to access the service.

To address these issues, it was decided to reverse the approach of the project. Instead of building a service around an existing technology, we developed the requirements and the architecture of the service, starting from the "information brokerage" model and from the needs of potential users, as assessed by a literature analysis and interviews. A prototype was developed and tested in the R&D information area.

[5] The project was funded by the Swiss National Science Foundation in the framework of the Priority Programme "Information and communication structures". Project leaders were Maurizio Decina, Eddo Rigotti and Fiorenzo Scaroni, researchers Lorenzo Cantoni, Neviano Dal Degan, Paolo Jannuzzi, Benedetto Lepori, Riccardo Mazza and Stefano Tardini.

Figure 1


Information providers
Internet (WWW)
Information editor area
Active providers area
Publish information to WWW
Gather information from WWW
Manage AIP accounts
Select & classify information
Select & classify information
Link to WWW pages
Insert information into document db
Filter document
Insert information into doc. db
Profile db
Document db
Match user profiles and documents
Attribute relevant documents to profiles
Notify new documents
Define & modify user profiles
Look at profiles & document's lists
Look at relevant documents
Service users area
Registration & log on
Read e-mail notification

2.1 The architecture of the Swisscast push service

Figure 1 displays the structure of information flows in the Swisscast push service. The whole application is built around a central database which contains all documents and the profiles defined by the users.

1. information content is inserted into the document database from different sources. Information is in part directly inserted by the active information providers (AIP), who are from organisations that have signed a special agreement with the Swisscast service, or it is retrieved by the information editor (mainly, but not exclusively, from the web) and inserted into the information storage. Ad hoc software modules have been implemented to interface external databases with the Swisscast document database. All items must be classified according to a keyword scheme and formatted along a pre-defined structure;

2. information on users' interests is gathered through user profiles, which are defined when users subscribe to the service. User profiles are based on the same keyword structure used for documents;

3. the system periodically matches new information items against user profiles and attributes new relevant documents to the corresponding profiles; users can read relevant documents through a web browser (personal web page approach). Moreover, this module contains an agent that regularly checks for new documents and sends notification to each concerned user via e-mail.

The Swisscast system was developed using open software tools adapted to the project needs (see Cantoni et al. 1999 for a complete description).

2.2 Major issues

In the development of the service, we had to address three major issues.

Information retrieval. Retrieval of good quality information is a known problem in Internet communication, since the quality of retrieval from automatic tools is unsatisfactory and the use of human competence is very resource demanding. For AIPs, the major problem was to motivate them - as individuals and as organisations - to publish information, by showing the usefulness of the service or by giving some other added value[6]. For other in-

[6] An important added value is the possibility to automatically generate a series of pages on AIP's own web sites showing the documents published by them (e.g., a page showing all the events published by a specific AIP). Of course, this brings great advantages in the maintenance of the AIP's web sites, which largely exceeds the extra amount of work needed to publish information on Swisscast.

formation sources, we followed a step-by-step approach: firstly, careful identification of the most reliable sources, then systematic follow-up of these through a gatherer module, finally the decision whether to publish the new information and the editing of a suitable text.

Information selection and classification. We tried automatic classification through probabilistic full text indexing performed by the Eurospider search engine (www.eurospider.ch). Unfortunately the quality of retrieval and matching with user profiles was not enough for a push service, where users expect to get information only on the subjects they have chosen. Manual classification through a fixed keyword scheme and Boolean matching between documents and profiles then became an obvious choice, since it gives fully predictable results[7]. Where information pieces were already classified in corporate databases, we realised a suitable interface to transfer them into the Swisscast database.

Interaction with the users. With professional users involved, user interfaces have been designed for maximum simplicity and ease of use. All interactions with the service can be done through web pages, avoiding the installation of other programs or plug-ins; we paid full attention to the compatibility with different browsers and browser versions. E-mail was also chosen as the notification tool, rejecting other tools offered by the software market. E-mail is already known by almost all potential users; it is easy to use and doesn't put special requirements on hardware and software. Moreover, it is a very discrete communication tool, where the user can decide when to look at the messages and can easily turn down unwanted information.

2.3 The application in the R & D area: results of the test phase

A first version of the Swisscast push application was released in spring 1999 and was then adopted by the Università della Svizzera italiana to build an information service on R&D financing opportunities in the Italian-speaking part of Switzerland (www.ticinoricerca.ch/swisscast/). R&D is particularly suitable for a test because the information is dispersed in the web sites of the financing agencies, and thus a service that concentrates it and diffuses selectively to the researchers can be quite useful[8].

[7]See the "Information subject gateways" concept developed within the European project DESIRE for a very similar approach (Worsfold 1988; http://www.desire.org).

[8] Many other similar services are being developed in the R&D area: main examples are CORDIS-Rapidus from the European Commission (www.cordis.lu/ en/ src/ i_014_ en.htm), the Aktiven Informationsdienst of KoWi in Germany (www.kowi.de), the US

The following table summarises the most important figures on the use of the service during 1999, 2000 and the first semester 2001.

	1999	2000	2001[9]
Subscribed users (31st December)	137	264	318[10]
Log-ins to the service	6118	9167	7129
Read documents[11]	4997	21103	19731
Published documents	1155	1505	891
Views per document (mean value)	4,3	14,0	22,1

Despite the small size of the target public[12] the service has succeeded in attracting a quite large number of subscribers and many active users (i.e., users who log on to the service to look at documents). Also, use has remained stable during the last 18 months, confirming that service subscribers are not simply attracted by the novelty of the service, but are truly interested in contents. A series of interviews carried out in spring 2000 gave a very positive judgement of the service, both from the perspective of contents and interfaces (see Lepori 2000).

The keyword scheme adopted (31 subject keywords) has been found to be very practical for both profile definition and document classification, but the selection effect has not been very strong, since on the mean subscribers receive 1/4 of the published documents. This seems to be a general dilemma for such services: very precise targeting, through a precise definition of keywords, conflicts with the behaviour of the users, who choose many topics in order to "be informed".

Our experience clearly shows the importance of a competent service manager who is a specialist of the information area covered. This person plays a central role in the definition of the main features of the service,

service ScienceWise Alert (http://content.sciencewise.com), and, finallly, the e-newsletter of the Büro für Internationale Forschungs- und Technologiekooperation in Austria (www.bit.ac.at). A push service will also be developed during 2001/2 by the Swiss information network on European programmes (www.euresearch.ch).

[9] January, 1st - November, 19th 2001.

[10] November, 19th 2001.

[11] Including documents seen on web pages generated automatically from the Swisscast database.

[12] The number of professors and researchers at the Università della Svizzera italiana, is about 350. Including researchers in the University of Applied Sciences of Ticino, in the public administration and in private companies in the region, we estimate that the potential audience of the service could range between 500 and 800.

i.e. the scope of the information, the target public, the selection of the information providers and their motivation, the selection of the sources and the choice of a suitable keyword scheme. Afterwards, he or she has to promote actively the service to potential users, to take care of customer contact and to monitor service activities (helped by statistical information); moreover, he or she has to filter and classify information retrieved from the web or posted by non-certified providers.

3. Some communication lessons learned

Our experience - as well as the recent history of push communication - raises a number of communication issues, to which it is now time to pay attention.

The different kinds of push communication share all the features of the computer-mediated communication / electronic communication (see, for instance, Bolter 1991, Landow 1997, Cantoni and Paolini 2001), but there are some aspects in which push communication seems to be peculiar with respect to other communication paths and strategies. Three conceptual tools seem, in particular, suitable to help better understand push services: those of relevance, happiness, and intrusiveness.

3.1 Relevance

A good message has to accomplish two different tasks: to be adequate in its content, the author being competent or expert in it, and to be adequate to its addresses/receivers, to their needs and questions: this characteristic is what is called relevance (Sperber and Wilson 1995).

Information quality is closely connected with both the above characteristics (Eppler 2001[13]).

If the relevance of a message is something that always needs to be fulfilled, the web has stressed its importance even more. People surfing the web can access an infinite number of information sources, and they are in constant danger of going astray or being side-tracked. However, the quality of automatic tools (e.g., search engines) in retrieving information is so low that they can at most help to find some entry points to the information, but leaving to users to judge about the quality and relevance of the retrieved documents (Dresner and Dascal 2001). Hence the need to offer

[13] See also the Vnet5 project: www.vnet5.org.

services which are tailored exactly to fit some users' needs. This happens mainly where users' needs can be well defined, and users make a professional and frequent use of the service.

Here two aspects should be emphasised: user profiling, which has to be suitable for a specific target audience, and the time and effort users need to define their profile or to refine it: the designer must be aware that the costs/benefits balance by the potential user will decide the success of the application.

The relevance issue, when approached by the service editor, concerns a number of factors: the choice of information sources and providers, the definition of a suitable keywords' scheme[14], the moderation of single messages, a continuous refining of all the previous elements according to the actual users' behaviour.

When an active information provider publishes a new message, s/he also has to make two judgements of relevance: first, s/he has to decide whether to publish it or not (is there somebody who could be interested in it?), and, secondly, choosing the keywords that best describe it (who is interested in it?).

In fact, for a service like this, all the publishers just try to understand the real interests of their target audience, although with a quite good approximation. It's only the receiver who can say if s/he is actually interested in a message or not; hence the possibilities s/he has to improve the relevance of the messages s/he gets: not reading the complete message (see par. 3.3), changing her/his user profile, making suggestions to the service editor, unsubscribing.

3.2 Happiness

An important aspect is that of motivation not only on the part of the receivers, but also on the part of the active information providers (AIP). When someone publishes a piece of information on the Internet quite often he or she does not know in advance how many people will read it, and what the level of happiness will be, i.e. to what extent it will reach its target, meet the required communicative conditions and fulfil its communicative goals (Rigotti and Rocci 2001: 68-71).

We have devised some happiness indicators to help overcome this problem.

[14] The issue of relevance crosses and overlaps with those of customisation and of semantically describing the information (Brusilovsky 1997).

When an AIP wants to publish information, he or she can know how many people will receive it, according to their user profiles (its potential target audience). Moreover, the AIP will be able to see how many people have actually accessed the information page; he or she can thus better decide whether the effort of publishing a message is worthwhile or not.

Some active information providers were offered the possibility of publishing in their own websites the information items they had inserted into the swisscast service: this helped them to get a better perception of having a public, and to become more involved with the service.

Although the main addressees of an active information provider are the end users themselves, the role of the service editor should not be underestimated: being an information broker s/he represents, in a sense, the users in front of the information providers; s/he has then to motivate them to offer an excellent and continuous service.

3.3 Intrusiveness

Intrusiveness has been studied in the area of courtesy and communication (Goffman 1959, Grice 1975, Raynaud 1988), and it has been argued that communication can be considered a sort of intrusiveness to be smoothed by forms of courtesy. Although generalising this interpretation could turn into a one-dimensional consideration of human relationships, shaped along the metaphor of conflict, the image of being more or less intrusive seems to suit well the forms of communication studied here.

In a certain sense, the communication used by a push service like Swisscast offers four different levels of "intrusiveness", which the addressee is able to control through different and simple choices.

First of all there is the frequency of the e-mails, which the user can set to a day or to a week; secondly, there is the single e-mail, which the receiver can decide to open or cancel without reading; thirdly, there is the content of the e-mail message: the user upon reading it can decide if the pieces of news are worth a more in-depth consideration or not; fourthly, there is the personal online page, through which news can be accessed and read.

This sort of courtesy helps maintain a good relationship between the service and its users, who are served without being disturbed.

As in the overall interaction between electronic publishing and readers, the features of a sort of dialogue can be seen: it seems to be necessary that the addressee (the service user) can initiate and orient the dialogue, and always be able to stop or modifying its content and pace. In addition, the

service acts according to those instructions, both by not being too intrusive and by not heavily burdening users by asking them to be too active.

4. Concluding remarks

We now wish to summarise four key elements of our approach to push services and their relevance for the good results of the Swisscast application.

The first element is to make our service fully compliant with the technology already adopted by the potential subscribers. In practice, this means to handle all the interactions with the system - both for the subscribers and the information providers - through a web browser and an e-mail programme, since these are the only two software tools which most of the people adopt to communicate on the Internet (this was not completely clear in 1997). Of course, given the constraints of this software, this means also to come back from the fashionable, multimedia services like Pointcast to a much simpler service relying strongly on textual communication[15].

This choice is coherent with the second element of our approach, that is to target mostly professional users in a specific information area, instead of delivering "general" information (e.g., weather, sports, stock quotes) to everybody as Pointcast did. The main advantages of this approach were (1) that the amount of information is much smaller and the most important information sources easier to identify by a specialist and (2) that the users' needs can be defined quite precisely (thus leading to a keyword structure tailored to these needs). A precise knowledge of the chosen information sector makes a much easier to achieve a good quality of the delivered information (in particular in terms of its relevance for the user). Since our targets are regular users who subscribe to the service for very specific (professional) purposes, the lack of multimedia features is really an advantage.

This is also strongly tied to the third element of the Swisscast service, which is the integration between human competence and technological tools. This means that a series of key actions - basically those related with judgements on the quality and relevance of information items - must be performed by experts. Swisscast can then be described at best as a service where a series of competent persons select, publish and classify informa-

[15] For instance, the e-mail messages sent by Swisscast are in plain text format, because not all e-mail programmes can handle correctly html messages

tion, helped by software tools to execute all tasks which are predictable and repetitive[16]. Of course, this is possible with a reasonable amount of effort and with affordable costs only for a service specialised in a small area.

The forth key element in our approach is to achieve a right balance between information push and information pull, that is between the information content of the notification message and the information left on the web server. For instance, in Swisscast we send only the titles of the documents through e-mail, leaving the full description on the service web server. Since the mapping of the user's interest will always be very imperfect, many of the push documents will not be interesting to them; then it is a safer strategy to send only a pointer giving to subscribers the possibility of judging themselves and to decide if it is worth to connect to the server. Thus, the right strategy is not to replace information pull with a new paradigm called information push (as the early proponents of push claimed), but to integrate these two models of interaction to improve access to information.

Finally, the definition of a more restricted market (both from the information area and from the target users) and the reduction of the complexity of the software give the possibility to realise smaller and more manageable applications. The costs to implement these are much lower and affordable for public institutions like universities or for small and medium enterprises wanting to build their own communication service[17]

These findings are confirmed by similar developments that we noticed in the main research area of the Swisscast project, that is R&D information, where, during the last 2-3 years, quite many push services were launched, each to answer to a very specific need of the promoting organi-

[16] An example can better explain this strategy. Swisscast R&D gets some information from the research information service of European Union CORDIS (www.cordis.lu); since these documents are already classified into the CORDIS database with a keyword scheme compatible with that of Swisscast, they are automatically copied into the Swisscast database every night. However, many of these documents are not really relevant to the public of Swisscast (for example, documents on internal matters of the European Union). To handle this problem, we decided to give to the information editor the possibility to decide whether of not to accept CORDIS documents though a specific interface. This is very efficient since such a decision (yes/no) can be handled very quickly by a competent information editor, who well knows the interests of subscribers (e.g., from the internal statistics of swisscast).

[17] To exploit this commercial potential of the Swisscast application, the University of Lugano founded in June 2001 a spin-off company, named Telos Internet Solutions, which sells the Swisscast software to develop push services in areas other than R&D information (www.telos-internet.ch). The first application will be an information service for the association for Italian culture in the Swiss Canton of Grisons (www.pgi.ch).

sation[18]. The recent evolution of some mailing list services adding some customisation features confirms the growing interest for this issue (see comments at the end of section 1).

In our opinion, the failure of Pointcast and of similar services represented only the failure of a specific model of push services which tried to compete in an information market which is already covered by other information tools (newspapers; broadcasting) and needs a very large number of regular users to cover the required investments.

We conclude that push services will certainly not revolutionise the communication model on the Internet, as was claimed some years ago; but, if they are suitably designed and managed, they could well complete it and, along with other tools, make the complexity of the Internet more manageable for the end user.

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[18] See footnote 9 for full references.

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