Situations in Life to Support the Use and Modelling of Municipal Information Systems

Wolf-Gideon Bleek

University of Hamburg, Department for Informatics
Vogt-Kölln-Str. 30, 22527 Hamburg, Germany
bleek@informatik.uni-hamburg.de

Abstract

Situations in Life are presented as an approach to transfer a concept from social sciences into information system development for municipalities. These findings are reported against the background of an ongoing project at the City of Hamburg where the approach supports software design on three levels: content, user interface and the systems architecture.

1 Introduction

In recent years web-based municipal information systems (MIS) have changed their face from merely presenting information to providing a collection of information and related services. These services range from customized information and online catalogues of printable forms, to a variety of interactive online services. At the same time, other services offered through the Internet have increased in number as well as in quality. Pressure on authorities is growing to offer ever more quality services online. But collecting individual services is not enough; these days it is more important to focus on integration and customers'. Current web-based MIS rarely take into account the citizen's perspective in accessing services and information. Most services are selected by chance.

This paper presents *Situations in Life* as an integrated approach for designing municipal information systems. It builds on a theoretical concept from the social sciences geared to understanding for what reasons citizens contact the authorities. By 'integrated' we mean that the following questions are addressed:

- How do I select the content to be presented?
- How do I design the user interface and dialogue structure?
- How flexible must the system architecture be designed?

Situations in Life is proposed here as a higher-level concept for information systems development and eGovernment. This integrated concept is currently used in a re-launch project for the City of Hamburg.

The paper is structured as follows: Firstly, we take a look at examples of current web-based MIS that are oriented towards *Situations in Life*, the services offered and level of integration. Secondly, *Situations in Life* are introduced as an integrated approach for analysing citizens' needs, designing software architecture and collecting content. Thirdly, we present the hamburg.de project, for which a prototype application has been designed. Examples of possible applications of *Situations in Life* are given. The paper concludes with an outlook on steps to be taken in the future.

2 State of the Art in MIS

Typical MIS make it necessary for users to collect activities to solve their current problem and find related online-services. Municipal information and services are mostly available through a menu structure on the portal site of a city or region. Users are forced to gather information and find and combine appropriate services on their own. Information and

services available from the private sector may or may not be linked and must be combined individually. In the following text we will focus on Singapore and German speaking countries.

2.1 The early days of MIS

Most German municipalities started their online activities with static web-pages that offer information of the type ‘opening hours’, ‘sightseeing’, ‘lodging and travel’, and ‘competence’. People can get information but need to shift media to solve their problems. Improved websites add a (web) content management system to their infrastructure to keep pages up-to-date and offer a search feature in addition to the hierarchical explorative sitemap. Advantages of this approach are those of typical websites: information of public interest is available anywhere, anytime. Nevertheless, these municipal websites lack interactive capabilities (Kubicek 1999, Kästner 2000).

Approaches that provide dynamic information can react much more flexibly. This includes a more sophisticated page-layout (generating page navigation depending on the access path), up-to-date information (e.g. local news and events), enhanced search capabilities and presenting information customized for each user. Again, these websites lack support for the current situation a user is in and do not offer interactive applications.

Introducing web-applications means providing application logic within a web-interface. Some of them need secure transfer or authentication because they deliver sensitive information. Examples are ‘tax return’, ‘change of address’ and ‘ordering official documents’ online. Some cities offer their services as shops. An advantage often of this approach is greater flexibility for users in comparison with face-to-face access. It is assumed that the number of applications available over the net will increase and penetration of necessary identification methods will grow at the same time. A mere increase in numbers of these services is seen as an improvement.

Although the combination of all three approaches (web-content management system (WCMS), dynamic web-page-generation, and web-applications) is currently state-of-the-art, users’ are still forced to create interrelations between different websites and their pieces of information and applications. In detail one can state the following problems in day-to-day access:

- Citizens have to identify their situation by themselves and need to envisage a plan for solving it on their own
- Citizens cannot find all types of service at the same site; combining public and private services is not intended
- Citizens have to combine the offered services and information by themselves

All of the municipalities following that path can only offer simple services.

2.2 Steps to life situations

Several cities and regions have tried to overcome some of these problems by initiating (redesign) initiatives. In Germany, the Freie Hansestadt Bremen, Städteverbund Nurenberg (Fürth, Erlangen, Schwabach, Bayreuth), and Esslingen have won the MEDIA@KOMM competition (www.mediakomm.net). Especially the City of Bremen is oriented towards introducing signed online transactions in municipal processes. Their aim is to bring as many processes to the web as is consistent with the law. The selection is guided by life situations.

The City of Linz (www.linz.at) and the Austrian government (www.help.gv.at) started their activities in 1997 (Winter 2000). Both focus on 'Lebensbereiche' ('life situations'), which includes e.g. 'passport', 'marriage' and 'birth'. Their aim is to be a "turntable redirecting citizens automatically to the competent body". Thus, in the case of the Austrian Government, collecting a pool of linked information and stimulating more electronic services.

Singapore (www.ecitizen.gov.sg) offers a so-called 'Life Journey' model, which is organised as a 'one-stop citizen service portal'. Topics addressed include 'birth registration' (one may request a certified extract from the register of births), registration for national services (including military service), job search, starting a business, and more (www.gov.sg/ps21/). Again, this attempt mainly focuses on a static selection of electronic application forms combined with informational texts.

The state of Bavaria (Germany) has launched an innovative website called 'BayNet' (www.baynet.de) which also offers the concept of life situations. But even this portal offers a static collection of information, links to institutions and authorities.

All examples presented have several drawbacks in common. Firstly, the idea of customer-orientation is reduced to offering alternative media of communication. The face-to-face channel is supplemented by the web-based channel while loosing the possibility of looking at a blackboard in the municipality building (where you might find something related).

Secondly, a static collection of services is linked under keywords completed with some informational texts and links to other organisations. No concept of dynamic information retrieval and presentation is available; no concept of including the private sector is facilitated.

None of the approaches presented above offers a complete range of user-oriented system design. They lack support for a broader view that goes beyond the sole availability of online services and stateless applications with respect to content orientation towards municipalities.

2.3 The Need for an Integrated Design Approach

This leads to the question of how one can design an improved MIS. An approach is required that makes use of situations in the life of citizens and offers guidance on different levels of system design. The result should be a process description of how to construct flexible and open MIS. This raises the following questions:

- How does one select content (including informational texts, applications and references to services offered elsewhere), and how is the process of content collection organised?
- What are the principles for the user-interface and the dialogue design?
- How must the system architecture be structured to be as flexible as necessary?

From the perspective of software development these questions can be formulated as questions concerning the design of a MIS. With regard to content selection, an editorial process needs to be supported. Both system and software need to support editorial work on the content and on the special design of *Situations in Life*. The user-interface must be so designed that a user can collect and annotate information gathered. The dialogue design must enable users to easily switch between informational parts of the system and applications and personalised pages. The seamless transfer from synonymous to pseudonymous access must be possible ensuring data protection. Thus, the system's architecture design must provide flexibility in terms of content types and combination, flexible generation of pages and the possibility to

store user-related information in a secure area. This paper focuses on these design levels of MIS.

3 The *Situations in Life* Approach

Designing MIS needs to address many levels at the same time. The 'design' process under observation here comprises user interface design, system architecture design and content design (selection). The approach presented here claims to improve quality on these levels by introducing a users' perspective that guides all three types of the design process. Firstly, the theoretical background of *Situations in Life* is discussed and this analytical concept is transferred to the domain of MIS. Secondly, for each of the proposed levels, the advantages of *Situations in Life* as a guiding metaphor are laid out.

It is intended to support users in their process of gathering information and finding online services that fit their needs.

3.1 Towards a Higher-Level Concept for *Situations in Life*

The social sciences in Germany have coined the term "*Lebenslagen"*, which can be translated as "*Situations in Life"*. This term is used for analysing citizens' perspective while getting in contact with the authorities (Alber 1984). *Situations in Life* denominates a certain situation in the life of a person or a family. Common examples are 'Marriage', 'Birth', 'Death', 'Moving house', 'Unemployment' etc. They are used to reflect the needs of a person in a given situation.

As was mentioned in section two, this social science perspective has been applied in a number of MIS in German speaking countries (Bremen, Bavaria, Linz, etc.) and outside (e.g. Singapore). In contrast with other approaches it is important from our point of view that a *Situation in Life* contains the following salient features:

- Time
- Planning and Acting
- Reification in a Checklist

It lasts for a certain length of time and guides actions in that respect. 'Birth' for example, as a *Situation in Life* includes all activities from medical care, diet plans, collecting diverse information to buying necessary goods, etc. This, of course, also includes, but is not limited to, activities that are authority-related, like birth certificate and nationality statement. The time constraint is important for the notion of what a *Situation in Life* is. Thus, 'marriage' can be regarded as a *Situation in Life* but 'going out tonight' is not.

Additionally, during that period of time, planning work and activities alternate. People collect actions and start to manage them. At the same time, they perform a number of actions with respect to the current *Situation in Life*. This planning work is usually done with a checklist that is completed every time a new topic arises. Tasks already performed are marked as done, others are grouped or assigned. Depending on the situation, a checklist can grow up to more than 100 items.

This notion of a checklist may or may not be embodied by a real checklist. The important aspect is that a communicative process is initiated in such a situation. First of all, one gathers tasks to do and information needed. Other persons may suggest things typically done in that kind of situation, and depending on certain factors a shared understanding of 'what to do'

exists. Factors for such a shared understanding depend on – but are not limited to – region, religion, social status, and ethnic membership.

Neither is the order of items on the checklist predefined nor is their order of execution fixed. Both heavily depend on personal preferences and the environment. Many tasks are performed situated and cannot be formalised. The important aspect of the checklist therefore is its collection of relevant tasks and topics rather than a workflow description.

With these characteristics of *Situations in Life* we feel confident that this is a useful concept in user-oriented software design and which is therefore transferred to systems design. The next section shows what it takes to use *Situations in Life* for designing municipal information systems.

3.2 Modelling *Situations in Life*

Situation in Life	**Variation (examples)**
Birth	Birth at home Birth in hospital
Initiation	Confirmation First Communion
Marriage	Christian Islamic
Travel	Extended weekend Travel in tropical areas
Road Accident	With goods damaged With person injured
Unemployment	In early years Before retirement
Moving house	Within the city To the city Moving away
Business	Founding a company Moving your company to Hamburg
Higher Education	Enrolment Change of University
Death of a Relative	Christian funeral Funeral at sea Funeral abroad
Tax	Employee Freelancer Self-employed
Public Commissioning	Attend a Commissioning
Having a house built	Building a house
Inheritance	Only heir Community of heirs
Retirement	Early retirement Disability Pension
Divorce	with children without children

Figure 1: A compilation of *Situations in Life* developed

We transfer the concept from the social sciences to a software and systems design approach. We must therefore make explicit what will be understood as a *Situation in Life*.

Naming

Each *Situation in Life* is given a meaningful name. This is used by the editors and presented to end-users. Both editors and end-users need this name to gain a shared understanding of what is the scope of the situation so named. It also helps to communicate its intended scope to and within the group of users. Additionally, a short description is needed to give an extended impression about the topic.

Attributes

An extensive checklist describes the core of each *Situation in Life*. Each checklist item denominates a possible task or topic within the scope of the situation. The number of items can quickly grow beyond 70 or 80. The items can be grouped to make them more convenient. A problem that can arise while collecting items for a checklist is that some items mutually exclude each other.

Variations

Variants can solve this problem by offering a flexible solution. A *Situation in Life* holds a pool of checklist items that are relevant to it. Certain subsets are collected in named variants (see figure 1). Each variant with its checklist acts like a template to produce personal instances by copying.

To work with *Situations in Life*, a few additional concepts are essential that are motivated by the technical environment. Personalisation and restricted access are obligatory for every publicly available online service. Personalisation means that a citizen making use of any *Situation in Life* is guaranteed to be the owner of all information, being able to use it privately but also granting access to other persons (e.g. relatives).

Allowing more than one person to work with an instance of a *Situation in Life* makes it necessary to offer a change-history. This enables the owner to follow changes made by others. For convenience and as an added value users can store information already gathered associated with each item. This makes the *Situation in Life* an online collection of work done. Storing online documents should be supported, too. As a completion of this a table of contents is offered to navigate through documents collected and information gathered.

The following three subsections discusses the different design levels and show how to realise them in a software design process.

3.3 Software Design for *Situations in Life*

3.3.1 Content Design

The level of content design deals with the questions of what content to include in the system and with which process to maintain. A MIS will typically comprise different content types like ‘businesses’, ‘news’, ‘events’, ‘articles’, ‘applications’ etc.

Keywords are assigned to each item to improve search result quality. Constantly gathering new content makes a regular revision of the keyword catalogue important. Content items that refer to deleted keywords have to be assigned new ones. Unused keywords should be removed, and new keywords have to be introduced as needed.

When entering content items manually, a tool for assigning keywords is inevitable. This should offer a browsable tree structure for keywords. If content is entered automatically, appropriate algorithms must be provided to assign keywords thoughtfully.

Although the system must provide different content types a level of abstraction is needed to access content items almost regardless of their type. This is particularly important for searching and presenting the results.

The important aspect relating content and *Situations in Life* is the selection of content. Introducing a situation into the system makes available a list of items that gives an idea of what content is needed. 'Marriage', for example, may include an item 'rings'. This will suggest buying rings online as well as documents about different styles of rings etc., demanding content (including online shops) in that area.

An editor can then list all items related to a certain situation and the number of results found in the current content to determine what content is still needed and what kind of content is already available to users.

The editorial process therefore comprises the development of *Situations in Life* as well as the collection of belonging content. For the development of a situation, checklist items are collected and assigned to variants. An iterative process is then needed to buy or produce related content.

3.3.2 User Interface and Dialogue Design

The user interface of a MIS needs the ability to structure and personalise the portal site. That means that a user entering the site will always be informed about the current location and the navigational means available. A WCMS with dynamic page generation takes care of consistence and may handle differences between clients.

This flexibility allows a system design that enables users to configure the portal to their own needs making the use of and interaction with the portal more convenient. Pages can be understood as being composed of elements that may be changed in visualisation and behaviour (Manber et al. 2000).

A consistent search improves convenience and quick access to the content described above. The search application and its result-presentation need to be modular to be used in different contexts. This makes learning easier and enables us to re-use the search application in the *Situations in Life*.

The ability to store personalised information and user data is necessary for implementing a true *Situation in Life* support. Users can choose which situation they want to be supported with. This and a copy of a current version of the variants' checklist are stored in their profile. Each time they re-visit the MIS they can come back to their information. A *Situation in Life* is supported by a folder that holds the following information: the type and title of the situation, a modifiable copy of a checklist, collected information concerning the checklist items, collected documents, a change-history and a table of contents.

3.3.3 System Architecture Design

To cope with a huge amount of content and at the same time allow different types and stages the need for a WCMS is obvious. This enables us to introduce content at any time, which may be launched and expire. The content design is crucial for the whole system in that it must allow content items like 'applications', thus making it possible to search for virtually anything within the system.

User interface and dialogue design can only be realised with a WCMS in that they require the dynamic construction of pages during the visit. The construction process combines branding, navigation, status information, and the requested content to a page paying attention to technical needs invisible to users.

Content and user interface design demand a flexible and extensible system architecture. Technically, entering the portal starts a session, which can hold the state of ongoing operations. Web applications (Lowe 1999) need to be integrated seamlessly. This includes session handling, personalisation and storing user data. Besides session handling, which allows user tracking and user settings to be stored from entering the portal, personalisation may allow the persistent storage of user preferences and data for future visits. It is vital to have a consistent model of personalisation (including accounts and privacy) for the portal and all applications. Furthermore, applications need to store their settings and data in a flexible way. Interconnection between applications and shared values are desirable.

The support for *Situations in Life* can be seen as an application. It should be integrated within the system page generation process, relies on session handling and personalisation, and makes heavy use on saving user data. However, applications (like 'child name explanation') need to run within the *Situations in Life* application.

The form auf this universal architecture is now substantiated by the example of hamburg.de.

4 Designing *Situations in Life* for the hamburg.de Project

The hamburg.de project was initiated by the City of Hamburg in 1999. Its goal was to improve the city's website by finding an outsourcing partner who would provide innovative technical services in a public-private partnership. The City of Hamburg and a number of banks and firms have founded a company to operate the portal, thus reflecting the different interests and the will to combine their forces. Part of that was a redesign of the existing portal site to offer more user-centred and customised services. The *Situations in Life* approach was chosen as an essential part of this redesign activity.

To start with, the focus was set on three *Situations in Life* chosen from a wide range of available themes: 'Birth', 'Traffic Accident with Personal Injury', and 'Planning an Extended Weekend'. 'Birth' was chosen as a positive theme, which includes the scope for a number of marketing strategies ('Children of Hamburg', 'My First Email', etc.). The 'Traffic Accident with Personal Injury' was selected to show competence in a more serious and problematic area where people usually need a lot of help and information all of a sudden. And, to include a tourist topic, the 'Planning an Extended Weekend' was picked.

The technical implementation of the presented concept is part of the overall approach in this paper. The implications for software design are focussed on in this section.

Developing the *Situations in Life* approach made obvious certain requirements:

- It is essential to have a professional keyword catalogue in the field of MIS because most of the system relies on searches. hamburg.de opted for buying one rather than creating a new one.
- A flexible search mechanism was implemented that uses the keyword catalogue, full text, and content category patterns.
- The system must offer the option to save searches for future use.
- An editorial interface is offered to maintain *Situations in Life* templates.

- Copies of those templates must be attachable to users' profile.

This is pointed out in the following three sections.

4.1 Content Design: Editorial Process

The editorial process for finding and developing *Situations in Life* is divided into two stages. The first part deals with the development of the situations, the second part with the development of the content.

Editors gather themes by reading newspapers, life-style magazines and other publications. They collect potential situations and build a common list. These themes are then discussed regularly and some situations are selected for development as *Situations in Life*. Therefore a pool of checklist items (consisting of tasks, information, shops, and other related things) is collected. Variants depending on the structure of the target group are denominated.

Software support is needed at the next step of the development process. *Situations in Life* is represented in the system as described above. An editor has to enter the name, a description and a pool of checklist items. Each item is entered as a title with a search description – making it possible to generate dynamic results rather than a fixed collection. Searches can be as generic as 'keyword equals <baby clothes>' delivering all types of content; other searches may be as precise as 'content id equals <10473>' resulting in a single content entry. These searches are saved by title and added to the pool.

The second part of *Situations in Life* development addresses the content of the MIS. Because each situation consists of a large number of possible searches, the editor needs to take care of the content to make results possible. Therefore a special editorial interface is used that can perform all searches associated with the situation and print out a list with the number of estimated results for each item. All searches with a small number of results are then of interest. The editor has to gain an understanding of the characteristics of that missing content and make sure that the content will be available in the near future.

A *Situation in Life* will only be available for public use if a significant number of checklist items generates a sufficient amount of results. When making use of a situation, users only get checklist items copied to their personal record that generate a non-empty result. Currently the project is in a phase of collecting content to reach critical mass.

4.2 User Interface and Dialogue Design

In the project, pages are structured in a three-column layout: navigation, content and applications. The navigation reflects the location of the user in the portal and is also used to set the scope for location-dependent (in the real world) operations. The content column displays the content of the current operation. This may be the content associated with a navigational point, the results of a search or an application. The application column is used for logging into the system and for quick access to related applications. If an application is running, it is used for that application's menu. Because page navigation and personalised information are displayed on each page, applications have to be integrated into the overall page design.

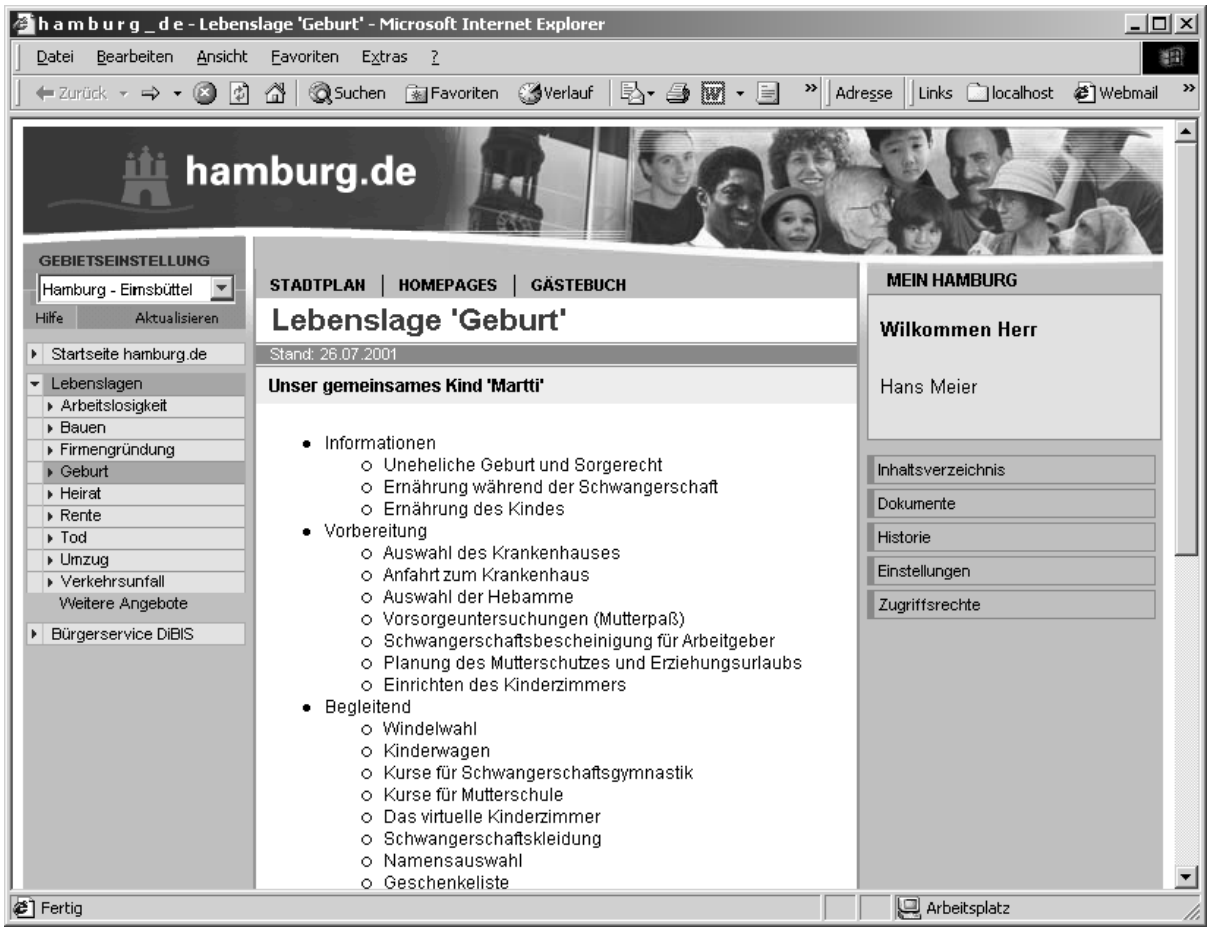

Figure 2: An opened folder for the situation 'Birth' ('Geburt')

The *Situations in Life* application relies on that structure. It follows a simple folder model using the content column for presenting the folders content, using the navigation column to orientate the user, and using the application column to offer it's functions. The application consists of a title page, a table of contents and a checklist interface. The folder automatically creates a history for each action performed. Checklist items make use of the search application available. As mentioned above, each item represents a more or less strict search description. Choosing an item from the list implicitly activates a search and presents the results within the folder. Users can recalibrate the search parameters if necessary or save selected results. Figure 2 shows an example of a *Situation in Life* overview.

The navigation through the portal and the folder application can be mixed as needed.

4.3 Systems Architecture Design

The concrete WCMS used in this project is Vignette Story Server (www.vignette.com). It offers an elaborate caching mechanism for high load websites. Pages are described with templates and components. They are constructed on demand. A content management service allows launching content at a specific point in time as well as the expiration of content.

Applications are implemented in Java using seamless support for session handling, which makes it possible to save settings and information already entered from one page request to another. This is delegated to an application server. Additionally, a login mechanism is offered which then makes personalisation (including settings and other information) persistent.

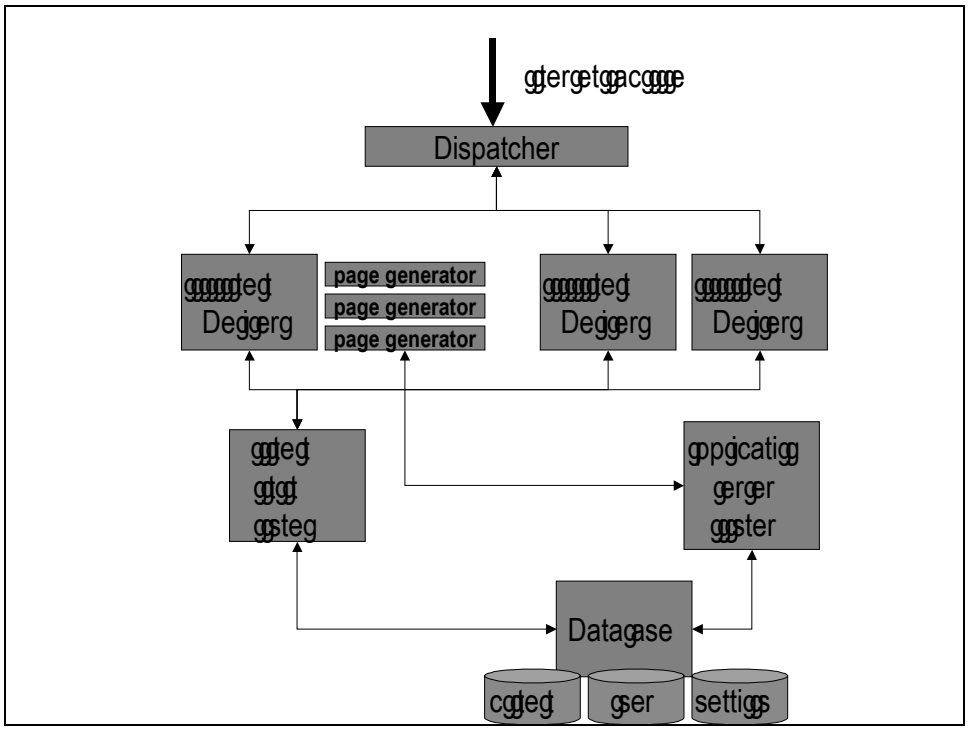

Figure 3: System Architecture

The notion of a content delivery system separates content management and content delivery, enabling a high performance infrastructure. Each content delivery machine has its own cache to re-use as many page components as possible. Components are created on demand by page generators that make use of an application cluster encapsulating the application logic. Both content management system and application cluster make use of a central database storing content and runtime information (see figure 3).

Besides standard architectural elements, a MIS offering *Situations in Life* needs to implement the following services: administration of a content type '*Situation in Life*', checklists and the ability to save search patterns. The search engine is the key factor for the whole system. It is the basis for almost all navigation and situations.

To store the different kinds of content in the same data model, a flexible and state-of-the-art storage technique was used (XML), making it possible to have single interface for accessing content items. The content management system is responsible for version handling and activation.

The listed services and their combination dramatically improve user orientation. Pages and information are not statically collected nor presented. Topics belonging together are stored as search-descriptions, which are flexible enough to react to recent changes in the database. *Situations in Life* is a simple concept that – being realised on different levels – forms an innovative approach for designing MIS.

5 Discussion

Municipalities can get a more attractive portal by implementing *Situations in Life*. The benefits gained from the *Situations in Life* approach for the actors involved can be summarised as follows:

- There is a single entry point to a combination of municipal services, public information, commercial and non-profit services on the same topic. Services do exist separately but can thus be included dynamically.
- An integrated tool provides prepared checklists at the user interface level.
- Commercial partners benefit from this approach by being included in an integrated portal.
- Content Editors are helped in determining the relevant topics that guide the selection of content. They model a situation by collecting checklists with relevant tasks. The result is offered as a template for end users. This editorial process helps system designers identify what information is needed as well as what applications or services should be included in a municipal site.
- Designers are requested to build a technical system with flexible access to different kinds of services and data. It requires freely combinable applications and shared services, thus fostering an extensible architecture. This can be realised by powerful searching capabilities and a pure dynamic creation of pages presented.

As one can see, the approach integrates use and design perspectives on a higher level for a portal site, which need not necessarily be a municipal site. However, the latter are predestined for most services because of the trust citizens place in them. Some applications belong to authorities and will not move to the private sector in the near future.

Open questions concerning *Situations in Life* draw on the transferability and possibility to generalise topics. E.g., can a certain situation for northern Europe be applied to a MIS in southern Europe? As is the case with all processes of model building, some aspects are not taken into account. But editors have to be aware of the fact that regional influences as well as assumptions may restrict re-usability. And, of course, not every aspect of a situation is of equal interest to everybody. The concept needs to reflect this design-decision and at the same time open ways for citizens to integrate items subsequently.

We feel confident that the flexibility is of great value to users. However, we have not so far gathered extensive empirical data. Future work must concentrate on the editorial process and the use of the application. The editorial process and its influence on the content structure is currently under investigation. The use of the *Situations in Life* application will be explored in a project beginning later this year.

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