docQuery –

A Medical Information System for Travellers

Internal Project Report

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1 Project Introduction

The World Wide Web gives many people a platform to communicate and exchange information. It does not matter where people live, to which culture they belong or of which background they are – web communities can be used from anywhere and by anyone. Especially in discussion forums a lot of topics are reviewed and experiences are compared.

Unfortunately, much information gets lost in discussion boards or web pages caused by the quantity and variety of different web communities. Hence, since the topic of a discussion is not clear and a wide range of keywords are used, it is hard to find detailed information. Furthermore the users do not know much about the authors and their background to ensure a high quality of information.

Nowadays it is easier than ever to travel to different places, experience new cultures and get to know new people. In preparation for a healthy journey it is important to get a high quality and reliable answer on travel medicine issues. Both layman and experts should get information they need and, in particular, they understand. For that reason we would like to introduce *docQuery* – a medical information system for travellers.

We propose building a web community which gives information for travellers and physicians (non-experts in the field of travel medicine) by travel medicine experts. *docQuery* will give an opportunity to share information and ensures a high quality because it is maintained by experts. Furthermore it will rise to the challenge of advancing the community alongside their users.

Travellers and experts can visit the website to get detailed information they need for their journey. A traveller will give *docQuery* the key data on their journey (like travel period, destination, age(s) of traveller(s), activities, etc.) and *docQuery* will prepare an information leaflet the traveller can take to his general practitioner to discuss the planned journey. The leaflet will contain all the information needed to be prepared and provide detailed information if they are required. In the event that *docQuery* cannot answer the traveller's question, the request will be sent to experts who will answer it.

2 Research Questions

The information contained in *docQuery* will be processed using intelligent information systems and methods like case-based reasoning. Both existing knowledge about countries, diseases, prevention, etc. and experiences of travellers and physicians will be integrated and spur *docQuery* on. People of different cultures will meet and communicate – they will exchange their experience and get up to date and reliable information about their journey and destination.

docQuery will provide information for travel medicine prevention work and it will be used by:

- – Physicians, who consult their patients
- – Physicians, who provide their knowledge
- – Travellers who plan a journey and look for information about their destination

Each user should be able to gather information of heterogeneous knowledge sources for their personal journey. Before starting their journey travellers can visit a website and according to their destination and activities *docQuery* will give the information, guidelines, suggestions, and references to travel healthy and provide diseases, be informed of outbreaks, earthquakes, eruptions, hurricanes, or typhoons at the travel destination.

2.1 Travel Medicine

mediScon[1] will support *docQuery* by providing travel medical information and assisting the modelling of the information. mediScon is a team of certified doctors of medicine from European Countries with a strong background in tourism related medicine. It is self-supporting and independent, and all information is scientifically proven and free of advertising. *docQuery* will provide all the information existing on mediScon and its sub domains. Hence the community can be used to provide new information and give feedback on given advices to ensure a high quality of information. Any information in *docQuery* is maintained by experts so users can trust the system.

docQuery will aim at providing high quality travel medicine information on demand. We will not provide a huge amount of data that the traveller has to go through – instead, we will focus on the information the traveller already has and extend it with the required information required to travel healthily. Furthermore we will integrate the

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[1] http://www.mediscon.com/

users of *docQuery* in its development. On the one hand, experts will take part in the community by exchanging and discussing topics with colleagues, and on the other hand, the travellers will share their experiences.

2.2 Collaborative Multi-Expert-Systems

docQuery will be an intelligent information system based on experts which are distributed all over the world and meet on the platform giving information to travellers. The implementation will pursue an approach based on software agent and case-based reasoning. Both software agent and case-based reasoning have already been used to implement experience based systems [Althoff2003, BergmannEtAl2003, Minor2006]. *docQuery* will use different knowledge sources (diseases, medications, outbreaks, guidelines, etc.) which are created in cooperation with experts, provided in databases and maintained by the users of *docQuery*.

Collaborative Multi-Expert-Systems (CoMES) are a new approach presented in [AlthoffEtAl2007] which presents a continuation of combining established techniques and the application of the product line concept (known from software engineering) creating knowledge lines. Furthermore this concept describes the collaboration of distributed knowledge sources which makes this approach adequate for an application scenario like *docQuery*.

docQuery will follow the CoMES-architecture, called SEASALT (Sharing Experience using an Agent-based System Architecture LayouT), as it can be seen in Figure 1 and is explained in detail in [BachEtAl2007].

The architecture can be vertically split in two parts. On the left hand side the knowledge provision and on the right hand side the knowledge acquisition. First we will focus on the knowledge provision and explain how a question to the system will be processed. A user enters a question using the Interface which passes the question on to the Coordination Agent. The Coordination Agent analyzes the question, looks up the matching Topic Agent(s) and sends its requests to them. A response based on the existing case base is created by each Topic Agent and passed back to the Coordination Agent. Finally, the response of the Topic Agents is used by the Coordination Agent to compile an answer.

To exemplify this, imagine the Knowledge Line as a cabinet with the Coordination Agent as its chancellor or president. Each member of the cabinet is concerned with a different department and has a large staff that provides them with information, updates it and makes simple decisions in the name of their respective cabinet member. In our architecture the members of the cabinet would be the Topic Agents, their staff would be each Topic Agent's individual Case Factory.
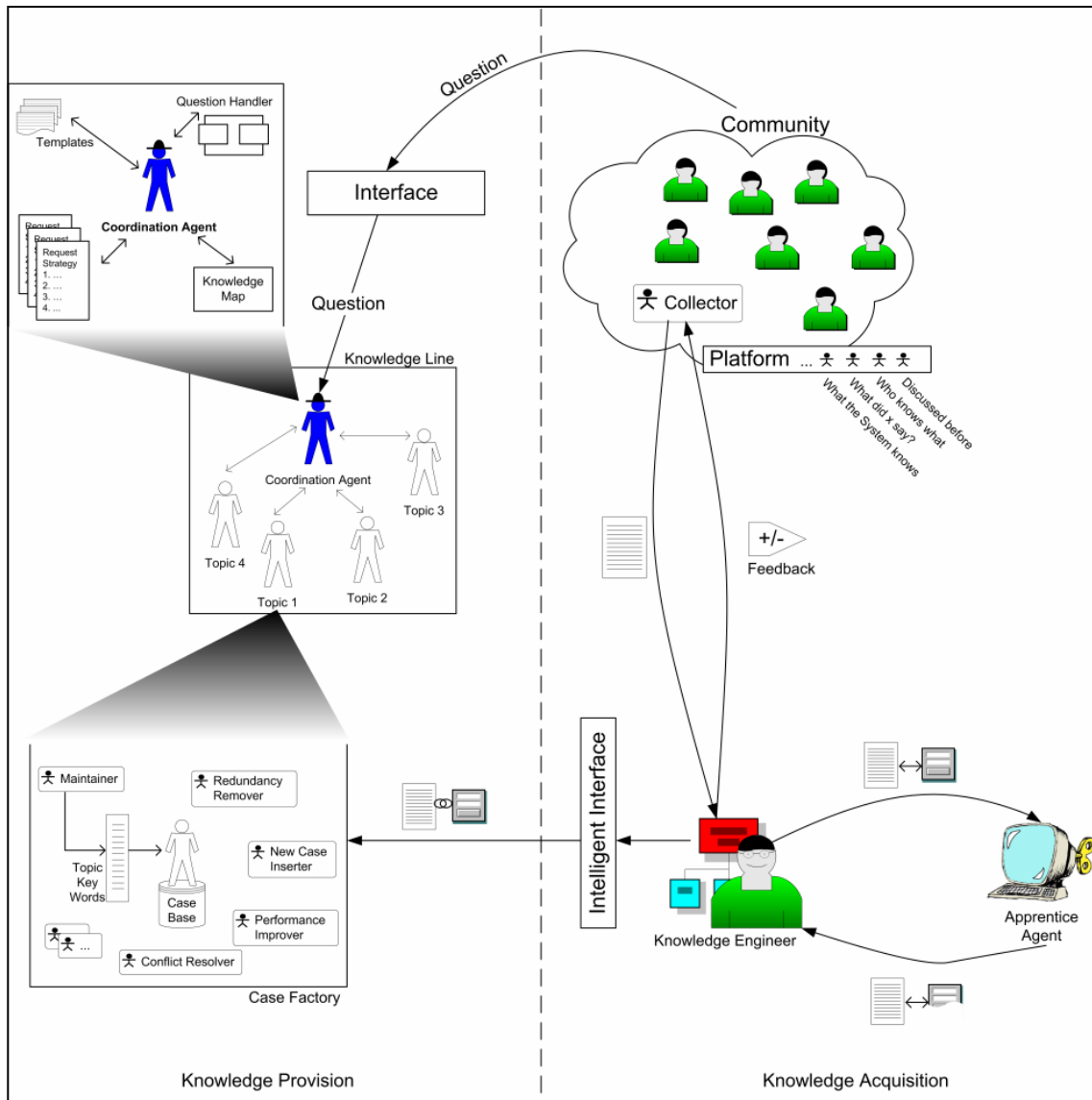
Figure 1: SEASALT: Architecture for CoMES

The knowledge acquisition process is illustrated on the right hand side of Figure 1. It consists of two parts: a platform that supports the community and offers communication services where community members can discuss and exchange experiences and a knowledge engineering part in which contributions are analyzed and processed. Based on the Topic Agents we will place Collectors belonging to a Topic Agent in the community to collect information. Since the information given in the community is not structured, a Knowledge Engineer has to support the Collector's work. The Knowledge Engineer will receive and formalize contributions that the Collectors classify to be useful for their individual topic. In the beginning this has to be a human being, but the Knowledge Engineer trains an Apprentice agent by providing it with a document set, consisting of the source contribution and the structured document. Thus the

Apprentice will soon be able to do at least basic pre-processing for the Knowledge Engineer. The formalized contribution is passed on to the Case Factory to include the new cases and make them available to the system. The original contributions that are provided with the new cases can be used by the system to support its answers. Additionally the community platform which is used by the Collectors to collect information also offers agents for intelligent services that make the platform more usable, ease the communication and accelerate conclusions on topics. It is necessary that the information provision and the community platform are presented and perceived as a single entity. Thereby the platform's intelligent services can be an additional motivation for the community members to not only passively let the system collect information, but to directly provide it with complete cases or feedback on the knowledge it already has collected. This is especially important, since it may be assumed that the system's knowledge provision component itself will mainly be used by those community members that have less knowledge on the domain, while those who are experts on the domain and have much knowledge about it (the community's regulars or core group) will use it less often. Those regulars however will make more use of the community platform and thus they will also more appreciate its intelligent services and be more motivated by them to actively provide the system with their knowledge.

Although CoMES is a very new approach, the used techniques, like the experience factory [Althoff2003], Case-Based Reasoning or Software Agents are well known. *docQuery* will integrate those techniques in a web community and creating an intelligent information system which is based on the knowledge of experts, experiences discussed on discussion boards and novelties presented by travel medicines that are a part of the community. Sharing knowledge at this level furthers the web 2.0 approach and allows us to develop new techniques.

3 Architecture and Methodology

3.1 Travel Medicine

The research project will develop a prototype for a collaborative multi-expert system on travel medicine using sub symbolic learning algorithms. *docQuery* will offer travel medicine prevention work for any traveller. Each request will be processed like an individual question, although the system will not substitute consulting a general practitioner. The leaflet should inform travellers and enable them to ask the right questions. Furthermore, the information given should help them to travel healthily and enjoy their stay. In developing *docQuery* the following requirements set our goal:

- Providing reliable, scientifically proven, up-to-date and understandable Information
- Giving independent information (no affinity to any pharmaceutical company)
- Informing any travellers without charging them
- Intuitional Usability of the Front-End (accessible with a common web browser via internet)
- Universally available
- Offering a communication platform for experts and travellers
- Enabling a multilingual und multicultural communication
- Applying new technologies and focussing on social problems to further their solution

DocQuery will support travellers of different cultures and countries giving trustworthy information based on key data like destination, travel period, previous knowledge, planned activities and language. The information on the leaflets will cover the following issues:

- Medical travel prevention: vaccination, clarification of threats, information about medicaments
- Each information is tailored especially for the travellers and their needs – especially country-specific information as well as outbreaks or natural disasters (e.g. hurricanes, tsunamis, earthquakes)
- Information about local hospitals at the destination – especially hospitals where the native language of the traveller is spoken
- Outbreaks of diseases and regional epidemics
- Governmental travel advice

– General information and guidelines like „What to Do if..." in case of earthquakes, volcanic eruptions, flooding, etc.

docQuery will be the core application and supports establishing a community to exchange experiences. Furthermore the users will be involved in advancing the knowledge provided by *docQuery* and influence which issues are raised by sending requests, giving feedback and sharing experiences. *docQuery* is supposed to be a non-profit project and will provide travel medical information, prevention and preparation with no charge.

3.2 Architecture of *docQuery*

The architecture of *docQuery* is based on a three-tier-architecture consisting of

- A client, basically containing the graphical user interface
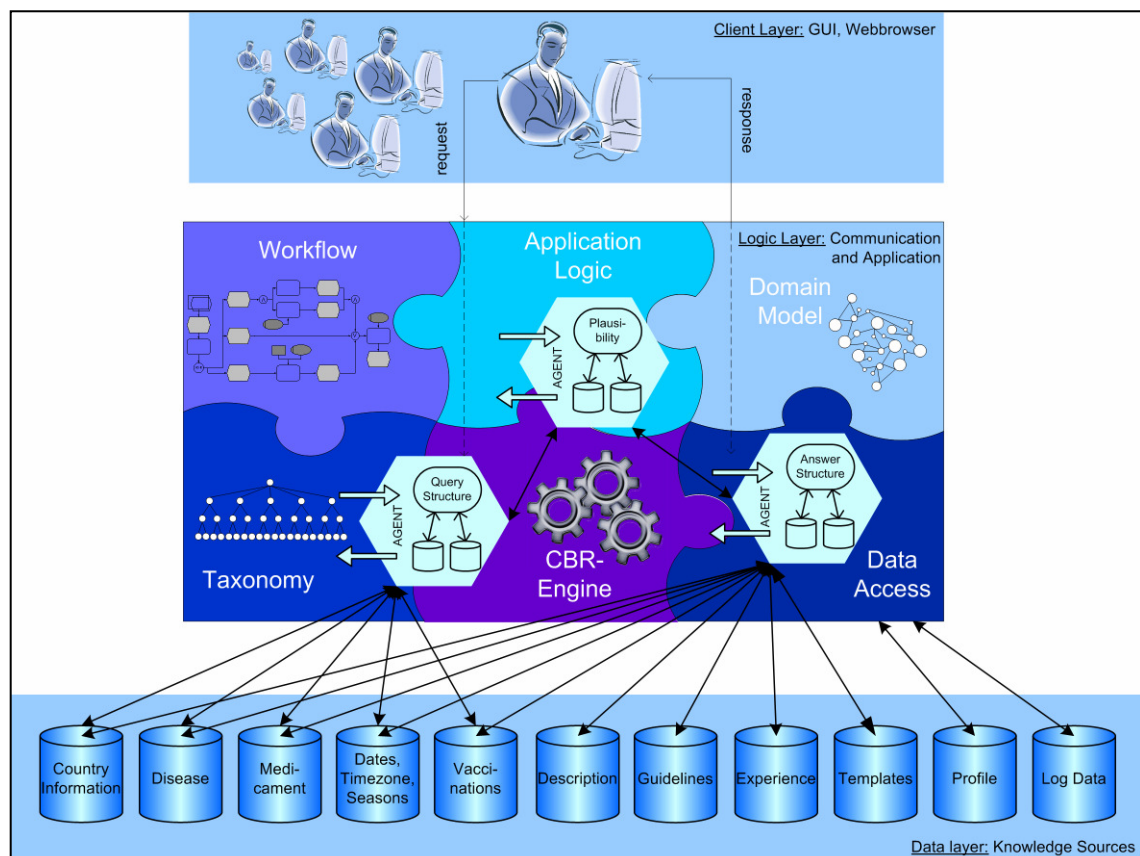- Communication and application layer
- Knowledge sources

Figure 2: Architecture of *docQuery*

The architecture shown in Figure 2 is based on three layers. The Data Layer (bottom) contains all the knowledge sources *docQuery* will need to provide information. It contains a knowledge source for each topic that makes it easy to follow a modularized structure and enables defining maintenance processes for the contained information. According to the well-known three tier architecture the middle tier will process questions answered of users passed through the client layer. The Logic Layer will use CBR techniques to retrieve cases, has rules and templates to create answers and possesses information derived from workflows, how to solve conflicts creating answers and forward unanswerable questions to experts. The client layer contains forms which will be used by travellers to ask questions and interact with *docQuery*.

Knowledge Sources

For each specific issue a database will be created to ensure a high quality of knowledge. The data structure of each issue is different and so is the case format and domain model. Creating high quality "local knowledge bases" will guarantee the high quality of the systems knowledge.

docQuery will initially consist of the following eleven databases:

Country Information: For any country specific information consisting of "Before the journey", "During the journey" and "After the journey" will be provided. The country information includes required vaccinations and guides for a healthy journey.

Disease: This knowledge base holds more than 100 diseases considered in travel medicine.

Medicament: Details about medicaments and its area of application (diseases, vaccinations, age, etc.) used in the system are contained in this knowledge base. Basically it contains information about active pharmaceutical ingredients, effectiveness, therapeutic field, contraindication and interdependences.

Dates/Seasons: For each country we will cover dates and seasons.

Vaccinations: If there are vaccinations recommended this database contains vaccination periods and types of vaccines.

Description: Any information given in the system can be described in different ways. This knowledge base contains different descriptions which can be given to the user: there will be a specific and detailed description (e.g. for physicians), detailed descriptions for travellers (who are no physicians) and brief information (for experienced travellers as reminders, etc.).

Guidelines: This knowledge source will contain the „How to"descriptions to help travellers to put the given information in practice.

Experience:	According to the motivation we will integrate the users experience to the system. This knowledge base will contain experiences and feedback given by travellers.
Template:	This database contains templates to display the result created during the processing of the request. The templates will be used to ensure a structured and printable output.
Profile:	This database contains user profiles of experts who edit data, administers or regular users who want to create a profile to get faster access to their required information.
Log:	This database will contain anonymized data about accessed information, questions asked of users and the behaviours using the system.

Each knowledge source is accessible by the application and will be used to process the requests given by the user. Furthermore the knowledge sources will be able to be extended by more knowledge bases in future and maintenance processes like they are described in [Hanft2005] can be defined for each knowledge base.

3.2.1 Communication and Application Layer

The communication and application layer uses the knowledge sources to process the request. The Layer contains the whole application logic and manages the software agents sending specific requests on their topics which will be used to answer the user's questions. If finding an answer requires further inquiries they will be generated in the communication layer and passed to the client, where they can answer the user. Also, in the event of conflicts or unanswerable questions the layer is responsible for forwarding the request, including all information given by the user and already extracted data, to an expert. Further inquiries will depend on the information already given and aims at finding an answer for the actual question. Each response for the user will be scrutinized by different agents ensuring plausibility as well as adequate presentation. Plausibility means checking if correct information is given and no conflicts occur. The answer given back to the user will be generated using templates, but also it has to be certain that all information needed is provided and the created document is set up properly.

Creating a request for the system should provide as much information as possible concerning the planned journey, so the system can narrow possible answers. Reflecting on previous questions asked we will need information regarding the following issues:

- Travel destination
- Travel period
- Kind of journey
- Activities

- Well-known diseases
- Previous illnesses and pre-existing conditions
- Previous knowledge on travel medicine
- Language

Based on the information on the issues mentioned above the system will send requests to the knowledge sources generating answers regarding the given constraints.

The application layer contains all functionalities the system is providing and it is communicating with both the Client and Data Layer. Therefore it uses software agents with different tasks and is also contains implicit workflows defining how conflicts are solved (e.g. sending unanswerable questions to an expert, refining requests using further question asked the user/traveller, using experience made before solving problems). In addition, the system will always give an answer - either giving back an information leaflet or forwarding the request – assuring the user can trust in the system and the given information.

The workflows defining the processing of information generating answers do not have to be explicitly defined – they can also be included in the tasks for each agent. Since we will have to deal with different kinds of source data, every software agent has a domain model of its knowledge source containing information on how to access data, which kind of data can be processed and how the response can be used.

Furthermore the application layer will contain questioning strategies on how to refine the users question in a way that they can be processed.

The retrieval will be done using the *CBR-Engine* which will use the requests to find an answer based on the given data and experiences. How CBR works will be described in section 4.2.

Each component of the Communication and Application Layer is able to communicate with each other and data can be exchanged, because the approach is based on the idea of a collaborative multi-expert-system as it is described in section 2.2.

3.2.2 Client-Layer

Travellers will be able to access the system via the World Wide Web, so the data and processing will take place on the server side. Furthermore the accessibility should be as easy as possible and in the first place we do not plan to have explicit user profiles. In case an e-mail response to the travel is required it will be handled via an extra form.

The traveller will use so called dialogues built on forms to input data, but as mentioned before the questions asked will depend on the given answer, not on a fixed structure. We aim at asking as few questions as possible to find a correct answer with a high quality. Furthermore this concept will avoid asking redundant questions.

After processing input data an answer will be generated and displayed on the client side. Given information should be short, goal-oriented and as concise as possible, as

well as containing all relevant information. The experience of mediScon shows that information leaflets are very useful, because travellers can take them to their doctors to ask further questions as well as taking them on their journey to remember and follow the given advice.

As well as travellers also the expert will access *docQuery* via World Wide Web to answer questions or discuss topics. The graphical user interface (GUI) for experts will differ from the travellers GUI because they will have more functionality like updating information, answering specific questions or inserting new information.

3.3 Further Research Aspects of *docQuery*

Creating a Web Community is not only providing a platform where information can be exchanged. Participants have to be motivated and the community should fulfil their expectations and needs. In this section we will give some aspects which will be considered introducing a successful web community.

3.3.1 Maintenance of data, information and knowledge

docQuery deals with different kinds of data and each kind has to be maintained differently. We will define maintaining processes for each source focussing on exact, up-to-date and reliable data. Furthermore each source will have its own maintainer in case old or erroneous data has to be removed or corrected. To follow this goal the maintenance processes has to be created along with the data models regarding the interfaces and the applications built upon them.

To ensure up-to-date data the system has to be checked by experts regularly, and by integrating a web community new topics will have to be identified and new cases will have to be entered in the knowledge sources. For that purpose processes for updating (inserting, maintaining, deleting, extending, etc.) have to be implemented and established.

3.3.2 Communication in the Community and Multilingualism

In general, we aim at building an international build web community, so information will be provided in different languages regarding different cultures. Furthermore we will provide experiences of various people from all over the world so we might be able to customize on special needs.

Furthermore we will have different roles in our web community ensuring trouble-free working with each other. These roles will be for example:

- Traveller/ Regular User,

- ▪ Travel Medicine Physician,
- ▪ Experts of different topics,
- ▪ Moderator,
- ▪ Administrator, etc.

The roles given above will ensure communication between different users and should help resolve conflicts and disaccords.

The application will provide information for users of different countries who are travelling to different destinations. Therefore the system will be able to handle different languages and manage interacting with people of different cultures.

The information leaflets on travel medicine (an example can be seen in section 5.1) will be available in different languages. Currently we have most of the leaflets in both German and English, and we are working on the translations in Indonesian, Vietnamese and other languages.

3.3.3   Questioning Strategy

The system will provide individual designed information and therefore we will need a strategy for how to educe information without boring the user and asking redundant questions. Furthermore we will try to ask questions the user can answer to reduce possible solutions and finding the correct one without having the user cancelling the request.

3.3.4   Knowledge Representation

As mentioned before we will have to deal with different kinds of information (*structured information* like country or medicament information or *unstructured information* like experience reportsor e-mails), and furthermore, we will have to pre-process our knowledge source enabling an access to the data. Therefore the knowledge representation for each knowledge source has to be defined and data models have to be written. Coping with those challenges we will use decision trees, case-based reasoning and experience management techniques.

3.3.5   Usability

We aim at building a system which can be used by anybody via World Wide Web. The user will be guided through the system using dialogues. Furthermore, in case terms are unknown, help will be provided. The GUI will be sate-of-the art, enabling anybody to use *docQuery*.

4 State-of-the-Art

This chapter will give an overview of the applied techniques and related work in the field of travel medicine which will be used in implementing *docQuery*. It will focus on software agents, case-based reasoning in the field of computer science and introduce some currently available applications in the field of travel medicine.

4.1 Agent Systems

The term agent has first been used in the Dissertation of Rosenschein [Rosenschein1985] in 1985. Today, software agents are computer systems which act autonomously in a dynamic, unpredictable and open environment and they bear problem solving behaviours see [Kirn2002]. Following [LuckEtAl2003] agents are used interacting with users as well as with each other and influencing their environment. Some application domains are Ambient Technologies, Grid Computing, Electronic Business or Bioinformatics and Computational Biology. As described in [Kirn2002], agents have the following properties:

- Agents act *flexible and autonomous*, because they are featured with a decision-making ability beyond an algorithm
- Agents do have their own *goals*, which can develop and change while they are working
- Agents *decide for themselves about their actions/operations*, that is why they need as many as possible operations and consequences of operations by the time they decide
- Agents have to plan their actions, so they need intentions/plans which they can use to base and further their goals on.

"Agent architectures are the fundamental engines underlying the autonomous components that support effective behaviour in real-world, dynamic and open environments" [LuckEtAl2003, p. 12]. Agent architectures range from *reactive (or behavioural) agents* to *deliberative agents*.

Reactive agents are simple stimulus-response-systems which react on changes in their environment. Therefore the agents have to capture the environments using sensors and as soon as the agent has been stimulated, it acts like it is described.

Deliberative agents have a symbolic representation of their environment and input (influences) of their environment will lead to intentions of the agents. Further development of an agent is caused by changing its mental model, which can be categorized based on the theory of Bratman [Bratman1987] in *beliefs*, *desires* and

intentions – which describes the BDI-agent. [Müller1996, S.17f] extended Bratman's concept and defines the following issues of goal-oriented agents:

- Beliefs: *Beliefs* describe the expectations considering the actual situation regarding the current (internal) status of agents. Furthermore it contains background knowledge which can be used for conclusions in the future.

- Desires: *Desires* contain the preferred environmental status which should be reached in the future, so the agent knows its intended purpose.

- Goals: *Goals* of an agent are the consistent and pursued desires (they are a part of the agents' desires) which influence the acting of the agents without precise intentions or plans.

- Intentions: *Intention* is a collection of possible reactions on situations of which an agent can choose from. During this process the agent uses the description of its goals to decide.

- Plans: *Plans* are more specific than intentions because they contain exact responses of an agent on a change in its environment.

As described in [Kirn2002], software agents are following new approaches of modularizing architectures which extend object oriented implementations. Agents are especially useful for local, autonomous entities which interact along others and can be implemented independently. Autonomous agents enable a faster and easier realization of software architectures which quicken software development processes. *docQuery* as an application scenario based on different distributed knowledge sources will benefit on an agent based architecture, because it furthers the development process and enables combining well-known technologies aiming building and collaborative multi-agent-system.

4.2 Case-Based Reasoning

The idea of case based reasoning has its roots in a psychological model, which describes the reasoning of human beings as a process of applying and adapting solved problems to resolve new problems. This approach has been introduced in [RiesbeckSchank1989] and was first developed and advanced in the USA, but since the 1990s CBR has been established in Europe as well.

The basics of learning from experiences were described in the *dynamic memory* approach of [Schank1982] and [Kolodner1993], which is an extension of [RiesbeckSchank1989]. This approach uses another aspect of the human problem solving, the *adaptation*. Solving problems is remembering experiences and adapting them, so new problems do not have to match exactly to be resolvable. Experiences in Case-

Based Reasoning (CBR) are stored as so called cases containing a problem and its solution. Furthermore in human behaviour, explanations and further information are used to solve problems and in CBR similarities between cases are used to find matching experiences. Learning in this context means learning how to find similarities between cases and adapting partial solutions of those cases. Furthermore Schank proposes that indexing of cases is similar to reorganizing made experiences which are kept in memory and enables an easier access [RiesbeckSchank1989].

Probably the best known descriptions on how CBR systems, which have been developed since the 1990s, follow the 4R-Cycle of Aamodt and Plaza [Aamodt1994].
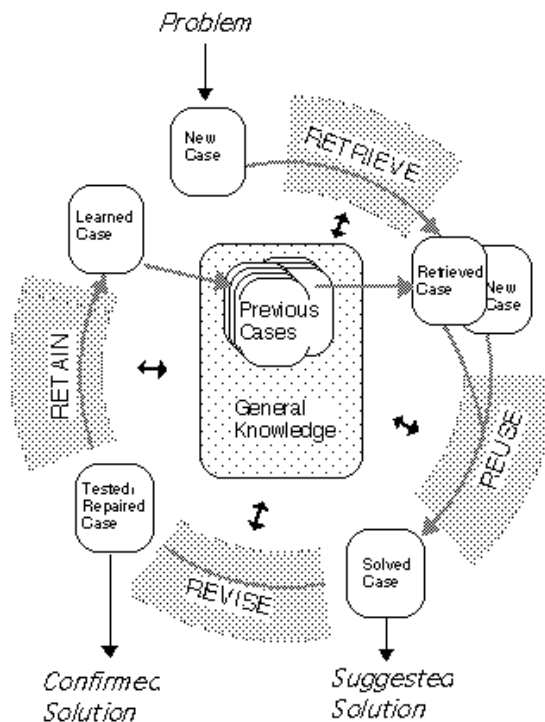

Figure 3: 4R-Cycle of Aamodt and Plaza [Aamodt1994].

Figure 3 describes in four steps how a problem will be solved using the knowledge of previous problems and their solutions. The cases (problem and solution) are contained in a so called case base which contains different kinds of knowledge as described in [Richter2003]. The problem will be the new case which is used to find similar cases (*Retrieve*) which will be reused to find a solution (*Reuse*). Ensuring the found solution can be applied the solution is tested based on the information given about the new case (*Revise*). If the new case has a solution, both the new case and its solution will be entered in the case base in the last step (*Retain*), so it will be available the next time a problem has to be solved.

Case-Based Reasoning has been successfully applied in numerous applications which are described in [BergmannEtAl2003], [Berghofer2003], [Minor2006]), this approach also helps to further knowledge management for different areas.

Depending on the given cases and domains CBR can be divided into analytical tasks and synthetical tasks. *docQuery* will use both kinds of tasks – depending on the given knowledge sources and domains. Analytical tasks are usually applied in the field of heterogeneous data sources and finding solutions in experiences. Putting together the answers of *docQuery*, for example, will be a synthetical task, because they are usually applied in planning, configuration or design problem and they have existing components. For both kinds of tasks applications are available and demonstrate their strength.

4.3   Travel Medicine

In Germany, the Federal Centre for Health Education[2] has to inform travellers about medical issues, but the website does not contain any information about travel medicine concerns. The World Wide Web offers many websites, discussion forums and services where one can gather information. Usually these websites do not contain all medical information a traveller might need and the editors are mostly unknown. Furthermore the information is spread over hundreds of websites and it is challenging and time-consuming to find it.

Travel medicine prevention and preparation information can be found on different web pages:

$\rightarrow$ Information about the economy, policy and culture about the travel destination can be found on the website of each country's embassy (e.g. http://indonesian-embassy.de/ or http://www.auswaertiges-amt.de). Furthermore there are consular and immigration or customs duty information.

$\rightarrow$ In preparation of a journey there are different kinds of websites which will help to prepare, i.e. http://wwwn.cdc.gov/travel/default.aspx.

$\rightarrow$ The latest weather forecast at the travel destination can be obtained at weather.com (www.weather.com)

$\rightarrow$ Current information about outbreaks, eruptions, hurricanes, or typhoons at the travel destination cannot be found at one website – therefore many sources have to be considered, i.e. http://earthquake.usgs.gov/.

According to the given example it is tough to gather all information for a travel destination. *mediScon* provides any information a traveller needs. Moreover any

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[2] http://www.bzga.de/

information given on the website is reviewed by experts and the user can trust in it. Currently mediScon provides outbreaks, eruptions, hurricanes, and typhoons as well as guides[3] concerning voyages. Furthermore travellers can ask via e-mail for precise information on their journey and a mediScon-expert will answer the questions. A responding e-mail is shown in chapter 5.1. The service is used by more and more users who highly appreciate and recommend this service.

By now mediScon provides more than 100 travel medicine leaflets for about 220 destinations which are usually attached to e-mail requests. Most of the requests are penned by travellers who have special questions regarding their journey. Hence, there are physicians asking for medicaments, prophylaxis and treatment concerning travel medicine.

Currently mediScon is hosting websites for the German, English, Indic, Vietnamese and Indonesian language. Most of the e-mail requests are in German, followed by requests in English and the other languages. All of the travel medicine leaflets exist in German and English and are translated in the other languages on demand.

In the area of travel medicine in 2004 the project TEMOS[4] has been established and aims at building a global network of hospitals to exchange information. TEMOS has been started under the auspices of the European Space Agency (ESA)[5] in collaboration with the Institute of Aerospace Medicine at the Technical University of Aachen[6] with the German Aerospace Centre (DLR)[7] in Cologne, the Centre for Travel Medicine (CRM)[8] in Duesseldorf (all three institutions are located in Germany), and Telemedicine Technologies SA[9] in Paris, France, as well as world-wide operating assistance companies (Mondial[10], Axa[11]).

TEMOS gives the opportunity to further topics like "tele medicine" and "tele education". "Tele medicine" will concentrate on information and knowledge exchange using video conference, telephone consultation as well as providing second advices on cases. "Tele education" on the other hand will focus on e-Learning, Tele-Teaching as well as providing of professional training for apothecary, physician or pharmacists on the travel medicine context.

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[3] At the moment the following guides are provided: insect-guide, sun-guide, clinic-guide, disease-guide, airport-guide, narcotic-guide, dutyfree-guide and service guide
[4] TEMOS means "**TE**lemedicine fort he **MO**bile **S**ociety", more information can be found on http://www.ukaachen.de/content/page/4193626/1
[5] http://www.esa.int/esaCP/
[6] http://www.ukaachen.de/go/
[7] http://www.dlr.de/en/
[8] http://www.crm.de/ (only in German)
[9] http://web.tentelemed.com/listeaccueil.do
[10] http://www.mondial.de/en/aboutus/homepage.htm
[11] http://www.axa.com/en/

In comparison to docQuery, TEMOS focuses on professionals in the field of medicine; docQuery addresses the traveller and will provide non-professionals with high-quality information. Ensuring correct and up-to-date information, docQuery will have to collaborate with travel medicine experts – and at this point both projects might meet.

Another approach supporting physicians getting information about travel medicine is tropimed®[12] – a database which can be used by experienced consultants. Tropimed® provides travel related information which can be put together in a travel dossier with guidelines and information regarding the travel destination.
In comparison to docQuery, the provided information is charged and it cannot be used by non-experts.

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[12] http://www.tropimed.com/

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5   Attachment

5.1   Example for a travel medicine request and answer

1. Currently, requests addressed at mediScon worldwide look like the given example. In the given case, a traveller from Germany sent the following e-mail to mediScon to get information on his journey:

```
Hello,
From March, 8th 2007 to March, 20th 2007 we are going to
travel to Alor to dive (at Thomas Schreibers place) and
afterwards we will travel around Bali by car.
We would like to ask, which kind of vaccine we will need and
if malaria prophylaxis is necessary - if malaria prophylaxis
is required what would you recommend? In case we need a
malaria prophylaxis can we use Doxycyclin 100?
Thanks in advance!
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2. As a next step, the team of mediScon write an individual answer concerning the request is sent back to the traveller. For the given request an answer and the leaflet would look like the following:

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Dear Mr ...,

Please find enclosed our travel medicine information leaflet
about Indonesia containing general vaccination requirements
for your destination.

Because of the fact that you will travel in the rainy season
we recommend a malaria prophylaxis for the region of
Alor/Flores/Komodo/Sumbawa/Sumba. Which medicament you
choose should be individually discussed and recommended by
your physician. In general, the medicament you have
mentioned would fit your requirements (if there is no health
risk taking this active ingredient and you are aware of the
fact that this medicament is not approved for malaria
prophylaxis in Germany; for further information please have
a look at our information leaflet "Medication Selection for
Malaria Prophylaxis").

If there are further questions after looking through the
information leaflets don't hesitate and ask us.

We hope we could feed your anticipation on your journey.
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3. Finally, the information leaflets are put together and along with the personal answer they are sent back to the traveller. The information looks like the following:

mediScon Service Information: Country Information Leaflet „Indonesia"

These are our medical recommendations for a trip to Indonesia. For further information please ask your travel health specialist or contact mediScon.

<u>„Before the trip"</u>

Immunizations
- Not recommended but required under certain conditions
    - Yellow Fever: immunization required if travelling from an endemic zone and >1 year of age
- Recommended for everyone
    - Diphtheria, Tetanus, Hepatitis A, Typhoid Fever, Poliomyelitis
    - Measles: not necessary for Americans born before 1957 or those who had measles or received 2 live-virus immunizations
- Recommended for special circumstances
    - Hepatitis B
    - Jap. Encephalitis: probably year-round risk; varies by island; peak risks associated with rainfall, rice cultivation, and presence of pigs; peak periods of risk months are November to March and in some years June to July; human cases recognized on Bali and Java, possibly in Lombok
    - Rabies: canine rabies highly endemic
- Comments
    - Hepatitis A: no vaccination if you have had the disease
    - Cholera: vaccination in not recommended (very low risk)

Malaria
- Risk Areas
    - risk in all areas of Irian Jaya (the western half of the island of New Guinea) and at the temple complex of Borobudur; Risk in rural areas only in other islands; No risk in the cities of Java and Sumatra or in the main resort areas of Java and Bali
- Transmission Period:
    - January to December
- Medication
    - Risk areas: before departure begin taking regular doses of chloroquin. When to start and how to take (dosage and duration) depend on the antimalarial medication prescribed.
    - Risk areas: plan on carrying atovaquone-proguanil for traveller who elect NOT to take or are unable to take appropriate chemoprophylaxis. Before departure talk to your physician on how to handle this medication in case of Self-Treatment.

AIDS
- Regulation of HIV tests:
    - Some countries require an HIV test for long stays, particularly for immigrants, students or workers. These regulations change frequently; contact the appropriate consulate for current information.

- AIDS-infected patients
  - AIDS-infected patients should consider not travelling to underdeveloped countries, where the risk of infection is higher and adequate medical care may not be available.

To take along
- Drugs:
  - drugs used at home, sterile dressings and disinfectant, an antipyretic, possibly an antimotility agent and an antibiotic (for diarrhea). For other consult your family physician or pharmacist.
- Condoms:
  - for safe sexual encounters.
- Travel insurance:
  - verify your insurance coverage with your insurance agent.

„During the trip"

Malaria
- If indicated, take regular doses of the drug prescribed for prevention of malaria.
- If signs of malaria appear (flu-like symptoms, fever headache, joint pain, …) seek medical attention within 24 hours! If this is not possible, assume you have malaria and take the "presumptive self-treatment", if recommended, at the prescribed dosage.

Measures to avoid mosquito bites
- For protection in the daytime (risk of dengue), apply an insect repellent to exposed skin.
- For protection at night (risk of malaria) apply an insect repellent to exposed skin. When outdoors at night, wear clothing with long pants and sleeves.

Food
- Water: drink only bottled water or water that has been boiled or treated (with a filter or chemical agent), no ice cubes
- Basic rule: food should be well cooked.
- Fruits and vegetables: wash, dry and peel them yourself.
- Beware: raw salad, cold cuts, raw or slightly cooked/grilled seafood, mayonnaise, ice cream, cream or butter, etc.
- Handwashing: do not use soiled towel to dry hands.

Sun
- Do not go out in the sun from 11:00 AM to 03:00 PM, wear a hat and sunglasses, and apply a sunscreen to the skin.

Sex
- Unprotected sexual encounters can transmit AIDS, hepatitis B, …

Some Rules
- Do not walk barefoot (risk of infection).
- No acupuncture or tattooing.
- Do not have ears or other areas pierced.
- Do not swim or wade in fresh water (risk of schistosomiasis).

„On returning"

In General
- If fever, diarrhea, or other symptoms develop, seek medical attention and mention to your trip.

Malaria
- Malaria prophylaxis should be continued for 1-4 weeks, depending upon the medication, after returning from a trip.
- If signs of malaria develop (flu-like symptoms), seek medical attention immediately and mention your trip.

[This leaflet is currently not available in English – if you would like to have a copy of the English version don't hesitate and send a request to: info@mediscon.com]

mediScon Information „Medikamentenwahl zur Malariaprophylaxe"

mediScon bietet Ihnen hiermit einen kurzen Überblick der Entscheidungskriterien zur Medikamentenauswahl zur Malariaprophylaxe in Gebieten mit überwiegend Mefloquin-sensiblen Falciparum-Stämmen.

Bei den Dosisangaben wurde eine erwachsene Person berücksichtigt. Die genaue jeweilige Dosis besprechen Sie bitte unbedingt vorab mit Ihrem Arzt.

Wir betrachten hierbei

1. Atovaquon+Proguanil (Markenname: „Malarone"), 2. Doxycyclin Monohydrat (1H2O) und 3. Mefloquin (Markenname: „Lariam")

1. Atovaquon+Proguanil (Malarone)

- Dosierung:
  - Erwachsene >40kg Körpergewicht 1 Tabl. täglich
- Positivpunkte:
  - Das Medikament hat eine hohe (>95%) Wirksamkeit gegen P.falciparum (Malaria tropica) und P.vivax (Malaria tertiana)
  - Zur kausalen Prophylaxe gegen P.falciparum (Malaria tropica) ist die Einnahmedauer 1-2 Tage vor bis 7 Tage nach dem Aufenthalt im Malariagebiet
  - Es hat ein gutes Profil bezogen auf mögliche Nebenwirkungen
  - Es ist ein sicheres Medikament, denn es handelt sich dabei um bekannte und erprobte Einzelsubstanzen
- Negativpunkte:
  - Es ist recht teuer
  - Es gibt Interaktionen mit Paracetamol (ein Medikament gegen Fieber und Schmerzen) und Metoclopramid "MCP" (ein Medikament zur Behandlung von Reizmagen, Sodbrennen, Übelkeit, Erbrechen,...)
  - Es kann zu Nebenwirkungen im Magen-Darmbereich, Kopfschmerzen und Aphten (schmerzhafte, grau-gelbe Flecken und Bläschen im Mundbereich) kommen
  - Es muss täglich eingenommen warden

2. Doxycyclin Monohydrat (Antibiotikum)

- Dosierung:
  - 1 Tabl. täglich (100mg)
- Positivpunkte:
  - Es ist ein sicheres Medikament
  - Die Wirksamkeit liegt bei 84-98% gegen P.falciparum (Malaria tropica)
  - Es sind keine Resistenzen bekannt
  - Es ist ein sehr günstiges Medikament
  - Es ist auch gegen Leptospirose und Rickettsiose wirksam
  - Als Monohydrat-Präparat hat es weniger Nebenwirkungen im Magen-Darmbereich, als die Hyclat-Präparate
- Negativpunkte:

- - Es kann in 1,4-10,5% der Fälle zu einer Phototoxizität kommen (daher muss bei Einnahme des Medikamentes auf einen konsequenten Sonnenschutz geachtet werden!)
  - Bei Frauen kann es zu Vaginalpilzen kommen (daher sollte ein entsprechendes Medikament mit zur Reiseapotheke gehören)
  - Es darf nicht bei Kindern unter 8 Jahren, bei Schwangeren und stillenden Frauen angewendet werden
  - Es kann zu Magen-Darmproblemen kommen
  - Es kann zu Interaktionen mit Antikoagulantien ("Blutverdünnern"), Sulfonylharnstoffderivaten, Phenytoin und Carbamazepin, Antazida, Bismut, Warfarin und Pille kommen
  - Es muss täglich eingenommen werden
  - HINWEIS: Doxycyclin ist in Deutschland nicht als Mittel zur Malariaprophylaxe zugelassen, obwohl es von der WHO und von anderen Ländern (z.B. USA, Australien) zur Prophylaxe für die Region Lombok empfohlen und eingesetzt wird. Da die gute Wirksamkeit und Verträglichkeit des Mittels durch zahlreiche Studien belegt wird, ist ein "off-label-use" prinzipiell möglich. In jedem Fall muss man als Reisender jedoch beachten, dass aufgrund der Nichtzulassung für diese Indikation, eine Produkthaftung durch den Hersteller nicht gegeben ist.

3. Mefloquin (Lariam)
- Dosierung:
  - 250mg = 1 Tabl. pro Woche
- Positivpunkte:
  - Eine hohe Wirksamkeit (>90%, alle Plasmodien)
  - Hohe Sicherheit (Erfahrung bei >20 Mio Reisenden)
  - Einnahmemodus (ein mal pro Woche)
  - Kosten
  - Keine toxische Akkumulierung
  - Einsatz bei Erwachsenen und Kindern
  - Auch im 2. und 3. Trimenon
- Negativpunkte:
  - Neuropsychologische Nebenwirkungen: Einschränkende NW 2-25% / schwere NW 1:13.600
  - Vereinzelte Malariadurchbrüche und zunehmende P.falciparum Resistenzen
  - Interaktion mit Antikoagulantien (z.Bsp. Aspirin), Antidiabetika u.a.
  - Öffentliche Meinung

Kurz noch zum Thema „Stand-By-Prophylaxe"

mediScon empfiehlt grundsätzlich vor einer Reise in Malariagebiete, unbedingt eine individuelle reisemedizinische Beratung bei einem auf dem Gebiet gut informierten Arzt.

Nur wenn Sie in eine Region reisen sollten, in der Sie keinen Arzt innerhalb von 24 Stunden erreichen können, erachten wir das Mitführen und Selbstverabreichen eines Medikamentes gegen eine mögliche Malariaerkrankung, als sinnvoll. Ansonsten sollten Sie immer einen Arzt aufsuchen, welcher Ihnen ggf. dann auch das entsprechende Medikament verordnen und besorgen wird. Das ist effektiver, sicherer und sogar deutlich günstiger.

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