

Ubiquitous Consultation Tool for Decentralized Knowledge Workers

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Abstract

The special issue of this initial study is to examine the current work situation of consulting companies, and to elaborate a concept for supporting decentralized working consultants.

The concept addresses significant challenges of decentralized work processes by deploying the Peer-to-Peer methodology to decentralized expert and Knowledge Management, cooperation, and enterprise resource planning.

1. Introduction

With 70 percent of the GDP and a share of 69 percent of the overall-employment (corresponding to about 67 million employees), the services sector is by far the most important and financially lucrative branch of economy within the European Union [1]. However, due to its financial attractiveness, many service providers and consultancies in particular heavily target this market segment. Mobility, flexibility, knowledge intensive work and information logistics are the keywords of success on this market.

Thus, consultancies targeting the service sector are forced to optimise workflow, Knowledge Management and customer integration in order to increase their competitiveness [2]. Information Technology (IT) can help those organizations to significantly improve information acquisition, organization and retrieval by providing them with effective and intuitive software.

Today's consulting software solutions are largely based on conventional client-server systems. Most of these systems show weaknesses for varying reasons and are often deserted by the end-users [2, 10, 11]. They force clients to explicitly push documents to central servers. This is a time-intensive procedure and a weakness of those systems, since consultants commonly

nominate time restrictions as being the top reason, why valuable information is not codified and updated. As a result of this shortcoming the information, which appears to the users, does not reflect the most up-to-date information available, thus diminishing the usefulness of its results for any given search query. The poor quality of documents and search results are also a concern. Timeliness and quality are important parameters for expert databases, as they are for Knowledge Management systems although these profile databases are not updated because of the lack of time for acquisition and maintenance of expert profiles [2]. Further Bonifacio [12] argues that "technological architectures, when dealing with processes deeply characterized by human communication", such as consulting processes, "must be consistent with the social architecture of the process itself. Further he argues that centric architectures (i.e. centric Enterprise KM solutions) are in contradiction with the "social processes of knowledge creation", because Knowledge Management processes are "intrinsically distributed".

Peer-to-Peer architectures are autonomous, dynamic and decentralized. These features of a Peer-to-Peer system match the spirit and the main non-functional aspects of KM applications [12].

The presented concept hides the complexity of external communication and provides a user-centric unified access to knowledge, independent of time and location, without need for centrally organized portals as all data is kept on the consultant's individual computers only and organized by Peer-to-Peer networking.

The described concept provides seamlessly integrated environment for dispersed working users. These services provide

- the possibility to integration of information created and gathered by the mobile consultant into the organisation,
- access of information relevant to the work process and existing within the organisations, as well as effective communication means for expert consultation on base of expert profiles

- services to interact and use ERP systems even for the mobile user.

Based on earlier case studies the presented paper identifies the needs of consultants, the requirements of current work processes in consultancies with different service sectors (business, IT, industrial production, relationship marketing, government programmes), as well as suggesting a concept of an ubiquitous tool that supports the mentioned processes and meets the identified requirements.

2. Identifying challenges and consultants needs

Different consultancies have different needs and requirements. This paper first summarizes two case studies that describe the current situation of two different consultancies.

2.1 Current situation in business consulting service sector

A consultant's everyday work includes the creation of documents, presentations and calculations by means of varying software tools. The results of this work must usually be forwarded to and discussed with several persons.

Consulting companies spent a lot of time on evaluating new concepts and technologies. Therefore, consultants have to become acquainted with complex topics and automatically gain in knowledge (so they become "experts" on that topic). This knowledge can be used to advantage in other projects and by other consultants by means of expert search in order to shorten the time for orientation spent on new subjects.

The data files are stored somewhere on the consultant's individual workstation, usually deeply buried within the folder architecture of the computer's file system. The distribution of the data files is facilitated via electronic mail or by means of a central file server.

2.2 Current situation in industrial production consulting service sector

Through the focus on providing consulting services for the industry, a high percentage of the consultants are working on-site at the customer's location and hence are most out of their office. Their work schedule on-site varies from one to four days a week. This issue complicates the exchange of information between consultants among each other and between consultants

and the management. Common practice is that all consultants gather in meetings one time in a week to discuss the results of every project. This leads to the fact that the project results like presentations, workflows, strategies or even schedules are available only with a latency of one week. Another fact is that not everybody is interested in the results of all presented projects. Thus, a lot of time is ineffectively spent.

In addition to that it is a complex, difficult and time-consuming task to find a specialist, who has experience and knowledge that is required by another consultant. The usual way of finding these experts is to announce the need for a specific topic in the weekly meetings. Therefore the consultant in need sometimes has to wait a few days before he is able to proceed in his project. This is a problem, which produces a lot of costs due to the increased project duration, which in turn decreases the consultancies' competitiveness.

2.3 Required Services

Based on the case studies above the following services have been identified and considered to be of particular benefit to consultancies:

- expert profiling and management
- Knowledge Management based on document search and retrieval
- communication and distributed working
- time keeping, project staffing

2.4 Challenges and weaknesses of existing procedures and solutions

Within the section one, key problems of existing client-server based systems were described.

Some other problems, which consultants commonly confront when using traditional systems, are:

- the requirement for a lot of equipment
- the large amount of information makes difficult the provision of a comprehensive index
- largely incomplete or low quality knowledge databases

Besides those problems, the technological aspects of potential software-based solutions throw up many different questions, which have to be considered and answered during solution development. Some of the most important questions are listed below:

- how can documents of past and other projects be retrieved quickly?
- how can experts for specific problems be found reliably, and how to deal with resulting social aspects and problems, such as conflicts in areas of interest and competence?

- how can activities of dislocated consultants be tracked efficiently, e.g. in order to enable timely service billing?

3 A Proposed Solution

3.1 Technical Approach

The current work aims to conceptualise a Peer-to-Peer-based [5] software system that targets consulting companies, supporting them in aspects of cooperation and information exchange between locally organized consultants. Equally the tool will be useful to all knowledge intensive value chains. In short the system aims to facilitate distributed practice and Knowledge Management.

Employment of Peer-to-Peer-based technologies solves several problems. Those problems include:

- Knowledge Management
- date exchange in E-Work-environments spanning across companies
- expert search
- team constitution (“project staffing”)
- service billing (in terms of timekeeping)

The proposed Peer-to-Peer-based consulting software attempts to solve common problems of existing solutions and to meet the identified needs of the targeted users by provision of following features:

- encryption and privilege system based on flexible user groups
- automatic analysis and indexing of documents with support for a variety of the most important file formats
- knowledge retrieval system based on decentralized search of documents and communication protocols
- automatic maintenance of expert profiles
- seamless integration of existing enterprise systems, groupware, Instant Messaging and audio/video communication systems.

3.2 Architecture Overview

The functionalities of the proposed Peer-to-Peer-based consulting software are subsequently described and classified into the technology areas Knowledge Management, Enterprise Resource Planning, Communication, Peer-to-Peer Networking, Security, and Text Mining. The technological components are used by the application scopes communication and distributed e-work (decentralised), enterprise resource planning, and Knowledge Management.

3.2.1 Knowledge Management: “The Locus of the resulting Know-How, when the project is finished?”

Because documents are locally stored and maintained by peers, no additional effort for acquisition and maintenance by extra personnel is necessary. New documents and updated versions do not require an upload on a central server. Because documents are locally indexed on the peers, a very high topicality of the documents is guaranteed. Seamlessly integrated efficient inter-personal communication facilities are in particular an essential tool for sharing of not codified (tacit) knowledge.

The situating of document indexing on “central Peer Workstations” of the network overcomes “the bottleneck syndrome” shown by strictly centralized systems, when it comes to (re)indexing a vast array of documents.

Supplying statistics for each document allows users to perform queries that include restrictions for statistics that must be met by a document in order to appear in the search results (e.g. “show me all relevant documents, whose rating is ‘good’ or ‘better’ and that have been downloaded at least 5 times”).

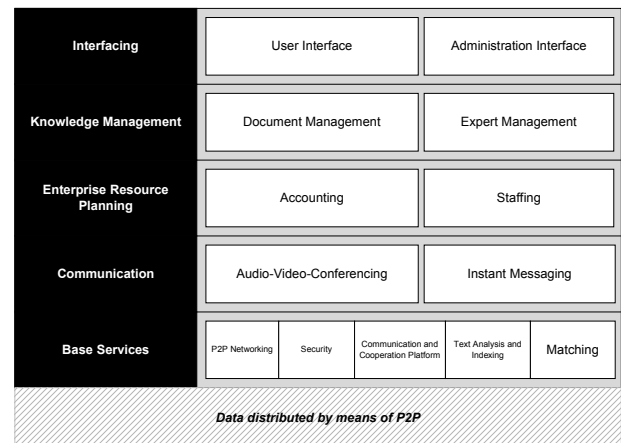


Figure 1 Overall system architecture of the proposed software

3.2.2 Expert search and resource management: “Who knows what, and how do I find that out?”

Based on the analysis of local documents of a consultant knowledge profiles can be created automatically and can be visually represented by means of Topic Maps. Additionally, users can create and publish handcrafted knowledge profiles. Basically any techniques used for Knowledge Management solutions can be used for the generation of expert profiles, too

Besides the identification of experts, it is important to know whether a given expert is currently available for consultation. This in turn requires some sort of activity tracking (e.g. by means of a shared calendar system),

continuously updated by the expert, and which is taken into account during the expert search. Another very common problem that consultancies face is the efficient management of available human resources. Thus, a powerful Enterprise Resource Planning (ERP) system is required that can be used by on-site resource managers as well as off-site consultants. In order to guarantee a seamless and smooth information flow, a role-based profiling scheme is required, which provides standardized formats for the codification of capability, competency and requirements profiles.

3.2.3 Accounting and Timekeeping: “No billing without activity recording”.

Consultancy companies monitor the activity of their consultants by means of timekeeping systems. In those systems, consultants assign their activities and project-based efforts to projects, classified by activity type. The proposed Peer-to-Peer-based consulting software allows localized and offline timekeeping.

3.2.4 Distributed e-work and communication.

P2P enables flexible, ad-hoc internet-based collaboration among groups [7]. “P2P collaborations, due to its high user-centric nature, also lend itself to the formation of different types of communities. By doing so, collaboration in a P2P environment further reinforces the power of the Personalisation approach to KM” [6].

Several backend systems are pre-existing at most consultancies. Thus, the system has to provide programming interfaces (based on open standards) that allow for the seamless integration of those backend systems. Backend systems to consider include popular tools, such as Lotus Notes, Groove, LDAP, Microsoft Outlook, Database Systems, tools for Customer Relationship Management among others.

4 Discussion

4.1 Related Work

According to [6], a comparatively recent study on P2P Knowledge Management, important technologies for knowledge sharing are Distributed Search, File Sharing and Distributed Content Networks (DCN), Collaboration, and Intelligent Mobile Agents. Currently, within these areas there exists several commercial as well as research products.

In [6] Eric Tsui compares secure P2P File Sharing tools, among others Roku, WebV2, Microsoft’s Farsite, and UC Berkeley’s OceanStore.

In [6] as tools for Distributed Search, Gnutella, BearShare, LimeWire, OpenCola Swarmcast, Aimster, and Centrata are compared. In the area of Expertise Discovery Systems StarBase and P2PQ are considered.

Eric Tsui considers in [6] as tools for P2P Collaboration among others Omniprise, Yenta, 1stWork, and hotComm in his study. A number of other studies [8, 9] report evaluation of collaboration tools - among others Oculus, Biz2Peer, BadBlue, NextPage, ICQ, FlyPaper, Groove, eRoom, SiteScape, InfoWorkspace and TeamWave.

Due to the special requirements of consultancies the focus of the presented concept is put on an integrated system supporting distributed Knowledge Management and distributed cooperation. There are several projects targeting cooperation or Knowledge Management within enterprises in general (e.g. HyperKnowledge [4]), but none we are aware of that specifically targets all requirements of consultancies as identified in last sections. PROMOTE [3] for instance focuses on a centralized, portal-based Knowledge Management approach aiming for financial organizations, and it neglects tacit knowledge, which usually does not become part of knowledge databases and thus usually is beyond scope and facilities of conventional Knowledge Management systems. In contrast, the presented solution specifically aims for decentralized workflows as observed in consultancies in particular. Further, it explicitly takes tacit knowledge into account by providing effective communication means (i.e. high-quality audio and video) for expert consultation on base of expert profiles.

In the context of the described work, the challenges and requirements of the above areas are combined and solved by overcoming the weaknesses of conventional client-server systems by means of Peer-to-Peer.

4.2 Future Work and Activities

The future work includes a usability study and an investigation of how the user motivation to use the system can be maximized.

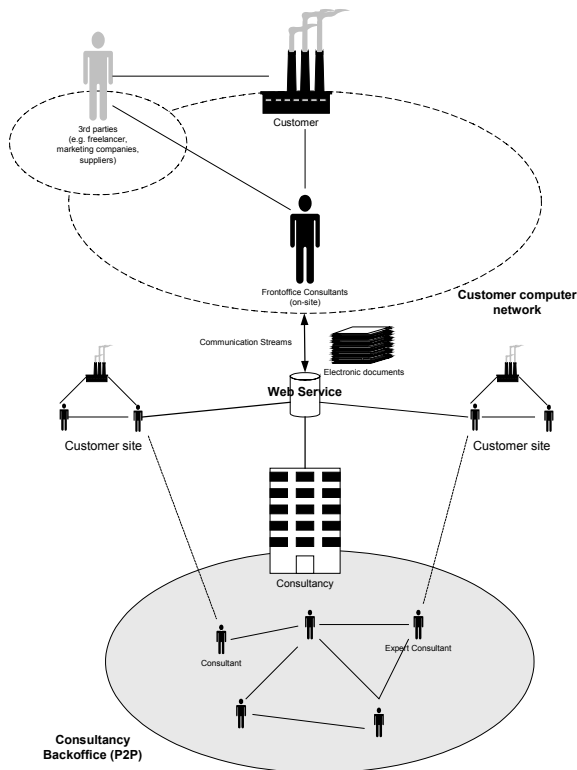


Figure 2 Sample use case scenario

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