MOTION: A Peer-to-Peer Platform for Mobile Teamwork Support

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Abstract

Large, global enterprises are increasingly faced with the problem of supporting employees that are on the move. Employees need to share business documents, locate expertise and knowledge through distributed searches, access effective subscription/notification mechanisms, and they need any time, anywhere access to the company's information resources. We address these problems and requirements in the MObile Teamwork Infrastructure for Organizations Networking (MOTION)[1] project and aim to create an advanced Information and Communication Technology (ICT) infrastructure for mobile teamwork. This short paper gives a brief description of the MOTION peer-to-peer platform for mobile teamwork.

Keywords*: MOTION, Mobile Teamworking, Distributed Mobile Collaboration*

1. Introduction

Due to their multi-site, multi-process and complex organizational structure, world-wide distributed enterprises experience increasing needs for advanced Information and Communication Technology (ICT) facilities for improving teamwork and distributed working activities in their engineering, manufacturing and production processes. Enhanced global information architectures, advanced capabilities for ubiquitous communication, sharing and locating information and any time, anywhere access to company information resources are needed.

General teamwork services are required that:

- Improve the interpersonal communication and cooperation between the employees and encouraging them to share their knowledge and expertise to solve problems and increase productivity.
- Provide efficient information and business artifact (i.e., document) sharing and locating across a widely distributed enterprise environment. Employees typically have business artifacts on their personal computers that may be of high interest to other employees, but they cannot be shared because they are not in an accessible repository.
- Support virtual communities that enable the employees to collaborate regardless of where they are and what computing device they are using.
- Provide advanced information subscription and notification mechanisms that allow the employees to subscribe to business-specific events and get notified on the availability of important information (e.g., Dr. X gets notified that Dr. Y has finished editing the draft of a research paper they are working on).
- Support ubiquitous and transparent access to the company's information and service network from fixed and mobile nodes (i.e., device-independent access from desktop computers, notebooks, Personal Digital Assistants (PDAs), WAP-enabled mobile phones or HTML Web browsers).
- Provide security and access control mechanisms that restrict and control the sharing of information (i.e., user names, passwords, encryption and certificates are needed).

We address the problems and requirements listed above in the MObile Teamwork Infrastructure for Organizations Networking (MOTION) project. Based on two global enterprises that served as case studies, we identified and built a core set of generic services and a peer to peer architecture that support mobile teamwork.

This short paper gives a brief description of the MOTION platform for mobile teamwork. The paper is structured as follows: The next section gives an overview of the case study global enterprises in the MOTION project. Section 3 discusses the MOTION architecture, and Section 4 concludes the paper.

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2. MOTION Case studies

Both case studies involve large, multi-national enterprises that are distributed across multiple sites in several countries and continents.

The first case study is a large producer of white goods. The company would like to improve the manufacturing activities for technologies such as refrigerators and freezers. It consists of production sites distributed globally around the world. These sites work independently of each other and produce different kinds of components. Many production experts travel across the sites to control and improve development processes. The company is mainly aiming to increase knowledge sharing among employees by allowing them to search for artifacts in well-defined problem domains and to increase productivity by giving them ubiquitous access to the information while they are on the move.

The second industry case study is a multi-national company in the market of global telecommunication systems and equipment. The company would like to reengineer and restructure the ways in which geographically distributed development centers of the company divide their work, communicate and collaborate. The company faces a typical problem: Many employees have a broad knowledge in a specific area, but this knowledge cannot be utilized because of the lack of communication in the company. It would like to enable its employees to ubiquitously search and contact experts to answer technical questions (e.g., in design reviews).

3. The MOTION service architecture

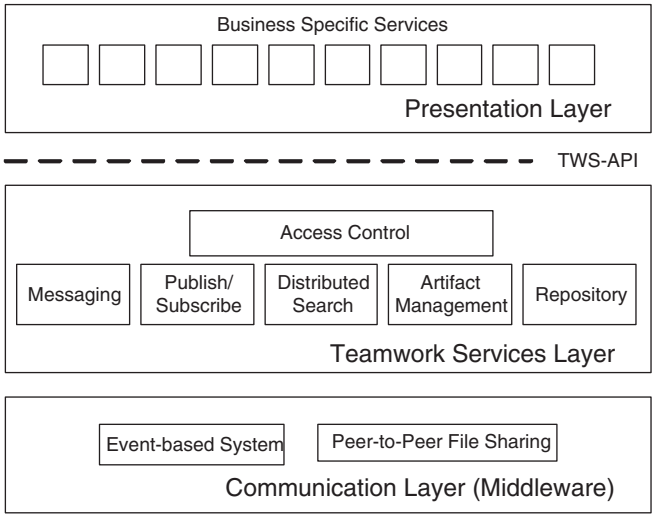

Figure 1. The layered MOTION architecture

The MOTION system is composed of three main layers: The communication layer, the teamwork services layer and the presentation layer. Figure 1 depicts the MOTION architecture.

The bottom layer is the communication middleware that provides an event-based infrastructure for publish/subscribe and peer-to-peer distributed file sharing support. It provides low-level distributed search propagation and invocation services to the upper layers and an Application Programming Interface (API) that allows the upper layers to subscribe to and get notified of events generated by system components. We chose to use PeerWare [4] in the prototype implementation because we had access to its source code and could make enhancements as necessary. Moreover, PeerWare has support for both distributed searches and publish/subscribe, and thus covers all the functionality necessary in the layer. The communication layer, however, could be replaced by other suitable systems that provide distributed search and publish/subscribe (e.g., distributed searches with JTella[3] and publish/subscribe with JEDI[1]).

The middle layer in the architecture, the Teamwork Services (TWS) Layer, integrates the basic system components and provides an API (TWS-API) to the MOTION generic teamwork services. This is a Java API in our prototype and offers services such as (1) storing artifacts and their metadata (*profile*) in a local repository on the user's computer (2) managing *resources* (artifacts, users, and communities), (3) sharing artifacts with other users in communities, (4) subscription to specific events in the MOTION system, (5) sending and receiving messages from other users or from the system, (6) managing access rights on resources, (7) and distributed searching for resources based on their profile information.

The TWS-API is used by the MOTION application programmers to construct Business Specific Services (BSSs). These services customize and extend the generic services provided by the platform according to the requirements of businesses and organizations. A company producing mobile phones, for example, may use the TWS-API to build BSSs that provide concurrent design and coordination support.

The presentation layer, the top layer of the architecture, provides a user interface to the generic services provided by the MOTION platform and the BSSs constructed by organizations on top of it. A typical configuration consists of user interfaces for the desktops, notebooks and custom-tailored smaller interfaces for PDAs, WAP phones and Web browsers. The prototype implementation consists of a native Java Swing user interface, a Java application running on the Nokia Communicator and HTML interfaces for PDAs and traditional Web browsers.

The distinguishing feature of the MOTION platform is its configurability. The MOTION system is composed of *peers*. Each user connected to the system is a peer and based on the characteristics of the computing devices the users

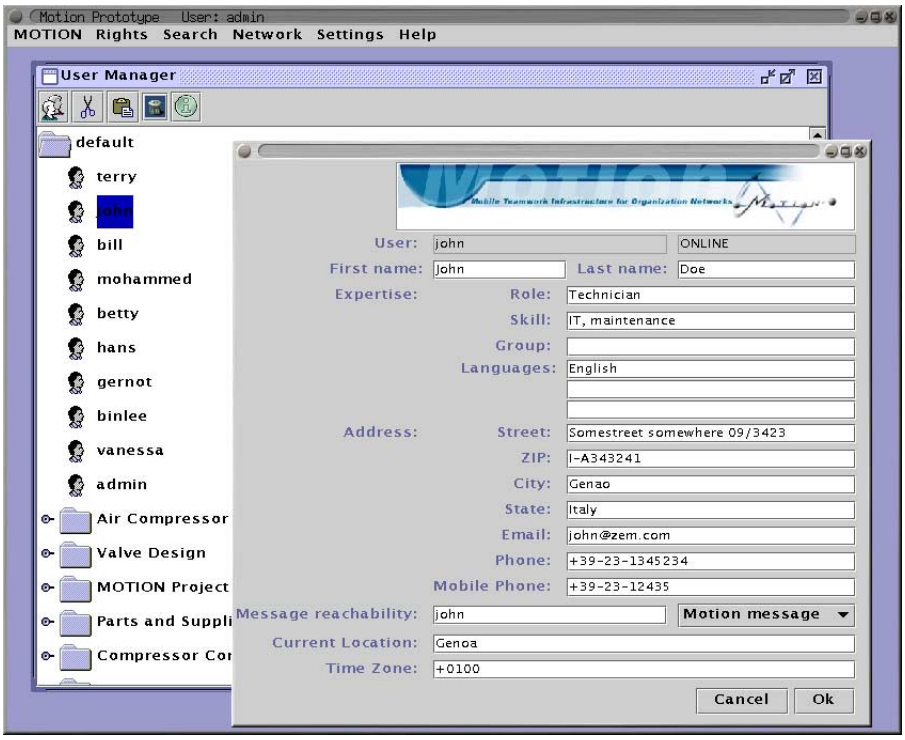

Figure 2. A screenshot of the MOTION native user interface displaying a user profile, users and communities

are using, some host services and some only act as clients. The same MOTION libraries are used to build applications that offer *and* consume services. Thin clients such as Web browsers and WAP-enabled mobile phones do not host services, but can only be used to remotely access them.

The reader is referred to [2] for a more detailed discussion of the architecture and its main components and a comparison to related systems.

4. Conclusion

Global enterprises are increasingly faced with the problem of supporting employees that are on the move. The MOTION system provides mobile teamwork support through advanced subscription/notification mechanisms, information sharing, and locating of expertise and knowledge through distributed searches.

The MOTION native user interface prototype has been tested under the Windows 2000 and Linux Red Hat 7.2 operating systems on notebooks and desktops. An experimental user interface has been built for the Compaq iPAQ PDA and has been tested under the Familiar Linux operating system.

The prototypes are currently under evaluation in two industry case studies and business specific user interfaces are under construction. One of the case study companies aims to use the MOTION system to provide collaborative support for their distributed software engineering activities.

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