A Context-aware Instant Messenger Based On A Novel Context-aware Communication Paradigm

Lars Geiger Frank Dürr Kurt Rothermel
Universität Stuttgart, Institute for Parallel and Distributed Systems
Universitätsstraße 38, 70569 Stuttgart

Introduction

Portable navigation devices supplying the user with additional information like the closest sights or restaurants, have become increasingly popular over the last few years. They are one example of mobile, context-based applications. The collaborative research center 627 “Nexus” at the University of Stuttgart is working on global, dynamic context models, which form the basis of a variety of context-based applications.

Context-aware Communication

One aspect of this research focuses on context-based communication mechanisms (contextcast). Contextcast is used to address and transmit messages to objects with certain properties (or attributes) within a specific geographic area. Such a system could, for example, be used to send traffic reports: on the one hand, vehicles are identified by their attribute type=vehicle, as traffic information is less important for pedestrians. On the other hand, the messages can be restricted to the affected area as well: a traffic jam is probably not as interesting for a vehicle 200km away as it is for one within 3km. Since there can be any number of recipients matching the addressing of a given message, contextcast forms a multicast or 1:m communication. Thus, the challenges are very similar to those occurring in other multicast techniques: the messages must be transmitted to all intended recipients, usually optimal with regard to a given metric (e.g. individual packet latency or number of message copies).

Contextcast is conceptually similar to two existing technologies: on the one hand, addressing messages to an area is used in so called geocast, where a message is routed by geographically-aware routers to all clients within a destination location [6]. However, none of the current geocast systems allow the use of attributes other than location to address participants. In content-based publish-subscribe systems, on the other hand, the clients (or subscribers) can specify their interest in notifications, which consist of attribute/value pairs, by using arbitrary constraints on the attributes [4, 7, 3, 1]. In recent years, many of these systems have received extensions to make them suitable for mobile users. The focus of these extensions, however, has been the support for disconnected clients and message forwarding if a subscriber physically moves to another broker [2]. To the best of our knowledge, only one system proposes to use the client location to select and route notifications, however no routing algorithms were detailed by the authors [5]. Also, the semantics of content-based publish-subscribe and contextcast are different: While in publish-subscribe systems the subscribers specify their interest in notifications with a number of attribute filters, which all have to match a given notification, in contextcast the attribute filters are actually part of the messages. Thus, the senders specify a number of constraints on attributes and locations, which a client has to match for the message to be transmitted to them. With contextcast bearing a strong similarity to distributed, content-based publish-subscribe, we currently focus our work on techniques based on research in this area.

Since it is economically impossible to establish a completely new routing infrastructure, we try to leverage the existing IP infrastructure of the Internet by using an overlay network atop the IP network. Figure 1 shows the current system model: it consists of ContextRouters, similar to brokers in a pub-

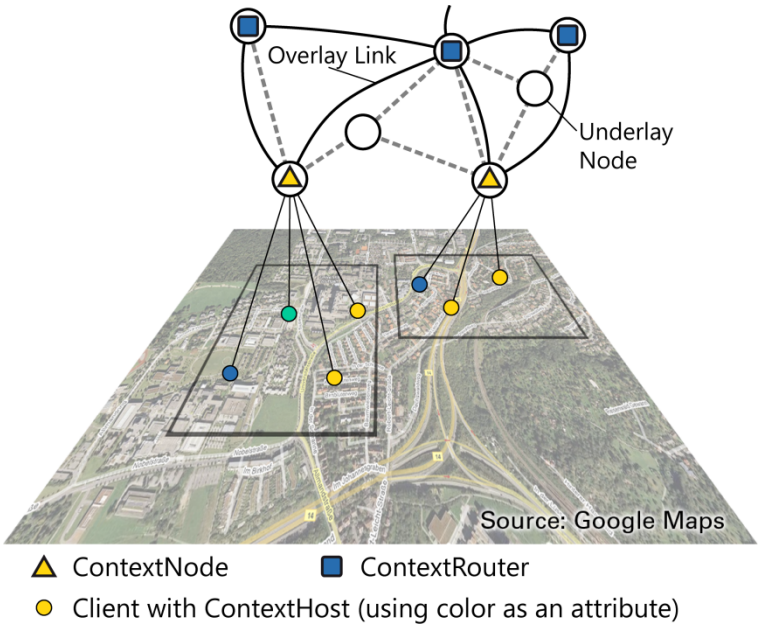

FIGURE 1

sub system. The clients connect to the system via certain access nodes, the ContextNodes. These access nodes have a service area assigned to them and a client can connect to any access node whose service area covers its current position. When the clients connect to an access node, they inform the system about their current context, i.e. a set of attributes. The location of the client can be approximated by the access node's service area and does not need to be part of the context. This has the advantage that movement within the service area alone does not cause a context update (only when a user leaves one service are and enters another, the client hast to register itself with the system again, thus updating the position and therefore the routing information in the system). The access nodes then forward each client's context to the routers that enter the contexts and the corresponding interface into their routing table. An incoming message can then be forwarded along the interfaces with matching contexts to the access nodes, which finally transmit them to the clients. With this algorithm, a message is transmitted to all access nodes via a tree of shortest paths. Optimizing the contextcast network for the highly dynamic nature of context information is part of ongoing work.

Conny: A Context-aware Instant Messenger

Instant Messaging allows the direct communication between users all over the world, using short, usually text-based messages ("chat"). Services like ICQ, Google Talk or Skype have become increasingly popular and are more and more coming to mobile devices

In our demonstration, we present Conny, a next generation instant messenger. Conny utilises the user context to disseminate messages intelligently. While the user previously had to select communication partners from a personal contact list, Conny users can contact other people who are in a specified context. Users can also subscribe to messages on certain topics or on their current location. This enables users to filter out interesting information from a vast amount of messages based on their context.

Literature:

[1] G. Banavar, T. Chandra, B. Mukherjee, J. Nagarajarao, R. E. Strom, and D. C. Sturman. An Efficient Multicast Protocol for Content-Based Publish-Subscribe Systems. In Proceedings of the 19th IEEE International Conference on Distributed Computing Systems (ICDCS'99), pages 262–272, 1999.

[2] M. Caporuscio, P. Inverardi, and P. Pelliccione. Formal Analysis of Clients Mobility in the Siena Publish/Subscribe Middleware, mar 2002.

[3] A. Carzaniga, D. S. Rosenblum, and A. L.Wolf. Interfaces and Algorithms for a Wide-Area Event Notification Service, jul 2000.

[4] G. Cugola, E. D. Nitto, and A. Fuggetta. The JEDI Event-Based Infrastructure and Its Application to the Development of the OPSS WFMS. IEEE Trans. Softw. Eng., 27(9):827–850, 2001.

[5] G. Cugola, J.E.M. deCote. On Introducing Location Awareness in Publish-Subscribe Middleware. In Proceedings of the Fourth International Workshop on Distributed Event-Based Systems (DEBS) (ICDCSW'05), 2005

[6] T. Imielinski and J. C. Navas. GPS-based geographic addressing, routing, and resource discovery. Commun. ACM, 42(4):86–92, 1999.

[7] G. Mühl. Large-Scale Content-Based Publish/Subscribe Systems. PhD thesis, TU Darmstadt, 2002.