Demo: Ontology-based Context-aware Delivery of Extended Points of Interest *

Alessandra Agostini Claudio Bettini Daniele Riboni

University of Milan, DICo
via Comelico, 39
I-20135 Milan, Italy
{agostini,bettini,riboni}@dico.unimi.it

1. INTRODUCTION

Context-awareness in mobile and ubiquitous computing requires the acquisition, representation and processing of context information which is not limited to the device features, network status, or user location but includes semantically rich data like user preferences and user current activity.

At the University of Milan, we have designed and implemented a middleware architecture for adapting mobile services accordingly to distributed context information involving all the aspects cited above. The middleware also allows users and service providers to define adaptation policies, in the form of logical rules. The framework adopts a hybrid form of ontological and rule-based reasoning and provides mechanisms to reconcile possibly conflicting context information and policies. The goal of this demonstration is to show the viability of our solution and to show its effectiveness when considering the adaptation of a real mobile service.

2. A FRAMEWORK FOR CONTEXT AGGREGATION AND REASONING

Figure 1 shows an overview of the framework, which is an extension of the one we presented in [1] to take into account ontologies and ontological reasoning. Our solution is based on the integrated representation of contextual data by means of profiles containing both CC/PP attributes [4] and references to ontological classes and relations. Contextual data are locally managed by modules devoted to their management (user, network operator, and service provider profile managers, called UPM, OPM, and SPPM respectively).

Profiles and policies are collected and integrated by the Context Provider module, which is in charge of solving possible conflicts, applying policies, and delivering to the application logic the parameter values relevant for adaptation. Rule-based reasoning on top of ontologies is obtained by an extension of our policy language [2], allowing predicates corresponding to ontological classes and relations to appear in rules.

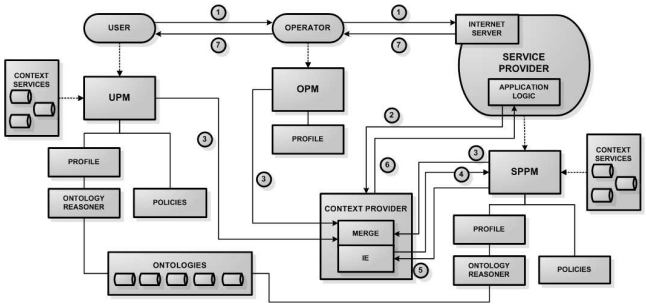

Figure 1: Architecture overview.

3. THE POISMART SERVICE

POIsmart is an adaptive location-based service which takes advantage of our middleware and that can be used to demonstrate its effectiveness and to highlight its benefits.

The notion of *POIsmart* is an extension of *Points of Interest* as used in GPS navigation software. A POIsmart stores information about a virtual and/or physical location which is of interest to a user, as well as multimedia content associated with the resource (e.g., a vocal comment to the quality of a restaurant).

The POIsmart service provides a peer-to-peer infrastructure –originally proposed in [3]– to store, share, and retrieve POIsmarts. Figure 2 shows its main components.

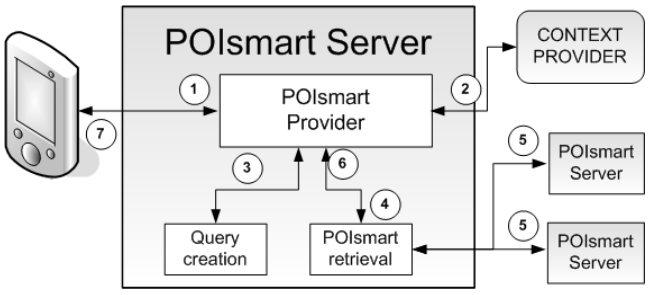

Figure 2: POIsmart architecture.

*This work has been partially supported by Italian MIUR (FIRB "Web-Minds" project N. RBNE01WEJT_005).

MDM 2005 05 Ayia Napa Cyprus
(c) 2005 ACM 1-59593-041-8/05/05....$5.00
Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, to republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.

Client systems are currently available for smartphones, PDAs, and desktop computers. When a user submits a query (Step 1), the POIsmart server retrieves context information from the Context Provider (Step 2) and builds a refined multi-feature query by considering data such as user's current location, device capabilities, known interests, and possibly current activity (Step 3). This query is executed locally (Step 4) and also forwarded to other peers (Step 5). Collected POIsmarts are ordered considering context information before final delivery to the user (Steps 6 and 7).

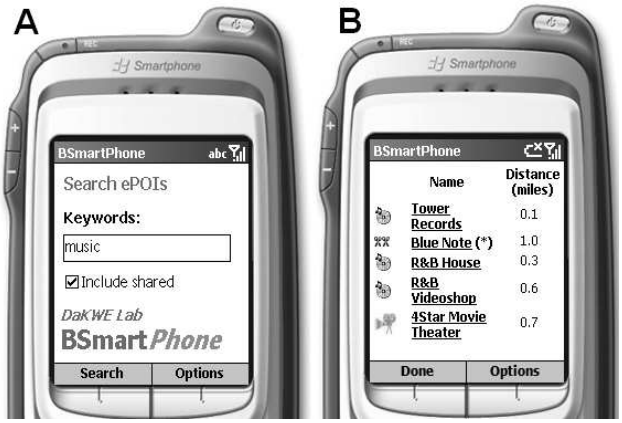

Figure 3: POIsmart client for Smartphones.

4. USE CASE

Assume a hypothetical user, John, is visiting a fictitious town with a PDA in his suitcase and a smartphone in his pocket, both equipped with our POIsmart client application. The town map is divided in zones that are used to simulate John's movements.

While strolling downtown, John remembers a friend of him mentioning a pub with live music in the area. He activates the POIsmart service on his smartphone, and submits a generic query on music (see Figure 3-A). His favorite music genre was previously inferred by John's Profile Manager (UPM) performing offline ontological reasoning. In particular, the ontological reasoner inferred from his preferred artists that his favorite music genre is R&B. The received POIsmarts (see Figure 3-B) include, for example, a music store very close to him together with the directions to get there and the URL with the current sales on R&B CDs.

POIsmarts are ordered according to several criteria, among which proximity to the user, priority on interests and the presence of annotations. For example, the second POIsmart returned in the above scenario is not that close to John, but it contains a vocal annotation left by Jim (a friend of him). Indeed, this was the resource sought by John. The POIsmart allows him to check the web site by clicking on the URL associated with the resource, and to obtain directions to get there by clicking on the associated address. When John selects the "Blue Note" web link on his smartphone, the available bandwidth is low since he is using a GPRS connection, and only text and small images are shown.

Later on, when John is back to his room, he performs the same query using his PDA with a WiFi connection. This time, the POIsmarts he receives regard jazz music as well as rock music, since no R&B-related POIsmarts were found close to him and ontological reasoning was used to get related music genres. Since now he is using a full-featured device and a high quality connection, when he follows the link to one of the new resources, he gets the complete multimedia content, including samples of videos by the performing artists.

5. REFERENCES

[1] A. Agostini, C. Bettini, N. Cesa-Bianchi, D. Maggiorini, D. Riboni, M. Ruberl, C. Sala, and D. Vitali. Towards Highly Adaptive Services for Mobile Computing. In *Proceedings of IFIP TC8 Working Conference on Mobile Information Systems (MOBIS)*, pages 121–134. Springer, 2004.

[2] C. Bettini and D. Riboni. Profile Aggregation and Policy Evaluation for Adaptive Internet Services. In *Proceedings of the 1st Annual International Conference on Mobile and Ubiquitous Systems (MobiQuitous 2004)*, pages 290–298, IEEE, 2004.

[3] C. Bettini, N. Cesa-Bianchi. An Architecture for Advanced Bookmark Management. In *Proceedings of WSDAAL (Workshop on Distributed Systems, Algorithms, Architectures, and Languages)*, Como, Italy, 2001. `http://homes.dico.unimi.it/~bettini/papers/wsdaal.pdf`.

[4] G. Klyne, et al. Composite Capability/Preference Profiles (CC/PP): Structure and Vocabularies 1.0. W3C Recommendation, 2004. http://www.w3.org/TR/2004/REC-CCPP-struct-vocab-20040115/.