TAGLINK: AN EVOLUTIONARY APPROACH TOWARDS ADVANCED MOBILE TAGGING APPLICATIONS

Jan Buck, Frederic Majer, Matthias Schmitt, Patrick Freudenstein and Martin Nussbaumer
Institute of Telematics, University of Karlsruhe (TH), Engesserstr. 4, 76128 Karlsruhe, Germany

Keywords: Mobile tagging, object hyperlinking, automatic identification and data capture.

Abstract: Within the last years camera phones have been established as an everyday appliance. Along with the advent of these appliances so called "mobile tagging applications", arose. Physical objects are tagged with a visual code containing the URI of a resource. Camera phones are used to capture these visual codes and to access content related to physical objects. In most current mobile tagging applications the evolution of content associated with physical objects is not considered. Thus a later change and adding of resources is not supported. Taking these problems into account we present a novel framework for the development and evolution of advanced mobile tagging applications, called TagLink.

1 INTRODUCTION

By the end of 2007 more than one billion camera phones will be in use. While in 2006 40% of US mobile phone users had a camera phone, in 2007 already 60% possessed a mobile phone with this functionality (Meyers 2007). Along with the establishment of camera phones as an everyday appliance, a new trend, „mobile tagging" arose. A tag containing a barcode that encodes the URI of a resource is put up at physical objects. Camera phones are used to capture these barcodes and subsequently software running on the phone decodes them. Mobile web user agents can be used to display content linked from barcodes.

Although endeavours to link real world objects and the information space have already been made before the current mobile tagging trend, all these approaches couldn't involve the public in a similar way due to the limited distribution of appropriate appliances. Nevertheless many of the developed systems, known as Automatic Identification and Data Capture (AIDC) systems (Smith 2002), realise advanced functionalities not considered in current mobile tagging solutions. An important drawback of current applications is the linking from a physical object to a resource by hard encoding the URI of the resource in a tag. The change of a resource demands republishing all tags linking to that resource. This is even aggravating in 1-n or n-n relations between resources and tags. Furthermore only the assignment of a single resource per barcode is allowed.

Taking these problems into account, we introduce a framework for the development and evolution of advanced mobile tagging systems. Section 2 outlines a scenario revealing the unexploited opportunities of current approaches. In section 3 the TagLink approach is presented. In section 4, we give a brief overview of related approaches and conclude with a summary and an outline of planned future work in section 5.

2 THE PROBLEM DOMAIN

In the following, a scenario for the employment of mobile tagging systems is described and requirements of a platform supporting this scenario are derived.

In a generic scenario tools can be used to produce tags that contain links to resources. These tags are attached to physical objects. Individuals can use camera phones to capture barcodes and navigate to the resources encoded in them using a web browser. This approach is appropriate in scenarios where objects shall be tagged only short-term and resources are not underlying change. In scenarios where information associated with physical objects evolves and users collaborate in the evolution of the information space this approach falls short.

Buck J., Majer F., Schmitt M., Freudenstein P. and Nussbaumer M. (2008).
TAGLINK: AN EVOLUTIONARY APPROACH TOWARDS ADVANCED MOBILE TAGGING APPLICATIONS.
In *Proceedings of the Fourth International Conference on Web Information Systems and Technologies*, pages 321-324
DOI: 10.5220/0001528803210324

The problems revealed by this simple scenario can be avoided by introducing a *mediator* that links tags to resources. That way the assignment of resources to barcodes can change and additional resources can be assigned. Such additional assignments comprise advanced interactions on resources like adding reviews or comments by end-users. Thus the quality of the provided information can be enhanced. Given this architecture dedicated scenarios become possible.

2.1 The Library Scenario

A library could offer a service that provides additional information on books by acting as a *mediator* between ISBN-13 (International ISBN Agency. 2005) barcodes attached to book covers and electronic resources. These barcodes encode the International Standard Book Number (ISBN) of a book. Client applications decode this information and request additional resources on books from a so called resolver service.

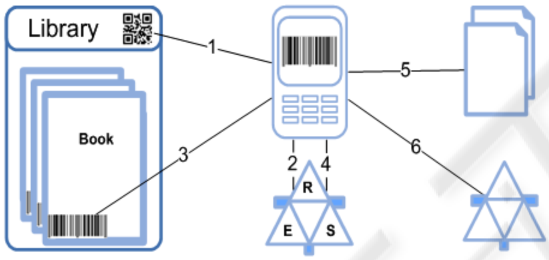

Figure 1: Library scenario.

In the following we will describe a possible sequence. As depicted in Figure 1 a library visitor uses his camera phone to capture a barcode attached to a shelf in the library that contains the URI of the library's resolver service (1). The visitor uses a mobile application to request the resolver service (2) and retrieves information concerning the library. Subsequently the visitor can capture ISBN-13 barcodes printed on book covers (3) and request the library resolver service for resources associated with the ISBN encoded in the barcode (4). Using web browsers or special mobile applications these resources can be accessed (5).

The types of resources provided by the library can vary from information about the author, the book, the availability of the book, other books of the same author or related books and their location in the library. Moreover users can enlarge the provided information by providing additional resources. They can write reviews for books or comment content and thus enhances the quality of information. Furthermore one could imagine that visitors are able to perform "actions" on books (6). For example it would be possible that a library visitor just walks through the library and scans the barcodes of books he wants to lend and at the end of his visit picks up all selected books at the lending. Another imaginable service provided by the library would be the sale of books in cooperation with publishing companies.

2.2 Requirements

In the following we will present basic requirements of a framework supporting the development and evolution of advanced mobile tagging applications.

Description: A central requirement is the ability to describe real world objects in a simple and extensible manner. Additionally bidirectional relations between these objects and virtual resources have to be allowed.

User Involvement: By involving users in the creation of virtual counterparts to physical objects and the distribution of barcodes linking to them, a rapid growing of interconnections between the real world and the information space can be achieved. Moreover users can review and comment the helpfulness and correctness of the provided data.

Mobility: Special conditions of mobile applications have to be considered. If no connection to electronic resources can be established or the mobile appliance is unsuitable for the processing of a resource, the system must support collecting and later processing of resources.

Standard Orientation: Applications should base on existing web standards. That way interoperability with existing web applications is ensured and isolation from technical trends is prevented.

3 THE TAGLINK FRAMEWORK

In the following section we present the TagLink framework, a framework supporting the development and evolution of mobile tagging solutions.

3.1 Overview

In contrast to most current mobile tagging approaches we propose an indirection between physical barcodes and electronic resources. As depicted in Figure 2 a barcode can be associated with multiple topics, which can be considered as containers for content. Likewise topics can be associated with multiple barcodes.

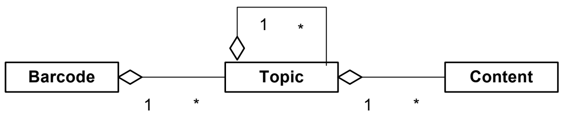

Figure 2: Indirection between Barcode and Content.

By allowing multiple associations of topics to barcodes, topics serve as items of reuse that can evolve independently over time. To support this approach the TagLink-framework provides a resolver service that acts as a *mediator* between barcodes and resources.

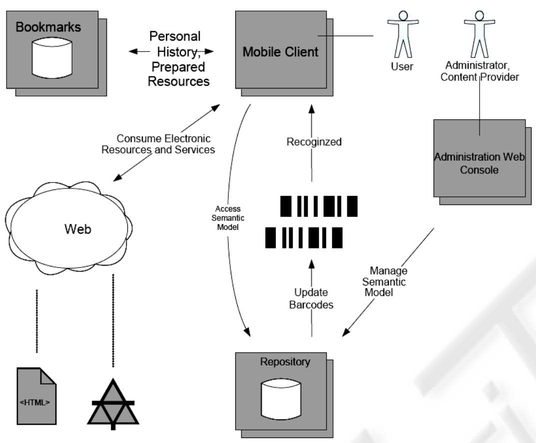

Figure 3: Overall architecture of an application developed with the TagLink framework.

The overall architecture of an application build on the TagLink-framework is depicted in Figure 3. The identifier of a barcode combined with the URI of the according resolver service is encoded in a barcode. Users capture barcodes using camera phones. Mobile applications decode the included information, communicate with the resolver service and retrieve resources related to barcodes. Common resources are electronic documents and Web Services. But resources especially tailored to the needs of a dedicated application are possible also.

To achieve a maximum of flexibility and extensibility concerning different types of resources used in mobile applications, resources are defined in RDF notation (Klyne G. and Carroll J. J. 2004) and are managed in a triple store. Thereby multiple applications can operate on a single triple store whereby synergy effects concerning the tagging of real world objects can be utilized. In Figure 4 an exemplarily RDF graph for the library scenario is depicted.

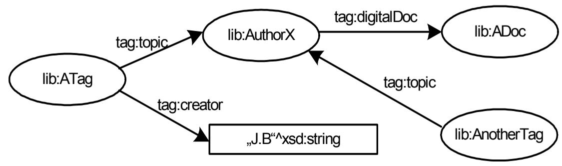

Figure 4: Example of a RDF graph.

The semantic model of an application can be accessed using mobile clients as well as an Administration Web Application by communicating with the resolver service. In the following the technical framework will be presented in detail.

3.2 Resolver Service

The resolver service is the core component of the TagLink architecture. It is a Web Service providing access to resources associated with barcodes. Existing triple stores can be used to store and manage RDF resources. The built-in reasoning support of triple stores can be applied to filter relevant resources on the server-side and thus to minimize client-side computation. Moreover the resolver service offers interfaces for the management of resources and provides functionality to create barcodes that can be printed and attached to physical objects.

3.3 SmartTag Mobile Application

On the client side the TagLink framework consists of an extensible client application, called SmartTag that allows users to perform operations on the application model managed by the resolver service. A plug-in mechanism allows the extension of the SmartTag application with forms, tailored to special resource. When starting the program all registered plug-ins are loaded and the user is presented an overview of all possible operations. To meet the special conditions of mobile applications the SmartTag application comprises a bookmark store. Thus resources can be copied to the bookmark store and processed later.

3.4 Administration Web Application

Beside the SmartTag mobile application the TagLink framework comprises an Administration Web Application that can be used by administrators and content providers to manage resources. Furthermore the Administration Web Application can be used to process resources stored in the bookmark store of the SmartTag application.

4 RELATED WORK

In the following existing approaches using AIDC methods to connect physical objects with the information space will be described briefly.

WebStickers is introduced in (Ljungstrand 2000) and deals with the idea to use tagged physical objects as bookmarks for websites. Thereby the physical surrounding is regarded as an extended workspace. Although many of the presented requirements were met, the approach lacks regarding extensibility as it focuses only bookmarks. Furthermore expensive barcode scanners are required, what increases the price of the system.

A very comprehensive approach is the CoolTown (Kindberg 2000) project. Due to the age of the project modern appliances like camera phones have not been considered. The goal of the project was to provide an infrastructure for nomadic computing. The project builds on web technologies and parts of the approach were considered in the TagLink approach. However the evolution and reuse of content is not considered.

Another examined approach is the ETHOC (short for "EveryThing Has Online Content") project, described in (Rohs 2003; Rohs 2004). The project covers the creation, administration and mediation of virtual counterparts of real world objects. Physical objects are tagged with barcodes encoding an identifier. The creation and modification of content is restricted to a web interface only and allows no support by the client application itself. Thus focussing stronger involvement of end-users is hindered.

5 CONCLUSIONS

In this paper we presented a novel approach for the development and evolution of advanced mobile tagging applications. Derived from an exemplary scenario, requirements of such a framework were presented. Taking these requirements into account the TagLink framework supporting the development and evolution of mobile tagging applications was introduced. In the future we will focus our research on the development of an ontology for mobile tagging applications. Moreover we will evaluate the framework using alternative identification technologies like Radio Frequency Identification (RFID) (Molnar 2004).

REFERENCES

International ISBN Agency., 2005. *The International Standard Book Number System: ISBN Users's Manual*.

Kindberg, T., et al., 2000. *Towards a real-world wide web*. 9th workshop on ACM SIGOPS European workshop: beyond the PC: new challenges for the operating system Kolding, Denmark ACM.

Klyne G. and Carroll J. J., 2004.). "*Resource Description Framework (RDF): Concepts and Abstract Syntax*." Retrieved 05.11.2004, from http://www.w3.org/TR/2004/REC-rdf-concepts-20040210/.

Ljungstrand, P., et al., 2000. *WebStickers: Using Physical Tokens to Access, Manage and Share Bookmarks to the Web*. DARE 2000 on Designing augmented reality environments. Elsinore, Denmark ACM.

Meyers, J., 2007. *Camera Phones and Social Networking-A New Global Focus*, In-Stat.

Molnar, D., Wagner, D., 2004. *Privacy and security in library RFID: issues, practices, and architectures*. 11th ACM conference on Computer and communications security Washington DC, USA, ACM.

Rohs, M., et al, 2004. "Using Camera-Equipped Mobile Phones for Interacting with Real-World Objects."

Rohs, M., Jürgen Bohn, 2003. *Entry Points into a Smart Campus Environment " Overview of the ETHOC System*. 23rd International Conference on Distributed Computing Systems, IEEE Computer Society.

Smith, A. D., Offodile, F., 2002. "Information management of automated data capture: an overview of technical developments." *Information Management and Computer Security* 10(3): 109-118.