

## Use of Near Field Communication in Culture 2.0

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**Abstract:** After many years of thorough data collection and digitalisation of objects in cultural institutions, the era of presentation, data usage, and data exploitation has arrived. The steady reduction in prices of NFC/RFID tags and the increasing popularity of smart phones with NFC support make the use of this technology interesting and affordable for smaller museums or archives. As part of a funded project, SeCoS, an application for smartphones, has been developed at the institute in collaboration with cultural institutions that enables these institutions to offer useful background information as an app for exhibitions. Only in this way, is it possible for the public to access “hoarded” treasure troves of background information. An estimated 50% of RFID chips used worldwide have been developed in Graz (Styria), Austria. Styrian companies are leaders in the field of chip innovation for applications such as access control, electronic tickets, and electronic payments. In a period where cultural budgets are continually decreasing, it is increasingly important that cultural institutions become embedded in the public consciousness. Due to the increasing popularity of smartphones and improvements in technology, visitors can more easily bring to mind exhibitions offered by cultural institutions that offer apps. This application type is tailored to the needs of museums or archives that want to provide background information for a limited number of objects at, for example, exhibitions. NFC tags are attached on or next to objects. When the visitor places their mobile phone over the tag, the app can automatically access detailed information about the object and display it. The information on the mobile phone can be synchronized with software on the visitor’s smartphone or tablet, as well as to the corresponding cultural database. In addition, the app also records additional information (e.g., photos) and appends them to the specific objects.

**Keywords:** Mobile Guide, NFC, Cultural 2.0, Web of Things, Collection Management

### Introduction

With the increasing processing power of mobile phones and the support of new electronics facilities, innovative services e.g. in form of mobile applications are enabled by NFC technology. In this way, NFC technology brings simplicity to transactions, provides easy content delivery and enables a new type of information sharing in museums. Beside this fact, it enables new opportunities for various stake holders in the supply chain of museums. This paper discusses some aspects from different perspectives.

Within our work we have developed new and integrated mobile applications with NFC technology designed to present and manage the constantly growing amount of multi-lingual content of museums and to selectively filter out the desired information for the visitor. Therefore, museum experts and technology combine new technologies from the “Web of Things” (VERMESAN 2013) to create an extensive new type of applications, developing tools for showing and presenting content of museums. The great strength is the tight

intermeshing type of media - as today the digital world no longer consists of numbers, texts and pictures alone, but also of an increasing number of audio or videos files. However, one of the main motivations for all this activities in a museum is to attract the young generation (digital natives) to objects with a long history. Furthermore in a world of extensive growing objects and regarding data it gets more and more important to find cost and time effective ways to store, locate and present and connect real objects as well as digital data.

### **Mobile Applications are part of the new Dissemination Network for Museums**

New technologies, inventions and possibilities coming originally from the huge field of contactless communication technologies such as NFC (ZEINER 2013), this development offers great possibilities also to the world of cultural heritage – to track and re-discover different kinds of information. These new contactless technologies can also be used in innovative solutions for presenting the objects and bringing the content of collection management systems to the interested public. The motivation for this works comes from the “Web of Things”. The “Web of Things” focuses on the establishment of connectivity for physical things such as museum objects with the web or the content of the web. Recently, some researchers have proposed a suggestion for an architecture for the “Web of Things” (Guinard 2011). The proposed architecture is based on the usage of resource-oriented (REST) principles using HTTP as the application protocol. An HTTP connection is initiated by the client and thus fits the needs of control-oriented applications. However, applications in the “Web of Things” are often rather monitoring-oriented, which means that connected things will push data to the clients autonomously.

Over the past decade, museums have been embracing the idea of open innovation and finding that a lot of innovation happens when you open up data catalogues and rethink “museums as a platform” for promoting innovation in other public services. To achieve this, we have to consider the human side of the “Web of Things”. Thus we will explore ways to interact with our objects over the web and reveal possibilities for giving things a virtual voice over the web. The used technology is Near Field Communication (NFC), a new mobile phone technology which allows users to share information with a simple tap of an archaeological object in your museum. Using your NFC enabled device you can learn more about exhibits. Just look out for the tags during your visit at the museum and tap your phone to extend the experience online.

NFC stands for important new technologies to connect to the physical world; however, carefully designed software needs to be developed. This software utilizes the new hardware solutions and offers versatile uses to a consumer or a museum. Business solutions for NFC are often proprietary, closed source solutions that can only be maintained and developed further by the original developer. This leads to closed platforms where a software solutions works only with the intended hardware, making open innovation development impossible.

The web as we know it today, however, depends on easily exchangeable and combinable technologies. This is also true for software solutions for museums. In other words, in the “Web of Things” objects will talk to its owners directly. One hypothesis is that user interaction concepts of the social web, such as activity streams, can be adapted to our needs in museums. Such a use case in a museum requires another paradigm of the “Web of Things”: our objects will have to transmit to the user, meaning that the user does not have to visit a museum to see what’s new once in a while, but is informed in other ways. This is also a new form of

dissemination for museums; the virtual objects will become visible to anybody, citizens and tourists, including young people.

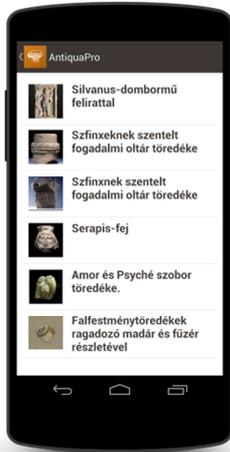


Fig. 1 – Mobile design of *AntiquaPro*

Fig. 2 – List view of object in *AntiquaPro*

Fig. 3 – Detailed object description of *AntiquaPro*

The use of NFC has many advantages. User of mobile phones can safely exchange data and information with other NFC-enabled devices and corresponding tags. There is no need for a complicated pairing process. For example, museums can provide mobile tour guides. In this way, museums can use this technology to provide the visitors with additional information. The visitors only need to tap the phone near a specially designed hot spot in front of the item in the exhibition and will get additional audio or video information or a set of photos or texts related to the object. NFC is even more convenient and faster than, for example, scanning a QR code. A significant advantage of NFC tags in comparison to the QR code is the reading process of the tag: a NFC tag can be behind an object. NFC tags are simple to use, so they are interesting for many museum applications.

These NFC tags could also be embedded in signs outside of museums. For example, if you visit a famous landmark you will usually find explanations in several languages on the item. With NFC tags you could even use more languages by using the available language technology on the smart phone.

To sum up, NFC helps to enhance your visitors' experience and overall the suggest solution is particularly cost-effective. It requires minimal installation and low maintenance costs. The entire approach is structured to make it easy for the visitors. Using NFC tags enhances the visitor participation. It is important for a museum to provide a choice of content use at various levels of detail and in this way you can interest new type of user groups.

Finally, to support programmers in this aspect, information security and protection measures were considered and integrated in here as well. Overall, NFC technology provides security, uncomplicated use and an added value that can easily communicate to the visitors. In the meantime, the technology is available via all major mobile operation platforms, meaning, customers bring their own tag reader and can use this new type of technology.

## Collection Management Systems as Back-end Service

In order to have access to the content, the goal is to develop a flexible micro service based way of the “Web of Things” platform of SeCoS to bring the content of the collection management software to the user. Advantages of micro services are that they can divide the application into smaller services. First each service fulfils a specific need and has their own domain-specific purpose. This new kind of software service principles provides the flexibility that a modern distributed web platform needs. Second, the architecture is built on small services which are connected through a service connector. The main purpose of the service connector is to be the external point at which all clients access the system. This approach also works like a gateway which presents all micro services as a single application. Third, the communication between the service connector and the micro-services components is driven by messages, so each micro service is completely isolated from others. This isolation provides some main advantages in relation to a monolithic architecture. In this way, an application can scale only those parts of our application that require more resources. Fourth, we can deploy individual services instead of deploying the whole application. The micro-service can be moved to different location e.g. in-house server or cloud provider without any notable changes to the application. As each micro-service is isolated from others, the micro-service could be developed in different programming languages and also by different teams. Finally, the maintenance of the application is easier. The errors that occur are isolated within the micro services. Moreover, changing micro services does not affect the rest of the application. In this way, we apply several principles for development of such micro services within a “Web of Things” infrastructure. In our case, an agile development strategy is used, which can be picked up and improved upon by a growing number of planned future services for the museum and the new mobile front-end applications. Our approach simplifies the establishment of such integration and makes the museum applications affordable.

An example of such a collection management software is the *imdas pro* software package. This package is based on very detailed research work in the cultural heritage sector and can greatly speed up these time-consuming organizational procedures of museums. The great strength of the documentation system for museums is its flexibility – it can be used to record dinosaur bones as well as to catalogue Picasso’s paintings. The advantage of this approach is the combination of new and light forms with already available powerful solutions and a well-integrated set of tools for the cultural heritage. Therefore, the user may choose tools and software fitting into his work flow, needs and wishes. The offered add-on micro services can be easily fed with the data of the *imdas pro* content, so that it is not necessary to know much about data structure and the storing mechanism. This concept is a time and cost saving one because you do not have to switch the software tools.

## Related Work

Cities are becoming the focal point for investment activities that drive economic growth. Museums are part of cities and therefore it is a clear investment in activities and exhibitions to attract tourists and business tourists to visit their institutions. The ongoing financial crisis in this area has motivated museums and city managers globally to think about ways to achieve greater efficiencies and compete with other institutions. Another challenge for museums such as the ISEUM SAVARIENSE is the integration of different thematic focuses

(e.g. by combining image galleries, archaeological collections or natural collections) ranging from various fields that often reinforces storage and fragmentation information content. One of the goals of the “Web of Things” movement is to think about museums as “platforms” and “eco-system” and connecting the storages so more holistic planning can occur. Therefore, there is a range of activities in this area (see also (ZEINER 2013)). Some museums also used NFC and mobile applications to help bring the content to the people outside the museum. A detailed survey is given in (COSKUN 2013). There is a large range of publications in this area such as (CEIPIDOR 2013) or (MCHUGH 2014).

## Conclusion and Outlook

The work of the project has shown that newer technologies like NFC tags, smartphones and tablets have become one of the most important channels to provide access to objects next to their physical presentation in museums and archives. Based on the knowledge and experience this approach offers a new and more flexible and easy-to-use system to present physical objects to different types of consumers in a completely different way. The concept in this paper shows that micro services are an adequate way to build add-on services to an available back-end infrastructure. The usage of the content as mobile applications for devices like smartphones and tablets attracts new types of users and helps bringing more young people to the museums. To sum up, an intelligent connection of real world objects in smart lean applications requires lowering the existing software integration barrier. This will be achieved by utilizing leading edge web technologies for the development of a truly novel “Web of Things” application integration, leading to the seamless integration of real world objects into new type of mobile applications.

The project further investigates new types of user interaction patterns needed to interact with real world objects in the web. For example, concepts of the human usage of objects will be analyzed and adapted appropriately.

## Acknowledgement

The work of this research was carried out within the K-Project SeCoS, funded in the context of COMET – Competence Centers for Excellent Technologies by BMVIT, BMWFW, Styrian Business Promotion Agency (SFG), Province of Styria – Government of Styria. The programme COMET is conducted by the Austrian Research Promotion Agency (FFG). The content of this work was provided by ISEUM SAVARIENSE, a part of Savaria Museum, Szombathely, Hungary. We would like to thank Mag. Andrea Csapláros (Director) for providing the content (© ISEUM SAVARIENSE – Savaria Museum) for this mobile application. Finally, we would like to thank NXP for providing the tags for the application.

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**Imprint:**

Proceedings of the 19th International Conference on Cultural Heritage and New Technologies 2014 (CHNT 19, 2014)

Vienna 2015

<http://www.chnt.at/proceedings-chnt-19/>

ISBN 978-3-200-04167-7

Editor/Publisher: Museen der Stadt Wien – Stadtarchäologie

Editorial Team: Wolfgang Börner, Susanne Uhlirz

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