

A Chinese Wall approach for Anonymous Recommendation in a Multi-Dimensional-Personalisation Scenario

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Abstract: Multi-Dimensional-Personalisation, especially if it spans between the online and offline world (i.e., in a mobile environment), requires a pro active recommendation service which is not only based on the interest of the users but also on the location of the user and a temporal component describing the “when”. As users are very privacy conscious such a service has to take care of providing privacy while delivering services. In order to achieve this a “Chinese Wall” approach is proposed based on a middleman to allow push services based recommendation without sacrificing privacy. By doing so recommenders can select their target audience via an anonymous profile and still reach their target audience without gaining access to any personal data of the user.

Key words: Chinese Wall, Location Based Services (LBS), Personalization, Recommendation

1 Introduction

The concept of the traditional idea of the “Chinese Wall” will be described. After this a introduction to the Multi-Dimensional-Personalisation (MDP) approach will be given. Starting from this MDP approach the “Chinese Wall” idea will be extended and adopted to a recommendation scenario which matches the needs for anonymity and privacy of the Multi-Dimensional-Personalisation approach.

“Personalisation” has been a hot term during the dot com era. In 1999 at a Gartner Group symposium it was predicted that “... by 2003, nearly 85 percent of global 1,000 Web sites will use some form of personalization (0.7 probability)” (Abrams et al., 1999). It seems that this prediction did not come true. Through the meltdown of the dot com companies lot of the hype went bust.

Nowadays personalisation is seen in a broader context known as an “Adaptive Interface”. The first two levels (i.e., conceptual and semantic level)

represent the personalisation (the other two levels are called syntactical and lexical – adapted from Foley et al. 1990).

This paper introduces a new next generation personalisation approach which goes beyond the approaches of earlier personalisation projects. Besides the personalisation efforts (usually based on the users interest) new dimensions like the location of the user and a temporal component will be taken into account. These main dimensions are used or applied for this new personalisation approach - hence the name “Multi-Dimensional-Personalisation” (MDP). The approach will enable the user and the application to span a bridge between the online and the offline world. In this approach one of the important components is a recommendation functionality which has to preserve the anonymity and privacy of the user. In order to achieve this a “Chinese Wall” like approach will be taken. The MDP service provider (e.g., the mobile phone service provider) will act as a middleman to provide a protective shield to the user.

Abowd and Mynatt wrote: “Most context-aware

systems still do not incorporate knowledge about time, history (recent or long past), other people than the user, as well as many other pieces of information often available in our environment" (Abowd et al., 2000). By adding knowledge of the future behaviour of the user, e.g., by using information from a schedule the MDP approach will be able to provide even more the this. In order to provide the user with recommendations which match his interests coupled with his location and the right timing a new scheme has to be established. As there are a lot of privacy, security or trust issues involved the user needs trust in the MDP provider to use the service with confidence. This requires a solution for the MDP service provider as well as for the provider of the recommendation (services or information). The proposed "Chinese Wall" / middleman approach will provided a solution for this problem.

2 The Chinese Wall approach

In various industries like banking, consulting or advertisement the "Chinese Wall" policy is used to keep information from one client separated from persons or teams which are working on projects or tasks for a competitor of first client. By doing so the organisation can work for two companies which are competitors and keep their confidential information separated (in theory). In the banking industry, e.g., the analysts and the investment bankers are divided by such a "Chinese Wall" to prevent, e.g., insider trading. Some countries (e.g., the United Kingdom) have laws in place which enforce such policies, e.g., in the financial services industries. This "non-computer" security policy attracted the interest of researchers in the security area "..., because it is a real-world information flow policy in the commercial sector rather than the usual military or government sectors." (Sandhu, 1992).

In a paper by Brewer & Nash the "Chinese Wall" is described that: "It can be most easily visualized as the code of practice that must be followed by a market analyst working for a financial institution providing corporate business services. Such an analyst must uphold the confidentiality of information provided to him by his firm's clients; this means he cannot advise corporations where he has insider knowledge of the plans, status or standing of a competitor. However, the analyst is free to advise corporations which are not in competition with each other, and also to draw on general market information. Many other instances of Chinese Walls are found in the financial world." (Brewer et al., 1989).

Lategan & Olivier describe the need for the usage of a "Chinese Wall" in the way that: "The security of private information is of paramount importance to the continuing use of the Internet for business dealings, as the risk of fraud or unintentional disclosure of private information could be a serious deterrent to individuals.

Privacy policies are being used more and more to promise the security of an individual's private information ..." (Lategan et al., 2002).

Brewer & Nash explain the function of the "Chinese Wall" that: "We note, in the first instance, that our user has complete freedom to access anything he cares to choose. Once that initial choice has been made, however, a Chinese Wall is created for that user around that data-set and we can think of "the wrong side of this Wall" as being any data-set within the same conflict of interest class as that data-set within the Wall. Nevertheless, the user still has freedom to access any other data-set which is in a different conflict of interest class, but as soon as that choice is made, the Wall changes shape to include the new data-set. Thus we see that the Chinese Wall policy is a subtle combination of free choice and mandatory control." (Brewer et al., 1989). Sandhu states that: „The objective of the Chinese Wall policy is to prevent information flows which cause conflict of interest for individual consultants.“(Sandhu 1992).

These are descriptions of the "traditional" usage of a "Chinese Wall" in industries like banking or consulting. To apply the "Chinese Wall" approach in a recommendation application for the Multi-Dimensional-Personalisation scenario we have to extend the traditional way of the „Chinese Wall“ to meet the requirements.

In the Lategan & Olivier paper it was expressed that: "The privacy of information used on the Internet is a very real and important issue. Many users have concerns about the security of private information supplied to organisations on the Internet, and rightfully so, as tales of compromised information abounds." (Lategan et al., 2002). L.Cranor (Cranor, 1999) has defined three ways to prevent that private information leaks out on the internet:

1. Private information is not disclosed at all.
2. The source of the private information is hidden, that is, anonymity is preserved.
3. Privacy policies are in effect that promise the responsible usage of private information.

By applying the first way it would not be possible to offer personalisation services at all, i.e., when the user does not trust anybody it will be difficult to offer personalisation services as no private information will be disclosed.

As mentioned before personalisation is only possible if the user trusts at least one organisation that they will do no harm to him based on the (private) information disclosed to them. For a personalisation concept which would work with multiple sources for the recommendations a solution is to store the profile

of the user anonymously (see way no. 2) with the middleman and pass a representation of this data without a real reference about the user to the participating / requesting servers. Such a type of middleman approach can act as a “Chinese wall”, i.e., act as in-between between the user and the service provider. By doing so the organisation that wants to offer a service or recommendation to the user will only deal with an anonymous profile. This makes it necessary that the middleman follows the point 3 stated above by L.Cranor (1999).

2.1 A special trust relationship for privacy

This approach would work if there is a trusted relationship between the user and the MDP service provider (a.k.a. as the middleman or the “Chinese Wall”). The middleman would handle the storage, collection, maintenance and handling of the profile data of the user. In order to allow other organisations to provide recommendations or services to the users based on their profile (i.e., the combination of the interest of the user, it's location and the temporal component, ...) the middleman would take the request from the information providers and return the number of matching profiles. If the provider orders the delivery of his offerings, the middleman will execute the delivery of the recommendation / service offering to the users with matching profiles.

There is a specific trust and privacy issue for the recommendation part as there are data protection laws in place which can cause problems for such a function. Besides that the users are very conscious about their privacy when they are using a service. The wish to stay anonymous or having their privacy protected is vital for the success of such a system. These function can only be successful if the user trust the entity which provides this service and passes on the recommendations. Similar trust relationships already exist to organisations like banks, mobile phone companies or credit card companies. This seems odd at the beginning but if we consider that all these organisations have information about their customers and their behaviour, their location when using the services provided and a kind of knowledge about their interest (e.g., from their shopping pattern (bank & credit card companies) or mobile phone companies (e.g., numbers called or services requested and paid for). Nowadays these organisation do not directly provide any real form of personalization or location based services. The only way this existing data about the users is used is, e.g., when a credit card company is analysing the “normal” behaviour of a credit card customer to identify “abnormal” behaviour, i.e., usage of the credit card to prevent fraud. This analysis of the behaviour is usually based on the usage location as well as on purchasing patterns.

2.2 Implementation issues

The difference between the traditional application of the “Chinese Wall” and the way applied in the MDP scenario is that in the traditional way a consulting company works on data of multiple clients and the teams use the “Chinese Wall” to prevent data leaking from one team to the other. In the case of a middleman / MDP “Chinese Wall” the middleman protects the profile data of the users from the organisations which want to offer recommendations or services.

Schafer et al. (2001) wrote that "Anonymizing techniques are disasters for recommenders, because they make it impossible for the recommender to easily recognize the customer, limiting the ability even to collect data, much less to make accurate recommendations. If recommenders are to be successful in the long-term, alternatives must be developed that alleviate consumer concerns about privacy ...". The case of the “Chinese Wall” approach would be such an alternative as the anonymity / privacy of the user would be preserved.

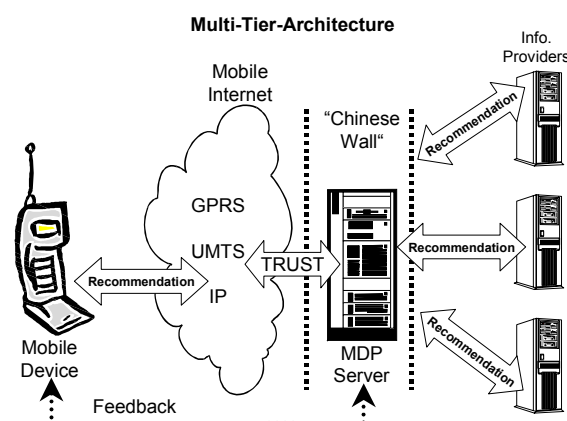


Figure 1: Multi-Tier-Architecture

The recommender would have the opportunity of actively providing recommendations without knowing the target personally. As written by Warren et al., 1890 the user has chosen his "right of the individual to be let alone" but they still can "... determine for themselves when, how, and to what extent information about them is communicated to others" (Westin, 1970).

By doing so an organisation which wants to provide recommendations to MDP users will only get the possibility to select profiles which do not contain any information about the user. Kobsa expresses exactly this as a legal requirement in Germany when he writes: "User profiles are permissible only if pseudonyms are used. Profiles retrievable under pseudonyms shall not be combined with data relating to the bearer of the pseudonym¹. This clause mandates

¹ Based on the German Teleservices Data Protection

a Chinese Wall between the component that receives data from identifiable users, and the user modeling component which makes generalizations about pseudonymous users and adapts hypermedia pages accordingly. Communication between these components may only take place through a trusted third component that manages the directory of pseudonyms, or through more complex pseudonymization procedures.” (Kobsa 2002).

When an organisation wants to provide recommendations or wants to recommend their services it will be able to select anonymous profiles which correspond to their chosen target audience. The middleman would take the offer of the recommender and would pass it on, based on the selected anonymous profiles, to the “real” users. By doing so the organisation which wants to offer recommendations can select a user base entirely based on the interests, their location and the available temporal information (their history and future) of the user without knowing the user personally. This way offers total anonymity to the user but allows to select a matching target audiences. This can be seen as a classical Win-Win situation for the user as well as for the recommender. The middleman could even act as a kind of quality control to prevent unwanted amounts of recommendations to be passed to the users.

The whole process would work in the following way: The recommender would define a profile of the target audience. This profile will be passed to the MDP Server (1). The MDP server would take this profile and run a check on the database with user profiles (2). Depending on the request several dimensions would be taken into account. In the sample case the location is represented by a range of zip codes (depending on the application other formats could be used as well, e.g., Cell ID, NUTS Code, latitude & longitude, ...). The user type would be a female which is between 16-21 years old. The Interest dimension is represented by an interest in fashion. The MDP server will return the number of matching profiles to the requestor (3).

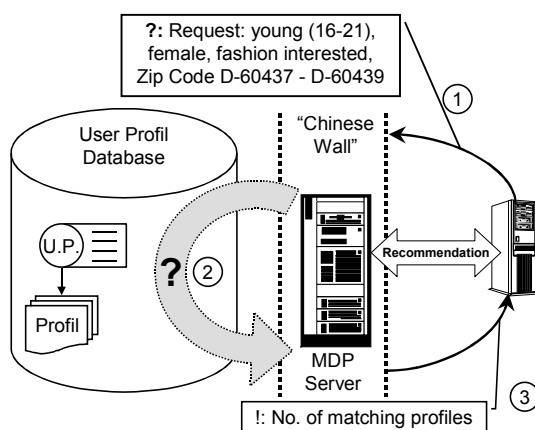


Figure 2: Profile selection process via “Chinese Wall”

Act (1997) reference by Kobsa

If the requestor is satisfied with the available number of profiles the order for the delivery of the recommendation can be fulfilled (4). The MDP server would use the profile and the location information to pass the recommendation on to the user (5). As this selection process and the confirmation should happen in a very short time the users will be still in the selected area for this recommendation (except they are moving fast (e.g., in a car or motorcycle)). For accounting purposes the MDP server will also pass the number of delivered recommendations to the recommender (6).

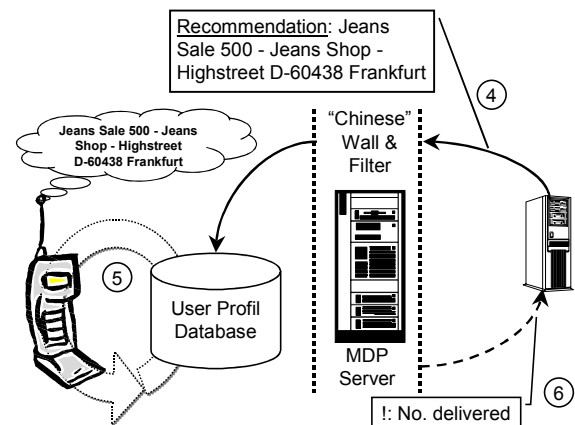


Figure 3: Delivery of recommendation

As a kind of quality measure the addressed user has the opportunity to give feedback (8) about the recommendations (7) to the MDP server. This can be done in several ways. The user can block recommendations from a certain source (9). I.e., in the next selection process (2) this profile will not be

Feedback for unwanted recommendations

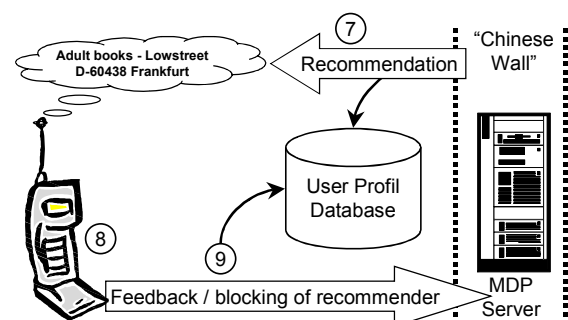


Figure 4: Giving Feedback & Blocking

selected for this recommender anymore. Another way of giving feedback (9) to the MDP server would be a rating for the recommendation to allow the MDP server to filter unwanted offerings to the users. In addition it would be possible to give a feedback of the acceptance rate to the recommender.

The other issues which have to be taken care of are issues like the cell size a user is willing to move to get

to an recommendation (depending on the way of transportation, e.g., by walking, bicycle, motorcycle, car or public transport). Another issue is how the user profile will be presented. There are various ways of representing the user profile, e.g., by meta data describing the user and certain parameters representing the user (age, gender, devices used, ...), by a hierarchical tree based on a classification scheme or by a free form presentation which can be matched to a request by the matter of algorithms like a vector space model. As another way of automatically creating the profile by analysing the user behaviour or evaluating the feedback / rating given on recommendations received. By these ways this Personalisation can be " ... done automatically based on the user's actions, the user's profile, and (possibly) the profiles of others with 'similar' profiles" (Mobasher et al. 2001).

The vital requirement for such a scenario is that the user trusts the middleman (which is acting as the "Chinese Wall" to provide the anonymity) and that the information provider / recommender is able to get his message through to potential clients, i.e., the target audience. One drawback could be an issue which was shown in the famous New Yorker cartoon where one dog tells another dog that: "On the Internet, nobody knows you're a dog." (Steiner 1993) this would be reality in this scenario as well. In the application of a MDP "Chinese Wall" only the middleman would know if the matching profile represents a matching dog or a matching person.

A user would be, e.g., selected by the information in the corresponding anonymous users profile. The data in the profile would be defined by the user (e.g., the interests of the user) and the users behaviour (i.e., regular movement patterns and the temporal information collected or provided, e.g., from a schedule). There would be several ways to gather this data. For the location and temporal information this data could be gathered automatically. For the interest dimension it would be possible to work with a controlled vocabulary / hierarchy of interests and let the user choose the matching interests. Another, more convenient, way would be to analyse the surfing behaviour of the user to gather information about his likes and dislikes (e.g., by a rating function for sites visited or information frequently read or accessed). As mentioned before Personalisation should be done automatically.

This is where the new Multi-Dimensional-Personalisation concept can provide significant benefits to the user. This is an approach to support the user in coping with massive information overflow. The online world as well as the offline world provides a vast array of opportunities, information and services or events that might be relevant to the user. The main problem nowadays is to get the right information at

the right time at the right place and in the right format.

A powerful extension of the model is to use a feedback function to the middleman to provide feedback about the recommendations or service offers received (similar to the ratings for Ebay sellers/buyers). This could work in multiple ways, e.g., to block an organisation because of wrong or bad recommendations or other reasons. This feedback would allow the middleman to fine tune the service provided for the individual user. If the middleman evaluates the user feedback it would be possible to eliminate organisations which provide bad services or recommendations. If an organisation gets many bad ratings the middleman should consider not to deal with them anymore. By doing so the service would get tailored right to the users wishes so that everybody could receive matching recommendations and not just Spam. As positive example of this feedback approach there could be the case that an user expresses his wish to the middleman to pass more personal details to the organisation which provided a recommendation. In this case a closer relationship between the user and an organisation could be established. Naturally this relationship could be revoked if the user wishes to do so.

3 Multi-Dimensional Personalisation

Multi-Dimensional-Personalisation (MDP) is an approach to support the user in coping with massive information overflow. There are the main dimensions time, interest and location and minor issues like bandwidth (e.g. GPRS, HCS, UMTS, LAN, WLAN), format / medium (from plain text format to rich media formats depending on the client, available bandwidth or hardware), priority (how important is an information) and cost (costs associated with information or an event). Besides these dimensions and issues there are security and trust concerns which have to be considered. As mentioned before, the main dimensions for such a new personalisation approach are:

- the time dimension: comparable to a calendar or schedule. The user has a certain repeating behaviour (always in a similar time frame, e.g., the way to / from work, lunchtime, etc.) or plans some trips ahead. The MDP would build up on this information and would allow a permission based recommendation taking into account the interest of the user and the location of the user. This would allow to recommend future events as well as events which fit the regular schedule of the user;
- the location dimension: the "moving" pattern of the user into account. Regardless of whether the user is using a desktop PC, a notebook, a mobile device like a PDA or

smart phone he will be “somewhere”. Either at home, at work or on the road there always will be interesting things or information related to this user. Combined with the other dimensions it is possible to offer recommendations “just in time” at the right place. Even planning ahead in time would be possible. Reoccurring moving patterns of a user can be tracked and used for recommendation based on the users location;

- the interest dimension: (or “personalisation” in prior approaches) addresses what the user is interested in. This can range from business or commercial interests which are related to the job or studies to private interests like hobbies. These interests can be grouped in profiles to allow switching and prioritising between them.

The minor issues which have been mentioned above can be taken care of during the implementation of the system. For example, issues like bandwidth of the communication, technical capabilities of the device used to participate, etc.

It seems that in existing systems, and in previous work or literature, such an MDP approach has not been taken before. There are usually the two main dimensions - interest and location - used in existing personalisation systems. The interest based personalisation usually uses filtering techniques like content filtering, collaborative filtering, rule based filtering, content mining, monitoring of the surf behaviour or by selection of interest topics through the user for the personalisation or recommendation to the user. For the location based personalisation usually a pull style implementation is nowadays the standard. I.e., the user has arrived at a certain location and has to request the information he wants (i.e., pull).

These methods have to be extended to be applied in the Multi-Dimensional-Personalisation context and have to be taken into account for the proof-of-concept or implementation phase. The user shall be provided “... with the information they want or need, without expecting from them to ask for it explicitly” (Mulvenna et al., 2000). Besides this the content and services should be “... actively tailored to individuals based on rich knowledge about their preferences and behaviour.” (Hagen et al., 1999). Nielsen writes on his web site that the “... bottom line is that for enabling Smart Personalization techniques the application needs to recognize individuals, not computers” (Nielsen 2002). By taking this into account and considering that personalisation usually happens only on one web site or within a portal (e.g., in an intranet) the requirements should be clear. This new approach proposes services which will provide the user with the possibility to use his profile across all participating web sites. As Schafer et al. writes “One classification

of delivery methods is pull, push, and passive” (Schafer et al., 2001). In order provide good services for the user it shall be an interactive solution providing the result of the Multi-Dimensional-Personalisation in form of a proactive push to the user. This requirement was described, e.g., in (Chavez et al., 1998) that “an optimal assistant provides the required information autonomously and independently, without requiring the user to ask for it explicitly”. The user shall get “... the right information at the right time and place - with minimal interaction” (Chavez et al., 1998).

As mentioned before the location based approach is nowadays generally used for mobile devices like mobile or smart phones. In such scenarios the information is generally used to navigate the user to a service or information provider. This is connected to a certain need or demand of the user (e.g., a pizza restaurant, a hotel or such things). This is mainly an “on demand” scenario, i.e., the user requests / pulls the information and has to select “what” he wants. The location based personalisation provides the “where” information for the “what”. A literature search has not found a system proposed which really combines these two dimensions in a personalisation engine. At present, there is no approach known to the authors that combines the third dimension, time, with the two other main dimensions. Another issue is that there are no real approaches known that try to bridge personalisation between the online and the offline world.

4 Chinese Wall & Multi-Dimensional Personalisation

After the introduction of the “Chinese Wall” and the Multi-Dimensional Personalisation approach it is obvious how both can work together to offer the opportunity of providing extended location based services which are combined with an interest and temporal component. The traditional “Chinese Wall” has to be extended from the old way used in banks, consulting companies and advertisement agencies to work in a fully automated database driven world with different requirements then a paper driven environment. Other approaches already have been taken to map this type of security to, e.g., database applications or file systems. But compared with these the application of the “Chinese Wall” in the Multi-Dimensional Personalisation environment the usage is actually rather similar to the traditional application. Instead of the access to a single clients data (like in banking / consulting) the middleman has access to multiple user profiles. By doing so the middleman can provide multiple recommenders anonymous access to many users. By doing so preserving the traditional “Chinese Wall” way of information access control / privacy. The use of this approach is necessary because of the demand of the users to preserve their privacy by still wanting to benefit from the services offered.

As the recommender / information provider will never get direct access to the profiles and the personal data of the users the privacy concerns can be considered as solved. The trust issue will be only present between the user and the MDP server. This will minimise this issue to only one trust relationship instead of having to cope with an open or a multiple number of relationship when no middleman (here the "Chinese Wall") is in place. The "Chinese Wall" will handle all the contacts necessary from recommenders / information service providers for the users.

This will be a reduction of efforts for the user to handle all these relationships. The user can influence the recommendation send by setting the profile information, giving feedback / ratings about the received information or blocking unwanted information.

Conclusion & Research Outlook

The basic theory on how to apply the "Chinese Wall" in a Multi - Dimensional - Personalisation recommendation scenario has been described. For the implementation a design decision has to be made on how to implement an automatic matching of either profiles or chosen interests. One approach could be to apply, e.g., an adapted vector space model based algorithm which identifies matching profiles by comparing the vectors of the user profiles and the offerings (similar as the vector space model is used to cluster documents). As the devices used by the mobile users are usually smart phones most of the processing has to be done on a server hence the Multi-Tier-Architecture which uses the smart phone only as thin client. For the communication between the middleman and the user standard protocols could be utilised. But still the architecture has to be designed to support the mobile users of the future. For the interfaces which accepts the recommendations a web service based architecture is advisable.

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