Testing Site Personalization, Unpacking Personalized Sites Through Emulation

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Abstract

Site personalization is becoming one of the most effective characteristics in online marketing websites. In a competitive environment, a few seconds matter if a site visitor is finding what they are looking for. Site personalization helps deliver personalized content, promotions and experiences. Though a very powerful solution that helps both the users and business, it brings new challenges to people who are testing this capability and to content authors trying to validate their content before publishing.

One of the widely used techniques for personalized content experience for different user groups is to install a client side cookie to track user location, origin, interests and navigation to the target site. The client side cookie will determine the content or pages that will be rendered to the user. Multiple versions of the same page are developed and tested individually by content authors and designers, but there is no easy way to test the navigation, page rendering and user experience in an efficient fashion.

This paper tries to address this problem with an efficient solution by developing a small cookie manipulation tool that the tester can use to change the cookie settings. With this approach, the tester can easily use the web tool to set the cookie based on the experience being tested and test the user experience and content for target audience.

Biography

Amith Pulla is a senior software quality analyst at Intel Corp, currently working at the Intel site in Hillsboro, Oregon. Over the last decade, he has been involved in software testing strategies and processes for applications mainly focused on sales and marketing. Amith has worked extensively on projects involving multiple platforms and complex architectures. Amith also worked on developing test methodologies and techniques to meet the business needs and timelines. As part of his QA lead role, Amith focused on improving and refining QA processes and standards for efficient software testing.

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1. Introduction

Site personalization technology can dynamically insert and customize content based on individual user profiles. The user profile can be determined by user’s implicit behavior, browsing patterns and preferences, and sometimes by explicitly captured details provided by the user.

Both implicit and explicit information for a specific user is used to personalize the content on the site and pages. Implicit information can be derived from user’s location, navigation patterns, search terms used or links clicked. Explicit information is something user declares as part of the navigation, this could be user providing information regarding age and gender, or in corporate marketing context the user can provide information related to company background, size, role and product development interests.

Personalization is becoming very popular with e-business and marketing sites by providing special treatment to the site visitors in the form of relevant content and information. One of the key goals of personalization is to attract and retain visitors that eventually lead to better user experience, satisfaction and sales. In big corporations, personalized sites for employees, vendors and contractors can improve productivity and customer satisfaction by simplified and faster access to data, information and applications based on role and profile.

Site personalization gives an edge to companies by delivering sites and applications that are easier to use as they are tailored to meet individual needs. Several studies proved that personalization increases conversion rate and revenue metrics. Personalization includes collecting and storing information concerning site visitors and analyzing the information, (Willy Chiu 2001). Based on the processed information, the site delivers the right content, experience and features to each visitor. Personalization techniques can enable the site for target advertising, promote products, create relevant and meaningful interactions across multiple channels, recommend articles and provide suitable guidance.

Designing personalized sites can be complicated; it involves a thorough process of gathering and storing information about site visitors, both on the client and server side, then based on the information the server needs to deliver the right content to each visitor. In marketing sites, personalization can enable companies to aim advertising, promote products, and recommend articles and reviews.

2. Unpacking Personalized Sites

To better test the personalized sites in a test environment, we need to understand how personalization variables drive the content on the page; later we will learn how to unpack personalized sites using the emulation tool as a testing technique. Unpacking a personalized site means opening up the site to view all versions of content for each module and page based on each combination of personalization variable values. Personalized sites cannot be fully tested unless they are unpacked to view all possible behaviors and facets of the site.

Personalized sites are often driven by a personalization engine in the application server layer (middleware) of a multi-tier architecture design, rendering the personalized content based on available data for preconfigured variables. The personalization engine works behind the scenes to render relevant or targeted content to the end user with the personalization logic and rules that are invisible to the users. Personalization variables play a key role in content rendering for a specific user; these variables are set in the personalization engine based on user interaction with the application or website. Often separate complex algorithms are used for each product line to support different personalization techniques. As Aggarwal, Wolf, Wu, Yu said (C. Aggarwal, J.L. Wolf, K-L. Wu and P.S. Yu 2000), “Web personalization algorithms are fast becoming an essential component of e-commerce”. These algorithms use personalization variables as inputs and process them to customize the content. There are many different types and categories of personalization; we will focus on four here that are popular in the industry for sales and marketing sites.
2.1 Implicit or Contextual Personalization

Contextual personalization uses implicit profiling techniques. This personalization is mostly capturing information on where the user is coming from and what the user is looking for by using search or clicking specific links. If the user is searching using specific keywords on the popular search engine sites, the site personalization engine can capture the keywords used by the user and serve up relevant content and products once the user lands on the target site.

2.1.1 In an automobile industry example, if the user searches for most fuel efficient car on the web using popular search engine sites, the specific car manufacturer site will be shown in the search results. Once the user or the potential buyer clicks on car manufacturer site link, the user enters the site and the site can highlight or recommend their most fuel-efficient cars from their entire line up of cars. This ensures the potential buyer is looking at the product offerings that he or she is most interested in first.

2.2 Explicit or Profile-Driven Personalization

Profile-driven personalization uses explicit profiling where the user provides some identifying information that can be used to personalize content based on user needs. Profile-driven personalization is all about the information that a user provides to the website during the current or a previous visit, either through profile information or through online questionnaire. The profile information can include user’s job function, interests, age, gender etc. Once the profile is created online, for each subsequent visit by the user, the saved information is used to render personalized content.

2.2.1 In a sporting goods online store example, a user creates an account in the initial visit and provides some basic information about them, like user’s age, location, favorite sports, gender. In the following visits to the site, the personalization engine can provide content and recommend products and offers based on users’ interests, preferences and previous product views or purchases.

2.3 Personalization by eNurturing and Cultivation

eNurturing refers to the specific sales strategy developed by a company based on customer's position within the sales cycle. Depending on the customer's position and purchase history and trends, specific online activities, promotions or products are pushed to a user or visitor. The website content is changed to align with sales cycles to encourage favorable decisions. eNurturing strategy is widely used in business-to-business (B2B) marketing. eNurturing creates several touch points with the potential customers and at each touch point a different content is pushed to the potential customers either in emails or online content. Cultivation is similar to eNurturing; it's a sales strategy to develop relationship with prospects over a period of time by pushing content at different communication points in the sales cycle prior to the purchasing decision.

2.3.1 A good example of eNurturing is IBM's marketing of their WebSphere software solutions, (Karen Gedney 2003). IBM's Worldwide Direct Marketing of WebSphere group adopted an eNurturing strategy that took a high-value approach to intelligently move potential customers through the sales cycle. There are several touch points created, starting with online registration, invitation to webcasts and interactive ROI assessment. The registration process provides a value exchange for prospect's time investment. Instead of providing same standard technical content to each prospect, based on the profile information provided by the prospect during the registration, the personalization engine creates a complete business information kit. The kit includes a product spec sheet, a customer case study, a demo, and a research paper from a well-regarded IT advisory firm. On subsequent visits to their site, several touch points are used in a sales cycle to deliver relevant content to encourage favorable purchasing decision.

2.4 Score-Driven Personalization

Score-driven personalization rates the customer's inclination to make a decision on a purchase. Depending on the user’s behavior, the personalization engine can determine when the customer is likely to make a decision to buy a product or service, and the site can provide higher level of service to the
customer, through specific promotions and discounts. The application scores all users or potential customers and renders content based on score.

2.4.1 Score driven personalization is used commonly in direct marketing. A good example is how the Dutch bank ING’s marketing campaigns used this approach to increase average campaign response rates and at the same time reduced direct marketing costs, (Alexander Hesse 2009). ING implemented a centralized campaign management program that creates personalized offers and content in real time. The centralized campaign management system uses historical and recent customer interaction data to score different customers and based on the score generated, the application creates real-time next best actions (NBAs) for each customer that include individualized product offers and promotions.

3. Cookies in Personalization

Browser cookies on the client side play an important role in site personalization; the personalization engine sends the browser cookie(s) to the client machine based on the user preferences and personalization variables. The cookie on the client side drives the user experience.

In implicit profiling, as part of the initializing process, the user context is set and a cookie is sent from the server to the client. The cookie contains all the user preferences, mostly in encrypted form and drives the content on the pages.

In explicit profiling, a user selects their preferences by entering information in a web form or logging in the application with an existing profile on the server. The personalization engine on the server encodes the preferences in a cookie and sends the cookie back to the client’s browser.

After the initialization process, where the cookie stored in the client has all the information about user preferences and personalization variables in an encoded format, relevant content is rendered on the page. In each subsequent visit by the user, the cookie on the client is read by the server and the information is used to deliver relevant personalized content to the user or potential customer.

4. User Context and Initialization

Setting the user context is an important aspect of both the implicit and explicit profiling; user context is typically set by initialization process. As soon as the user lands on the personalized site, the personalization engine tries to capture information to set the variables. Once the variables are set, a cookie is sent to the client and this cookie has all the information in an encoded format on user preferences and interests in the form of variables.

4.1 Initialization in Implicit Profiling

With implicit profiling, the initialization process starts when the user first comes to the personalized site, either from a search engine or by clicking on link in a marketing email or webpage. This process initializes the user context variables such as product or services interests, preferences, location based on available information from user actions. For example, if the user came from a search engine site, the personalization engine sets the variables based on the search keywords used. If the user came to the site by clicking on direct marketing email, relevant email campaign information is used to set variables.

4.2 Initialization in Explicit Profiling

With explicit profiling, the initialization process is straight forward as the user explicitly states his or her preferences by selecting options on the site, by completing an online questionnaire or by creating a profile. Based on the selections made by the user, the personalization variables are set.
4.3 Triggers

Based on the user's behavior and navigation on the website, specific triggers are used to re-set some of the personalization variables. User context is set initially, but if user's preferences change during the session, specific triggers are used to track and update variables. The specific user actions include, profile updates, browse to different product lines, and searches. Once the variables are updated or reset, the information in the cookie changes and the new information is used by the server to drive user experience and content.

For instance, in the online sporting goods store example mentioned earlier, if the user buys products related to tennis, the product interest variable is set to tennis and more tennis related offers and promotions are shown and recommended to the user. Later on, if the same user searches for soccer products and browses soccer product pages, the search or browse actions are used as triggers to reset the product interest variable to soccer and soccer related products are highlighted or recommended to the user.

On Intel's embedded design site, the site recommends targeted technical papers and articles to visitors based on user preferences in the “Recommended for You” module on the home page. Examples of a personalized module are shown below in Figure 1 and Figure 2. Figure 1 shows the “Recommended for You” module with content targeted for a technical audience with technical specifications and white papers. In contrast, Figure 2 shows the “Recommended for You” module targeted towards a general audience with no product preference.

![Recommended for You Module](image)

Figure 1
5. Testing Challenges

5.1 Site personalization is a powerful feature, highly regarded by both businesses and visitors. For the people testing the site in a test environment, it can be a nightmare. Site personalization introduces new challenges on how to test the site and cover all content scenarios. Both testers and content authors have challenges in testing content and user experience for each profile and personalization variable. There is no fast and effective method to test websites/web pages without fully going through initialization process, setting the user context and simulating the real life user actions and behaviors. Simulating user behavior and actions is a time consuming and labor intensive process, costing too much testing effort and time. The challenges slightly vary for sites using implicit and explicit profiling, but each requires a number of user actions and behaviors to fully test the content personalized for each variable.

5.1.1 With implicit profiling, depending on the personalization variables that the application or website is tracking, it may take many days of testing to simulate all possible scenarios. There can be multiple user actions and behaviors that the tester needs to simulate for the site to determine and set personalization variable, including how the user got onto the target site, what search keywords were used, which products the user is viewing, specific browsing patterns and the location.

5.1.2 In the context of automobile industry example we talked about in section 2.1.1, for the tester and content author testing in a test environment, they need to search using multiple keywords like fuel-efficient cars, high mpg, hybrid, low maintenance etc. or for a different variable the search terms can be AWD, 4x4, 4WD, cross country etc. to get into the site with specific user context. This searching using hundreds of keywords can be time intensive and makes the testing effort inefficient.

5.2 With explicit profiling, the application or website already knows some information about the user’s preferences; this information is provided by user either by creating an online profile/account or data provided by user as part of self-identification and preference settings. As with implicit profiling, for testers and content authors, it may take many days of testing as the testers need to either keep updating the user settings and login/logout of the application or create multiple test accounts with different profiles for each user preference or personalization variable. Both of these methods are time consuming and not efficient.
5.2.1 In the sporting goods online store example we discussed in section 2.2.1, testing the site requires constant updating of the user setting for each age group, gender, location and favorite sport to test the site for all possible versions, again not an efficient effort.

5.3 Because testing personalized sites with implicit or explicit profiling can be challenging and time consuming, we need to explore other tools and techniques to test content and user experience efficiently, shortening the testing window without compromising quality.

6. Emulation as a Testing Technique

Emulation is a widely used concept in software industry for software quality testing and production support to imitate users. The concept behind emulation is navigating a site or application as a user with specific roles or access, mainly to test application behavior, troubleshooting issues and to reproduce defects. While emulation is not a new technique to mimic a logged in experience where a user already has a profile setup, the use of emulation for testing personalized sites with or without login is fairly new.

For testing a personalized website successfully, first we need to unpack the website based on each personalization variable. The testers should be able to validate the user experience and content for each variable or each combination of variables, this will ensure comprehensive content coverage. The emulation approach enables the testers to unpack the personalized site in a structured way to effectively and efficiently test the website.

6.1 Manipulation of Cookies on the Client

The role of cookies in site personalization was discussed previously. In this section we will focus on creating, modifying and manipulating cookies on the client side without user context initialization process. The goal is to trick the server into thinking that the initialization process already occurred and the cookie has been sent by the server. Bypassing the initialization process enables the testers of the personalized sites to navigate the site and test content and user experience for each preconfigured user profile with combination of personalization variables without having to do the actions needed for initialization process. A web tool was developed to create and modify client side cookies based on tester’s inputs and selections.

6.2 Setting Personalization Variables Using the Tool

To efficiently test site personalization, the approach we used is to design and build an emulation tool. The goal of the emulation tool is to imitate the user behavior and actions by simply creating and modifying cookies with the personalization variables set, on the client side as if the cookies were created by site’s application server. The tool captures the values for the personalization variables or user preferences in a simple UI with a dropdown for each personalization variable. The tool provides a dropdown list for each personalization variable, in our case the variables are the user tier, industry, preferred brand and preferred platform. The testers and content authors validating the page content select the personalization variable values from the dropdowns and clicks on submit. Based on the selected values, the tool creates the cookies on the client side that drives the content on the website. If the cookies already exist, they are overwritten by the tool. The project development team designed and developed the tool to help save the QA team weeks of testing time.

6.3 Tool Overview and Features

The tool has a single screen interface as shown in Figure 3, where the testers and content authors can select the combination of personalized variables and click Submit. Based on the selected personalization variables, the sites content is changed, giving access to all versions of the same page.
The tool forces the website or the application to render relevant content and pages based on the variables set by the testers. Testers or content authors can navigate the site as if the real user is navigating, which helps the testers identify any issues and defects with content or user experience.

### 6.4 Testing the Emulation Tool

The emulation tool is a small application, independent of the personalized website. The emulation tool needs separate testing to ensure correct functionality, that the data in UI is setup correctly and the right cookies are generated by the tool based on variable values shown in the UI. The testing effort is relatively small, 2-3 days of manual testing. The testing mainly involves testers manually verifying the information in the cookie that is generated by the tool based on the selected values.

### 6.5 Limitations of Emulation Approach

Though the emulation approach unpacks the site quickly for easy content validation by circumventing the whole initialization process, there are some drawbacks to this approach. This method or approach doesn’t test the functionality related to initialization process and user actions/behaviors resulting in creating a cookie by the server on the client side. The initialization process and cookie creation process by server should be tested separately. The emulation approach is really effective when the site has multiple personalization variables and where each variable can have multiple possible values. Though the emulation approach provides the ability for testers to quickly change the combination of personalization variable values and validate content to each combination, it’s not a comprehensive test strategy and additional testing is necessary to validate initialization and cookie creation process.

### 7. Conclusion

The adoption of this emulation approach helped the QA team and content authors quickly access different personalized version of the same page/URL, without actually recreating the user behavior and actions. The emulation approach bypasses the initialization process and gives testers quick access to personalized content for each profile, saving time and enabling the QA team to complete testing in one third of time compared to the conventional methods of testing, which required simulating user behavior and setting user context. With this emulation approach, several versions of same page or module can be accessed quickly, resulting in faster validation of the entire site and content as well as site’s
personalization code. The testing team was able to access and test all personalized pages and capabilities easily, ensuring higher quality of the application and content at the same time shrinking the testing schedule.

In summary, with this emulation approach/solution, the testing team could complete site personalization testing and content validation faster, ensuring higher quality and accuracy of personalized sites with minimal testing cost and effort, and delivering customer satisfaction and quality.

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