Web Analytics for B to B Marketing in Semiconductor Industry

Akiyuki Sekiguchi, Tadao Katsunuma, Itsumi Hokao, Yusuke Yamada, and Kazuhiko Tsuda

Abstract—Visitors to B-to-B sites have a variety of goals. Therefore, the following types of analysis are important for carrying out site optimization and making use of data for marketing: Step 1. Path analysis using web beacon; Step 2. A/B testing using t-test, including multivariate testing; Step 3. Contribution analysis; Step 4. Relative analysis of web beacon, user registration database, and authenticated download against product performance.

It is predicted that customer tracking technologies using user registration databases and beacon analysis will become even more important with the evolution of web technology, and the time will come when the behavior of individual customers will be tracked.

***Index Terms*—B-to-B Market, Semiconductor Industry, Web Analytics.**

I. Introduction

The semiconductor business has traditionally focused on large companies as customers. However, the market of large semiconductor customers has become saturated (especially in Japan), and support for small and medium-sized companies, including the long tail market, must be considered for further business expansion.

However, the strategy of assigning sales staff and performing very targeted marketing, which worked for large companies, cannot realistically be used for small and medium-sized companies due to support costs.

Therefore, it is critical that in addition to using a website as a medium for providing information to small and medium-sized companies, it should also be used for marketing activities such as collecting user information and getting a handle on the needs of the market. Furthermore, the volume of product information is increasing with the increasing functionality of semiconductor products. And due to increasing numbers of customized products, the number of webpages and database records is also ever-increasing. In addition, websites need to be localized for local strategies in each market, and there is a demand for site management and language localized for each market. Many semiconductor chip manufacturers have websites for multiple languages and regions, such as Japan, Europe, North America, Asia & Oceania, China, Taiwan, Brazil, and Russia. Therefore, access analytics need to be used to optimize user paths through a website and so on. Moreover, there is a need to use analytics data for business (especially marketing and sales activities).

The following are the research objectives of this study.

1) To establish web analytics techniques for visitors to B-to-B sites, who have a variety of goals. In particular, consider an analytics model for small and medium-sized companies in the semiconductor business.
2) To investigate ways of applying web analytics to business (marketing and sales activities)
3) To make future suggestions for the above

II. Previous Research

Analysis of access logs (analytics) is important for building a website which is user-friendly for visitors and which can provide a lot of marketing data to the site owner [1]-[3].

The background and reasons for the importance of access log analysis in web marketing, and a case example of removing services that analysis found to be unpopular from a website is summarized [4]. A method of allocating wait time to dynamic webpages using webpage requests and span time values, and a system that can constantly have a grasp of the desires of the visitor is suggested [5]. Using not visitor access logs, but a panel log analysis system that uses web community techniques to extract similar webpages is important to extract user behavior patterns globally [6] -[13] are references for the whole topics in this report.

However, these types of visitor behavior analysis are for B-to-C, and there were no research results regarding analytics for B-to-B.

III. Overview of Analytics

There are two ways of using B-to-B web analytics, (1) improve and optimize the site for users by path analysis, and (2) use in marketing activities. Compared to B-to-C web analytics, B-to-B web analytics has the following three characteristics.

1) In many cases, the buyer is not the same person as the web user. So it is important to analyze all the users from the same company or organization as a single unit.
2) The goal of visitors to the website is often not only to make a purchase.

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3) It is rare for a user to complete their goal within a single session. In most cases, the user requires multiple sessions spread out over a long period of time to complete their goal.

A. Changes in Analytics Techniques

Web analytics techniques come in (1) server log type, (2) packet capture type, and (3) web beacon type. The (3) web beacon type is the most used type now for capturing the user path while taking cache and so on into consideration

In this paper, we analyzed B-to-B web analytics using the following procedure.

Step 1: Path analysis using web beacon

Step 2: A/B testing using t-test, including multivariate testing

Step 3: Conversion contribution analysis

Step 4: Relative analysis of web beacon, user registration database, and authenticated download against product performance

B. Analyzed Data

We analyzed statistical access data for the Renesas Electronics web from April 2010 to March 2012. We used analytical data from eleven regional sites, such as Japan, North America, Asia/Oceania, Europe, Hong Kong, China, Taiwan, and South Korea.

Each site consists of about 20,000 HTML pages, 7000 PD F files, and a 40,000-record product database (for displaying product specifications as parameters).

C. Web Analytics Method

1) Step 1: Path analysis using web beacon

A web beacon refers to the embedding of JavaScript into a page to track each time a user's browser loads that page. In path analysis, the sequence of pages that visitors follow through the entire site is tracked, "thin" paths are identified, and measures are taken to make these "thin" paths "thicker". When path analysis is performed for a B-to-B site, two types of paths are found. One type is “roving”, which is typically seen for example on product information pages. The user visits several different product information pages while absorbing information. The other type is “straight-line”, where the user goes towards a goal, such as making a download or purchase, in a straight line. For roving type, indicators such as time spent on page and average number of page views per page need to be measured. Furthermore for roving type it is necessary to identify core pages, for example by looking at which pages have low exit rates, or which pages are entry pages for the site, in order to analyze the characteristics of the roving behavior. Fig. 1 shows the page transition models.

Because the core page in the roving path easily attracts users and easily guides users to other pages, it is important in site analytics. Also, since the behavior ratio differs between visitors coming from search engines and visitors coming from e-mail, users need to be divided into segments and analyzed. Fig. 2 shows an example of an analysis of roving type. Indicators are analyzed according to exit rate and number of entries. This example shows that the product family page is the core page. Users navigate in a roving path centered around this page, so we know we need to improve its indexability and improve links out to pages that we want users to visit. Also the user behavior is different between user segments. No referrer access is normally from e-mail or bookmarks. As an example we can see Environmental info page over e-mails can be an entry more easily and also less an exit than through search engine (like Google).

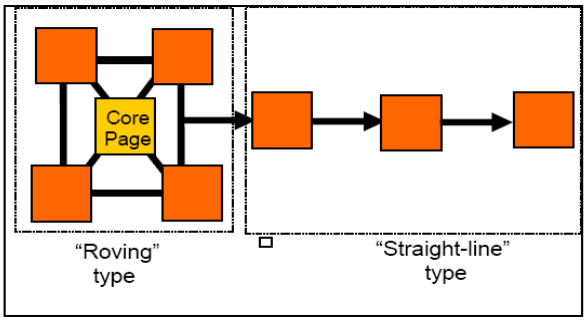

Fig. 1. Page transition model

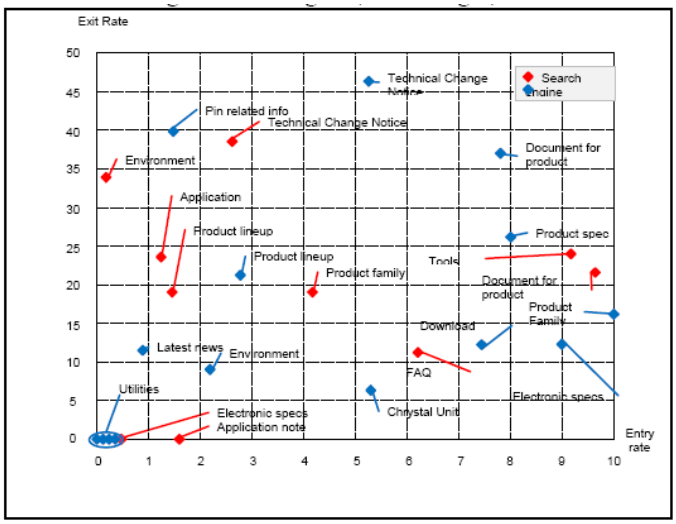

Fig. 2. Indicator analysis according to exit rate and entry rate

Typical examples of straight-line type are page transitions leading to an inquiry, purchase, or other conversion, or paths involving user registration. Fig. 3 shows a typical model of straight-line type.

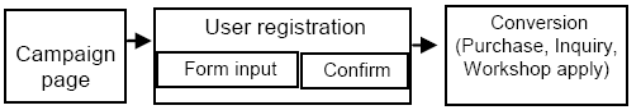

Fig. 3. Straight-line model

We found that it is especially easy for users to exit a straight-line path when they encounter an error message or other trouble during the registration process. The exit rate for the user registration screen is shown in Fig. 4. In this example, we can see that many users hesitate and exit when they are asked to specify a sales agent. This tells us that many users don't think about sales agents while they're using the website. On the same registration page, it is important to analyze where error messages occurred and where users tend to exit so that those parts can be improved. The exit rate rises even higher after an error message occurs. The final exit rates are shown in Fig. 5. With Fig. 5 we can see that users tend to exit at the password creation step, and after one look at the registration screen. We could tell that the number of input fields needed to be reexamined. After making improvements

to the form as shown in Fig. 6 (simplified multi-step form), the exit rate decreased by about 30%. Fig. 6 shows the improved user registration screen.

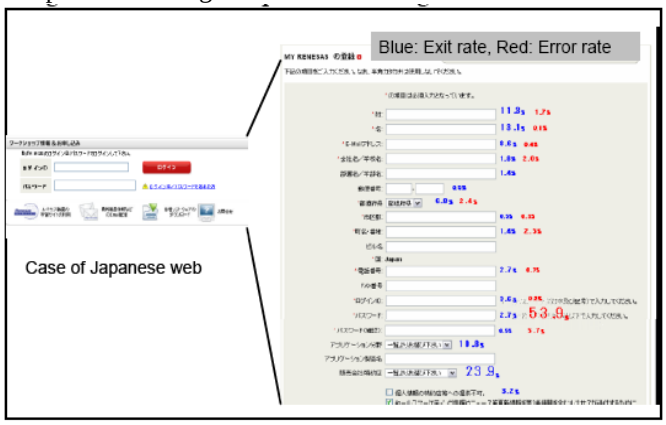

Fig. 4. Exit rates for user registration screen

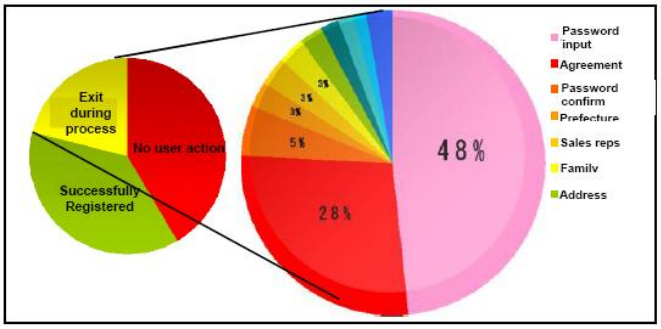

Fig. 5. Final exit rates for user registration

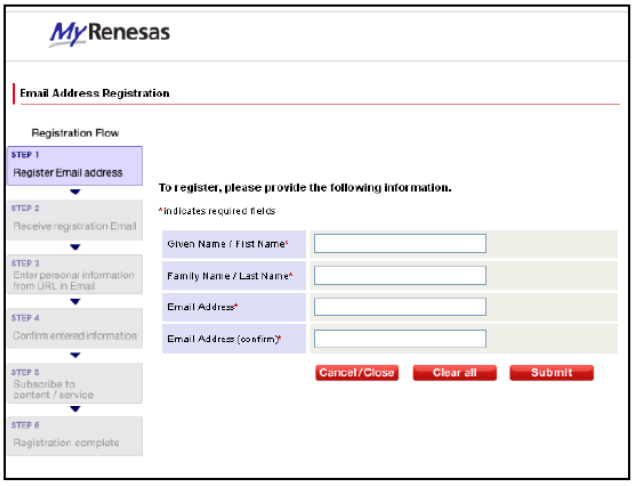

Fig. 6. Improved user registration screen

2) Step 2: A/B testing using t-test, including multivariate testing

Although web analytics can be used to improve usability, normally it is difficult to compare two user interfaces at the same time. For example, when comparing data before and after a change is made, analysis may be difficult due to seasonal or other factors for the two time periods. It is effective to use JavaScript to divide users into two equal groups for measuring conversions (inquiry, etc.). We carried out A/B testing using the t-test (a statistical technique). t-test is one of statistical hypothesis test and it is most commonly applied when the test statistic would follow a normal distribution if the value of a scaling term in the test statistic were known. Using this we can compare two interfaces over the same time period, collect data until the t-test is satisfied, and determine which interface was more effective. By using more than two (A/B) patterns, multivariate testing can be carried out for many variations and combinations. Rather than a simple page comparison, an accurate conversion comparison can be performed (for example, testing the effectiveness of different combinations of banner and position). This is extremely useful for site optimization.

Furthermore, we found that testing of users from specific regions can be performed by expanding these A/B testing and multivariate testing techniques, and then, after effective designs and combinations are identified, the techniques can be used to use to display only the effective design for access from specific regions, in what is called targeting. Fig. 7 shows an example of A/B testing, and Fig. 8 shows an example of t-test measurements.

Fig. 7. An example of A/B testing

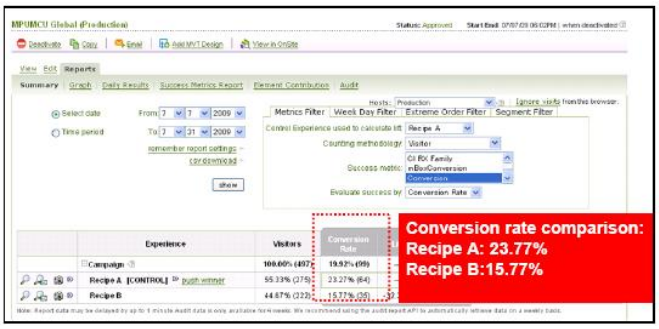

Fig. 8. An example of t-test measurements (including multivariate testing)

3) Step 3: Conversion contribution analysis

Taking a Buy action as a conversion (user goal), we would like to propose a way to analyze which function contributed the most to the conversion (contribution analysis).

In conventional conversion analysis, measurements were only performed over the same session for a B-to-C site. This is not a very effective way of analyzing a B-to-B site. Fig. 9 shows an example of a B-to-C conversion.

On the other hand, it is rare for a conversion to be completed in a single visit to a B-to-B site. There are many examples of conversions completing over the course of multiple visits over several weeks or in some cases several months.

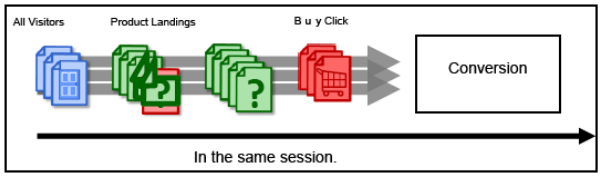

Fig. 9. Conversion on B-to-C site

In the semiconductor industry, the so-called Find (search

for a product or solution), Try (prototype using a product), Buy (purchase) model is typical, and in many cases this process is completed over the course of several visits. There are also many cases where the website is used as a supplement up to a certain point, and then the actual purchase is made via a sales agent in an offline channel. Thus, we would like to recommend measuring contribution over the long term. This will allow us to know what the user did during a long time span before the actual purchase. It is possible to measure this using cookies, access measuring tools and so on. The example in Fig. 10 shows which pages a user who pushed the Buy button on the website used over multiple sessions, or in other words contribution analysis. We analyzed the contribution of user characteristics (How did the user come to the site?) and user behavior on the site (What pages did the user view? What site functions were used?). In this example, we can see that conversions can be strongly attributed to the search engine, and behavior analysis shows that conversions can be strongly attributed to parametric search.

Contribution rate by user characteristics

Items	Mail click	Google search	Bookmark/Type	Visit at first time
Contribution rate	3.8%	54.8%	48.2%	23.8%

Contribution rate by user actions

Items	MCU Top page	Keyword Search	Parametric Search
Contribution rate	18.3%	18.4%	24.1%

Fig. 10. Example of contribution analysis

As shown in Fig. 11, if conversion occurs at during the second visit, we have the example of contribution analysis shown in table 1. Visitor participation attributed across multiple sessions is especially effective for B-to-B sites.

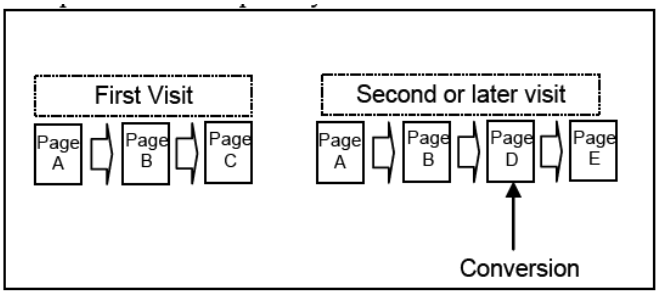

Fig. 11. Example of conversion

TABLE I: EXAMPLE OF CONTRIBUTION ANALYSIS

Page	Purchase	Participation over sessions	Participation in a session
A	0	Yes	Yes
B	0	Yes	Yes
C	0	-	Yes
D	Yes	Yes	Yes

4) Step 4: Analysis of product adoption using user registration database

For a B-to-B site, information which requires user authentication to access is more meaningful to analytics than information which can be freely viewed by anyone. The reason is because user profiles and company (organization) profiles can be logged. Although most of the information on a website can be freely viewed by anyone, key important information requires user authentication to view. More advanced analysis (especially of small and medium-sized companies) can be carried out by analyzing access logs of authenticated users.

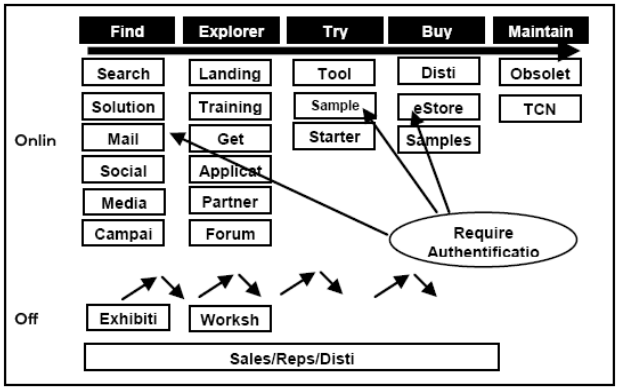

Fig. 12. Semiconductor web model and user authentication

IV. PROPOSED ANALYTICS MODEL

The semiconductor business model and the web access model are correlated.

Web analytics should be carried out based on the semiconductor user design cycle. We would like to propose the following web analytics methods for the semiconductor industry: (1) Path analysis using web beacon; (2) A/B testing using t-test (including multivariate testing); (3) Contribution analysis; and (4) Analysis of product adoption using user registration database.

We would also like to propose the following analysis model (Fig. 13).

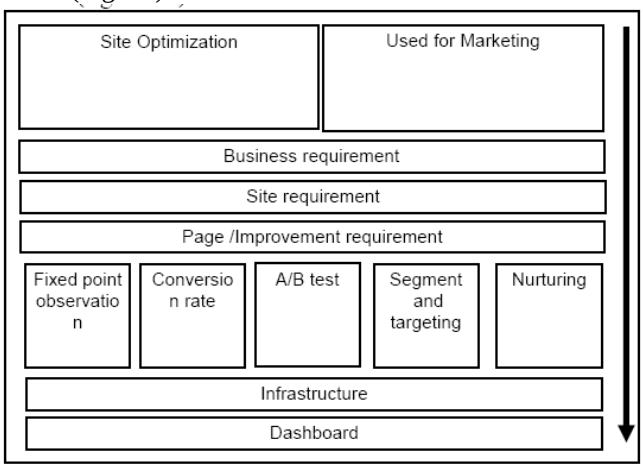

Fig. 13. Analysis framework for a semiconductor site

We would also like to propose the following as key performance indicators (KPIs).

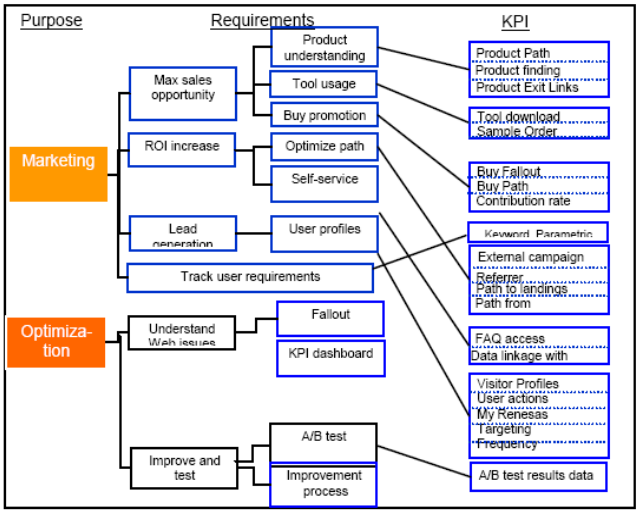

Fig. 14. Key performance indicators for a semiconductor site

A dashboard for visualizing analytics results is also required.

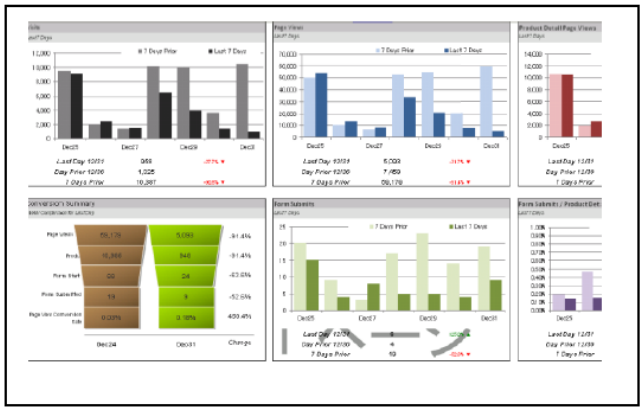

Fig. 15. KPI dashboard

V. Conclusion

The following conclusions can be made.

Visitors to B-to-B sites have a variety of goals. Therefore, the following types of analysis are important for carrying out site optimization and making use of data for marketing.

Step1: Path analysis using web beacon

Step2: A/B testing using t-test, including multivariatetesting

Step3: Contribution analysis

Step4: Relative analysis of web beacon, user registration database, and authenticated download against product performance.

It is predicted that customer tracking technologies using user registration databases and beacon analysis will become even more important with the evolution of web technology, and the time will come when the behavior of individual customers will be tracked.

References

[1] Y. Ichikawa, M. Nakamura, Y. Kishimoto, and T. Kobayashi, "A Proposal of Extracting Innovative Users with Web Access Log of an E-Commerce site," *IPSJ SIG Notes*, pp.1-7, March 2012.

[2] C. J. Aivalis, "Log File Analysis of E-commerce Systems in Rich Internet Web 2.0 Applications," *Informatics (PCI), 2011 15th Panhellenic Conference*, pp. 222-226, 2011.

[3] J. Park, K. Jung, Y. Lee, G. Cho, J. Kim, and J. Koh, "The Continuous Service Usage Intention in the Web Analytics Services," *System Sciences, 2009. HICSS '09. 42nd Hawaii International Conference* on, pp. 1-7, January 2009.

[4] T. Ejiri, "Web Analytics and Web Marketing: Access Log Analytics Realized Web Marketing Kaizen Cycle," *Management systems: a journal of Japan Industrial Management Association*, vol. 18, no. 1, pp.38-43, April 2008.

[5] P. Sampath, "An efficient weighted rule mining for web logs using systolic tree," *Advances in Engineering, Science and Management (ICAESM), 2012 International Conference* on, pp.432-436, March 2012.

[6] S. Otsuka, M. Toyoda, and M. Kitsuregawa, "A Study for Analysis of Web Access Logs with Web Communitie," *Information Processing Society of Japan (IPSJ)*, Database44, pp. 32-44, 2003.

[7] A. Phippen, L. Sheppard, and S. Furnell, "A practical evaluation of Web analytics," *Internet Research*, vol. 14 no. 4, pp.284–293, 2004.

[8] K. Rebecca, P. Justin and P. Graeme, "Ethical considerations and guidelines in web analytics and digital marketing: a retail case study," in *Proc. the 6th Australian Institute of Computer Ethics conference 2012, Australian Institute of Computer Ethics, Melbourne, Vic.*, pp. 5-12, 2012.

[9] X. Wang, D. Shen, H. Chen, and L. Wedman, "Applying web analytics in a K-12 resource inventory," *Electronic Library*, vol. 29, no. 1, pp. 20-35, 2011.

[10] W. Xiao-Gang, "Web mining based on user access patterns for web personalization": Computing, Communication, Control, and Management, 2009. CCCM 2009. *ISECS International Colloquium* on,pp.194-197, 2009.

[11] G. K. New, "Web Analytics for Security Informatics," *Intelligence and Security Informatics Conference (EISIC)*, pp. 214-219, September 2011.

[12] V. Pascual-Cid, "An information visualisation system for the understanding of web data," *Visual Analytics Science and Technology, 2008. VAST '08. IEEE Symposium*, pp.183-184, October 2008.

[13] N. O. Univ, L. Louisville, M.Soliman, E. Saka, A. Badia, and R. Germain, "A Web Usage Mining Framework for Mining Evolving User Profiles in Dynamic Web Sites," *Knowledge and Data Engineering, IEEE Transactions*, pp. 202-215, February 2008.

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