

Research on the Application of Notification Service for Service-oriented Digital Library

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Abstract: Individualized notification service is a hotspot of research on Service-oriented digital library, and one of the key problems of the realization of digital library. Based on the investigation and analysis of the research of notification service, We have concluded four modules of notification service in the service-oriented digital library: the basic notification service module, the notification service module with event channel, the notification service module with event agent and the notification service module with multi-agent. According to the reality of current practices in service, we have researched the architectures, main technique points and methods of these four notification service modules under the framework of web service and information grid. In this paper, the notification services in the individualized Portal System of Shanghai Jiaotong University Library are introduced.

Key words: Notification Service, Digital Library, Customized Information Service

I. INTRODUCTION

Active service is one of the service modes of the service-oriented digital library. The characteristic of active service is to organize and push the resources according to users' customized requests. The service type should be changed with the users' requirements and information could be transferred effectively to users. Only when we realize the individualized information service, we can provide users the pertinent, high quality and on-time information. The individualized portal system analyses the users' requirements, and provides users efficient service for teaching and scientific research using data mining and knowledge discovery technology. In the individualized notification service mode, users can design their digital library interface and customize the resources according to their individualized

interest. Users are active, while digital library is reactive, which is just push the information to users on time .

The portal project of service-oriented digital library of Shanghai Jiao Tong University is brought forward on this background. The objective is to build an individualized information service system. The primary function is integrating, managing and organizing the resources and services, to provide a clear and convenient retrieve platform for users. On the base of integrating information resources, information and internet resource navigation, this system provides users individualized customization service. Users can retrieve all the customized resource and build their individualized digital library through the unique web entrance. Besides, this system also provides users the pertinent "individualized consultation assistant".

II. FOUR MODULES OF NOTIFICATION SERVICE IN SERVICE-ORIENTED DIGITAL LIBRARY

A. Basic Notification Service Module

In the basic notification service module, the publisher (librarian) notifies the subscriber (user) by calling the subscriber's push() interface, using the events to be notified as parameters. The publisher should support "Push Supplier" interface, and the subscriber should support "Push Consumer" interface, as shown in Fig. 1.

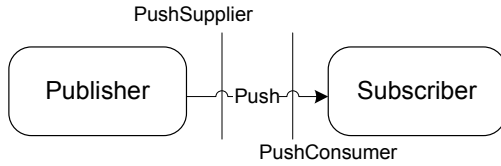


Fig.1 Basic Notification Service Module

The major advantage of the basic notification service module is that it's easy to implemented, as long as both the subscriber and the publisher support some interface or protocol. There are already several event models and protocols (e.g. CORBA, SIENA) supporting this module well. Of course, the disadvantage of this module is also very obvious, such as: the communication is real time, so notification

service is unavailable if either the publisher or the subscriber is not online at the same time; It's hard to realize the customized filtering; It's impossible to control the quality of service (QoS); Different notification systems are detached, which makes the integration of notification service very difficult.

A.1. Notification Service Module with Event Channel

An event channel can be considered as a web object in substance. The event channel receives events from multi-publishers, and dispatches every event to any subscriber connected with it. The event channel communicates with the subscribers as a publisher, and communicates with the publishers as a subscriber.

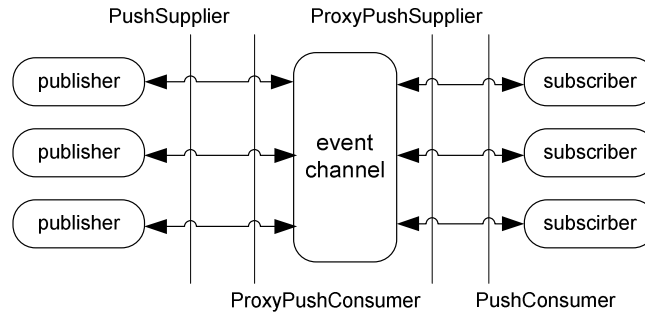


Fig.2. Notification Service Module with Event Channel

This module reduces the complexity of the communication between publishers and subscribers, and realizes the asynchronous communication. An event channel can communicate with multi-publisher and multi-subscriber, which make the large-scale integration of notification service possible. Another advantage is that this module separates publishers and subscribers, and supports the mixed communications of push and pull module.

The major disadvantage of this module is: it doesn't ensure the connection reliability and doesn't support the QoS setting and structural events filtering. Subscribers have to spend a lot of time to discard the needless events, which reduces the efficiency of subscribers.

Agent

In the notification service module with event agent, the agent manages subscription information and filters of events. Subscribers call the subscribe() interface of the agent to register the events which they are interested. There is no need for subscribers to know who publish the events. The subscription information is stored and managed by the agent. If subscribers want to cancel the subscription, they just need to call the unsubscribe() interface to stop the notification service. Publishers call the publish() interface to publish events. When the agent receives events, the agent determines the route after filtering events with the subscription information, and call the corresponding subscribers notify() interface to dispatch the events.

A.2. Notification Service Module with Event

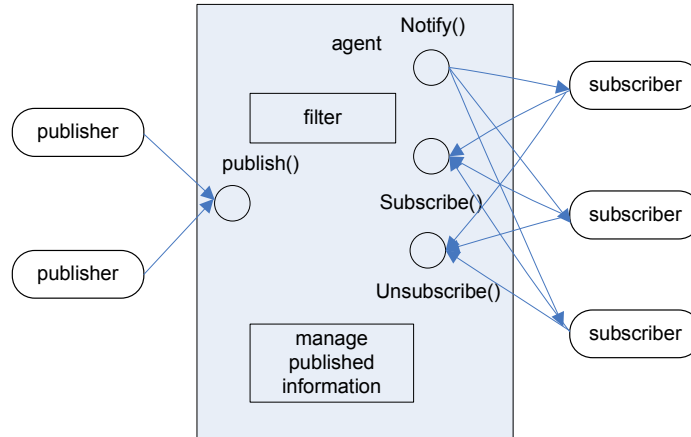


Fig.3. Notification Service Module with Event Agent

In this module, subscribers/publishers don't need to know the publisher's/subscriber's address. Subscribers and publishers do not communicate with each other directly, and they don't even know how many publishers and subscribers are involved. In the former two modules, publishers may have to support events filtering. If publishers filter the events, publishers have to manage the subscription information, which increases the complexity. In this module, neither subscribers nor publishers need to focus on the design of events filtering.

But there is an obvious disadvantage in the notification service module with event agent—the event agent may be the bottle-neck of the whole system. If the event agent goes wrong, the whole notification service will fail.

A.3. Notification Service Module with Multi-Agent

Digital libraries connect many data source, and serve large-scale users, so a centralized notification service system may be the bottle-neck of the whole system. Furthermore, when the scale of notification service becomes larger, it seems more and more difficult to match the mass data and subscription information. In the multi-agent module, each agent receives parts of events and manages parts of subscription information. Agents connect with each other via Internet. Publishers can publish events to any agent. When an agent receives events, it forwards these events to the adjacent agents and matching these events with the subscription information it manages.

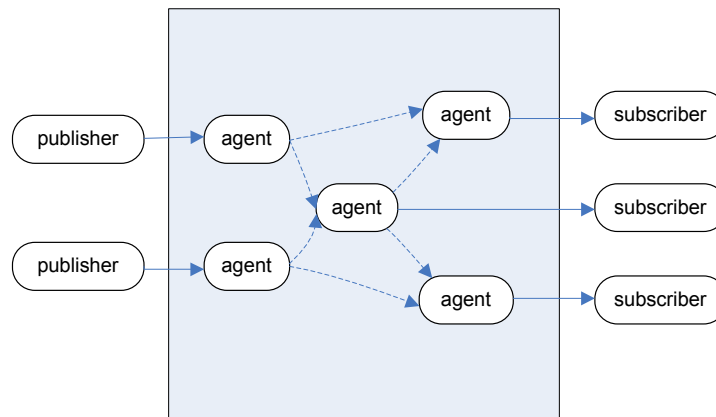


Fig.4. Notification Service Module with Multi-Agent

The notification service module with multi-agent almost contains all the advantages

of the former three modules. Besides, this module solves the bottle-neck problem of

single agent, and makes the large scale filtering possible. This module can also process more complex events, to make the notification service more customized. With the scale of notification service larger and larger, the major problem is how to enhance the cooperative efficiency of all the agents.

B. Resources and Notification Service

The chief function of the notification service module of the portal project of service-oriented digital library of Shanghai Jiao Tong University is to notify the users with the latest information they are interested in automatically without any users' information retrieval and request. The users only need to do is to register the kind of their subject. Considering the actual application of our portal system, the information types to be notified including: the subject information - internet databases, subject navigations and pertinent internet resources; the latest digital magazines users customized; the individual information - subject references, book records in the Internet Public Access Catalog System; public information - the library news/notification, new services provided by library.

B.1. Notification service for subject Resources

B.1.1. Online databases

Notification service pushes the latest information to users according to users' configuration in the customized module of the portal system. Users can acquire the resources they need at the best time, which greatly enhance the efficiency of digital resources and the quality of digital library service.

B.1.2. Subject navigation database resources

Notification service pushes the appropriate subject navigation database resources to users according to users' research registered. Usually the librarians, who have strong abilities on information consultation and retrieval, organize the subject navigation database resources. The librarians are familiar with correlative specialty knowledge, and communicate well with the professors on the correlative subject. The subject navigation database resources they organize accord with requirement of correlative subject, and are propitious to posting, releasing and utilizing of specialty literature information. These resources should be the footstone of individual notification service system.

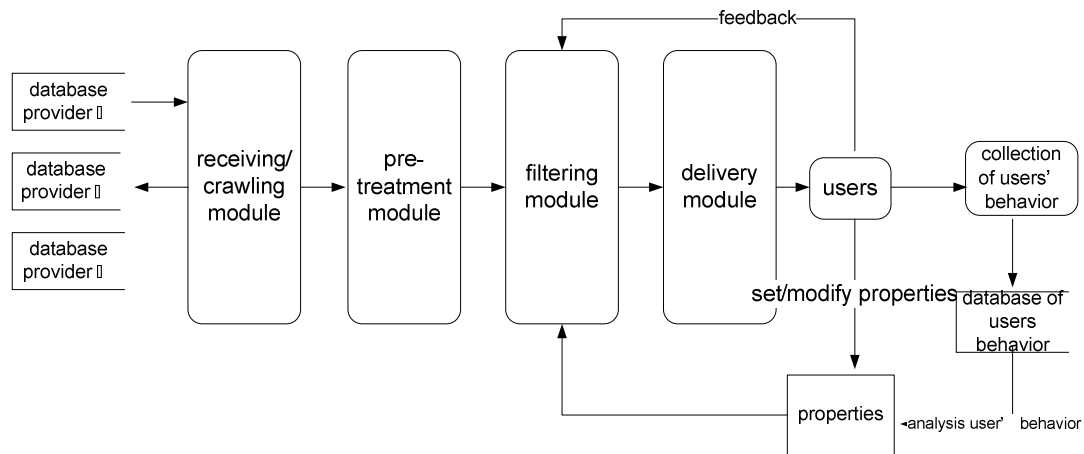


Fig.5. The frame of Notification service for online database

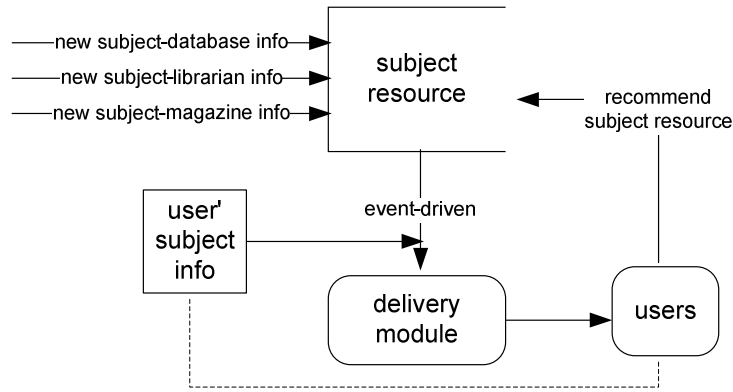


Fig.6. The frame of Notification service for subject navigation database resources

B.1.3. Notification service for Individual information

The individual information to be notified includes book checkin or checkout records in the Public Access Catalog System, new book arrivals, new book scheduled information, interlibrary loan information, virtual reference information and other individual information in the other digital library systems.

B.1.4. Notification service for information in circulation transaction

Many libraries have realized the active notification service of book recall, using email as the notification method usually. This notification service can be divided into three major modules in general: email address collection, overdue information drawing out and email delivery. The email delivering and receiving technology is relatively mature, and the information in circulation transaction demands real time, such as book recall and book hold arrival information, so the notification service is easy and appropriate to be implemented through email.

B.1.5. Notification service for other individual information

Besides, the individual information to be notified includes correlative virtual reference information, answers of the users' questions, and so on. The real time reference can be realized by the virtual reference system, while the non-real time virtual reference can be realized by the notification system. If users submit their questions through email or form, librarian analysis the question, collect the correlative information and push the answers to users through the notification service system.

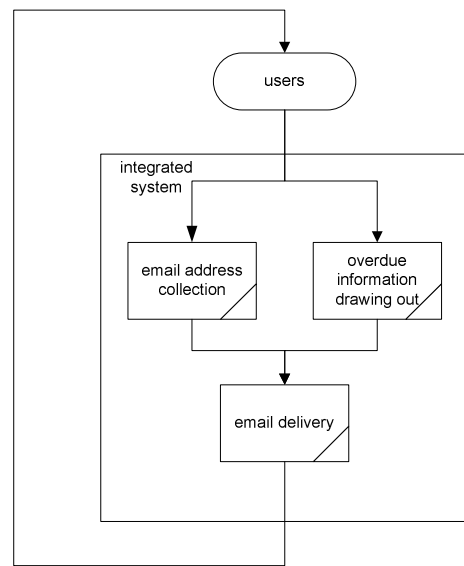


Fig 7 The frame of Notification service for circulation transaction

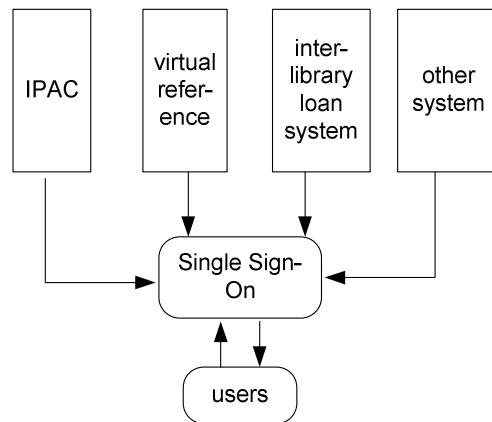


Fig 8 The frame of Notification service other individual information

B.1.6. Notification service for system information

System information includes the library news/notification, new services, readers' suggestion, and so on. These information is easy to get, so the notification of system information is relatively easy to implement, which is usually published in the system notification channels.

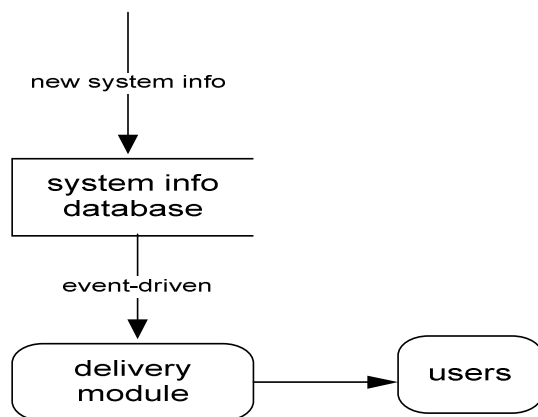


Fig 9 The frame of Notification service for system information

III. CONCLUSION

The service-oriented digital library has changed the service mode from inactive service to active service. The service depth, service contents, service quality are most concerned by users. Users much more welcome notification service because of its server model, real time, and the tightness between the contents and subject. Along with the further research of digital library technology, the efficiency and quality of notification service are enhanced effectively. By applying the new technologies, such as artificial intelligence, knowledge discovery and data mining technology. Identifying and predicting different users' hobby and choosing the logical information distributing strategy, to satisfy the different users' individual information requirement are met. The real individualized service becomes more convenient and saves the users' time, it is the inevitable trend of the development of information service.

REFERENCES

[1] Lyman, Peter, and Varian, Hal R. et al. How much information? Report from School of

Information Management and Systems at the University of California at Berkeley, <http://www.sims.berkeley.edu/research/projects/how-much-info/internet.html>

- [2] Boston Library Consortium. The Portal Investigation Task Force Final Report. 2002, June
- [3] Mary E. Jackson. The Advent of Portals. Library Journal, 2002, n9
- [4] Library of Congress Portals Applications Issues Group. List of Portal Application Functionalities for the Library of Congress—first draft for public comment, 2003, July 15
- [5] Zou Kai Wang Quanli. Intelligent Search Engine and Digital Library's Personalized Service, Journal of Information Science, vol.1 22, No1 7
- [6] Bai Xue Song, Research on the Application of Notification Service in Digital Library, Thesis of master's degree, 2005
- [7] Jones, Michael B, Theimer, Marvin. Herald: Achieving a global event notification service Cabrera, Luis Felipe (Microsoft Research, Microsoft Corporation), Proceedings of the Workshop on Hot Topics in Operating Systems - HOTOS, 2001, p 87-92
- [8] D. Faensen, L. Faulstich, H. Schweppe, A. Hinze, A. Steidinger. Hermes: a notification service for digital libraries. JCDL'01, June 24-28, 2001, Roanoke, Virginia, USA.
- [9] Xue Tao, Feng Boqin, Design and Implementation of Content-based Event Notification Service for Digital Library, Mini-Micro Systems, Vol.25 No.3 Mar.2004
- [10] Wang Yang. Research on Key Technologies and Application of Distributed Event Notification Services. Thesis of doctor's degree 2004.