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Device Management System Using Group Information on SNS

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Abstract. Recently, ubiquitous networks have become increasingly popular and many devices are connected to them. Devices owned by individuals will proliferate in the future, and we can obtain much information from them and new services will be generated. To use such services, a device management system is quite important for using and controlling the devices. In this paper, a device management system using SNS information is described, and the basic design of the proposed system is discussed.

1. Introduction

In home network systems, home appliances and sensors are connected to the network, and the home network systems provide more convenient and comfortable services to users. For those services, sharing information among users (e.g. colleagues, friends, and families) is important for coordinating the appliances and sensors. Digital content such as photos, music, and videos are stored in appliances, and that digital content is used via a home network system interacting with sensors.
The number of home appliances and sensors connected to networks is increasing, and the information used by them will also increase. Thus, to coordinate those appliances and sensors adequately, a device management system is needed.

On the other hand, the social graph used in social network services (SNSs) is also getting popular for web services to manage and share information of users. The social graph consists of information about the relation between users and its reliability. The information is often used for authorization, sharing, interaction and so on. The social graph information can be seen as a de facto standard for web services.

However, conventional device management systems cannot handle social graph information, and such information is not designed for conventional device management systems. Thus, the information should be handled by each device management system, and its data should be available to achieve sharing of information and cooperation.

This paper discusses a new device management system using the social graph employed by major SNSs. Moreover, the system can handle not only users but also devices or content. The new device management system will create the connections of the real world on the Internet, and convenient and comfortable services can be achieved by employing social graph information.

2. Related Works

2.1 SNS

SNS is one of the web services and is attracting user attention in the web service area. The social graph is the key information used in SNS. The social graph represents the connection between a friend and an acquaintance who know each other in the real world. In SNS, a user can share information only with a trusted user by using the social graph. In recent years, SNS services have been evolving, and many APIs for social graphs are open to the public. Users can freely use the social graph by using the APIs. We describe some features of existing examples: mixiOpenID [1] developed by mixi and Open Social developed by Google.

MixiOpenID is an open service that certifies user information using mixi's OpenID registered on mixi's server. The social graph is provided only for registered users and the information is restricted to only registered users. The group information provided by mixi is similar to the group information

provided by Facebook [2]; if we can handle their basic group information, the group information of twelve major SNSs can also be used in the same manner due to the common data format. Open Social [3] is also an open system providing WebAPIs and is designed for supporting major SNSs developed by Google. Major SNSs such as Orkut, MySpace, and mixi employ the OpenSocial system. The OpenSocial system coordinates a web service with another web service in different SNSs using APIs. For those works, group information and its format are unified into common information for each SNS. The OpenSocial system can unite different APIs to access the social graph and can coordinate different SNS services in the same API by uniting formats. Common APIs can be used when group information on an SNS that corresponds to the OpenSocial system is used, and group information can be used more easily.

2.2 Device Management System

In this subsection, we describe several works focusing on SNS and device management systems. In [4], SNS information and DLNA digital content are associated with each other; the key feature of the study is that an authentication server is replaced with a group information gateway using SNS for DLNA content. The home gateway and API of SNS are coordinated with each other. In this case, the group information is used only for the certification, and group information on SNS for device management is not addressed. Web of Things [5] is a mechanism that connects devices and sensors to the REST architecture through the gateway, and also connects them to the Internet. If Web of Things is achieved, not only the cooperation of a device in a real space and a sensor but also web service will be included in the same manner. For those previous works, a developer is not needed to construct a user database, and the authentication system of a user's database and the social graph enable a developer to construct a database easily. Users registered in group information on SNS can share the information with other trusted users.

2.3 Problem

If users share information by using the social graph, sharing the information enables users to use information more significantly. However, no studies focused on employing SNS and devices. This means that group information on SNS has been used only for the certification for sharing in previous studies, and it is necessary to examine the management of devices connected with the network. Thus, its design should be considered.

3 System Design

To solve the problem described in the previous section, we discuss a new device management system and its design alternatives.

3.1 System Requirement

The function required for the device management system that uses the social graph is shown in the following. They are user management and group management functions.

User Management: When a user shares information obtained from a device, the information must be accessed only by a specific user defined by the social graph. Information is shared by several users. Therefore, a user management function is needed to design an access control mechanism that supports multiple authentications.

Group Management: The information group function used in SNS does not identify devices and users. The function in which the device is newly registered to the group is handled by users. This function also requires a device to be registered by the group the same as with conventional SNS functions, and device operation and information sharing between users in the group should be managed in the same manner.

3.2 Device Management System using SNS

To meet the above requirements, we propose a device management system that allows multiple users to share information and manage network devices. The device management system for the SNS group information requires managing the group for certification. Group information on SNS is used, and

group information that already exists can be used. In addition, it requires management of the new group information. Therefore, it becomes possible to construct the system easily by using group information on SNS for the device management system, and to achieve sharing with higher reliability.

3.3 Management Functions

User Management: Group information in SNS is effective for connecting trusted users, and for sharing information that is not intended to be open information. User management is achieved using the API provided by the SNS group information obtained from conventional SNS, and the range for disclosing information can be specified. Also, sharing with trusted users would be available. In the case where several users share information, group information available in the SNS can be used easily because it already contains information of relation between the users. Figure 1 shows an overview of the user management function. As shown, the information obtained from a device connected to the network device management system is coordinated. Group information on SNS is used for the certification when a user accesses the device management system. At that time, the device management system acquires group information from SNS. The device management system judges whether to authorize a user to access information based on group information on SNS and permits sharing the information for disclosure. In that case, the sharing is certified according to group information. Therefore, it is also possible through the device management system to allow user access from the same group. The access of multiple users from the user who belongs to the same group becomes possible by using information from the SNS group as the attestation management mechanism.

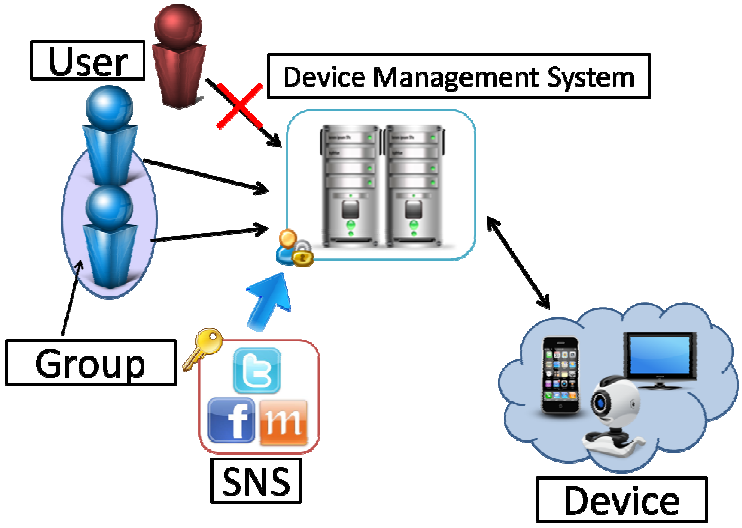

Fig. 1. User Management

Group Management: Figure 2 shows an overview of the device management function. The group management function handles one device as a user. Consequently, information of the device can be seen like that of a user and can be used by anyone who belongs to the same group. It is possible to manage groups to register new users and groups to be treated like a user's device belonging to the group as shown in Figure 2. In addition, groups can be added freely to the network that owns the device. However, group information defined by SNS is only a user's connection and does not have the connection to the device. Therefore, it is necessary to add the device to the group. Then, the user and the device for which the user discloses information based on group information on SNS are selected. Also, it is assumed to be a system in which the user can construct a new group. Group information on the device is not defined by SNS, so it is necessary to offer the function of the group management that handles the equipment with the user as the same group. In addition to this feature, the group management function enables equipment to be added and deleted based on group information on SNS. Using the connection of the user constructed with SNS in the real world mutually by using group information on SNS becomes possible.

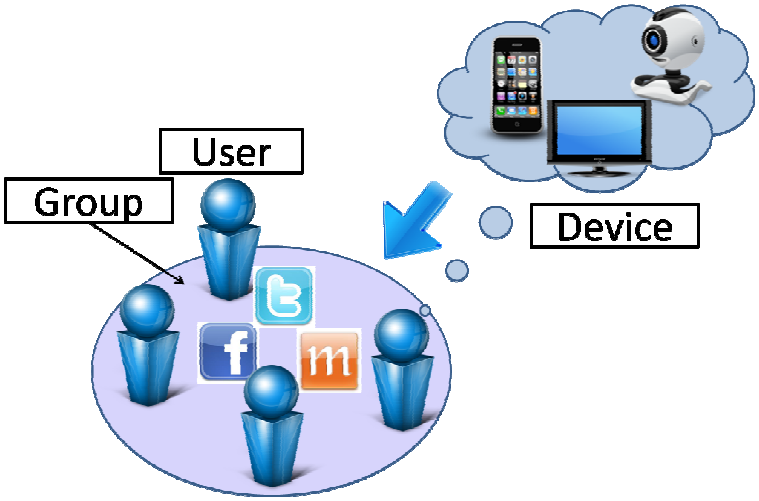

Fig. 2. Group Management

4. Implementation

4.1 Basic Schemes

The main point of the design for the device management system is where the information should be placed and be managed. Two types of schemes can be considered, and they are the server-side scheme and client-side scheme.

Information on SNS (server-side scheme): This scheme entrusts them with everything on the SNS side as for information and the operation of the device. Currently, SNSs already have a mechanism to share photos and video. We can apply this mechanism to SNS devices as well.

Information on middleware (client-side scheme): This scheme is registering device information in a middleware system and gateway. SNS is used to acquire group information from the middleware. For this scheme all data is placed in the gateway.

4.2 Server-side Scheme

The scheme of maintaining information in SNS is a method of registering the device in SNS as a user's possession. Figure 3 shows the outline of the system configuration that maintains information in SNS. Currently, users can share photos and videos in the SNS. The server-side scheme is a system to share the devices as well. In that case, device information registered in SNS is as follows. The first information is what function the device has. Second is the owner of device. Third is device identification. The advantage of this scheme is registering device information on the SNS side where the management of device information is needless. Also, everyone can easily use it because it does not pass systems other than SNS. The operation of the device becomes possible on SNS, which is only sent group information.

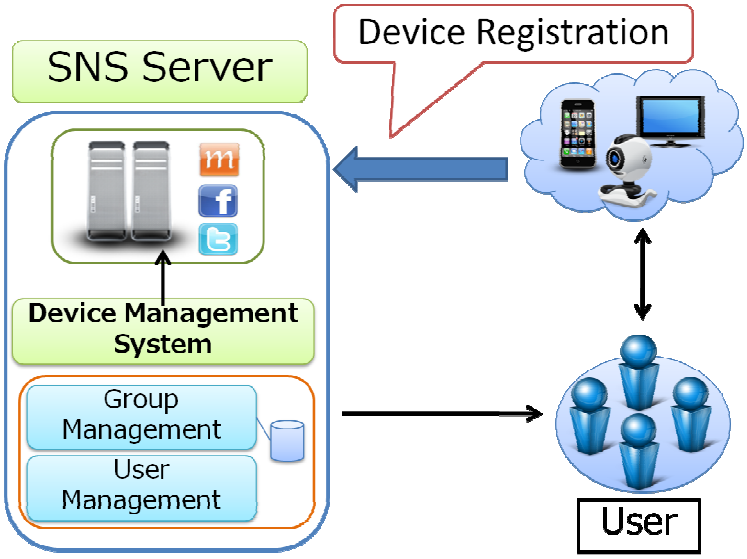

Fig. 3. Server-side Scheme

4.3 Client-side Scheme

The system with device information is different in this scheme. The system is built to hold the device sharing or the gateway has device information. The rest are all made by the system that holds the device information. When information is presented to the user in this method, the system integrates group information acquired from SNS and maintained device information. The advantage of this scheme is a user can access the device without accessing SNS, and the user can freely customize the device management system.

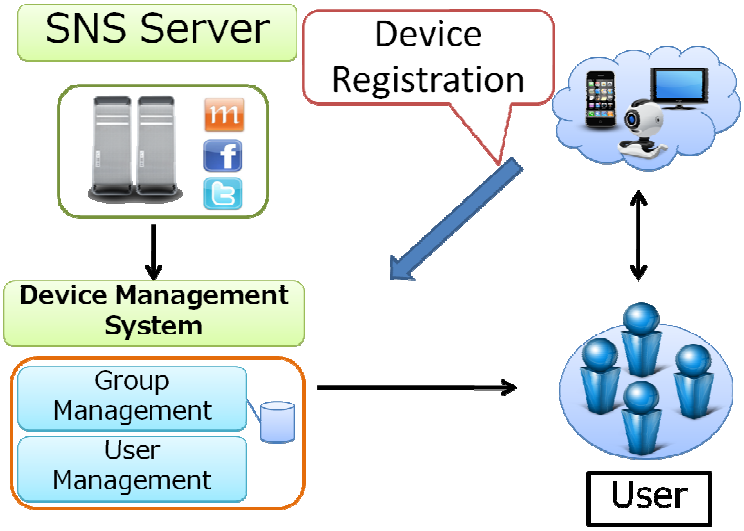

Fig. 4. Client-side Scheme

4.4 Discussion

Information on the SNS method has all the information because of the SNS, less burden of managing device information and an administrator is not required. However, the system cannot be changed freely by the user, the device is not available and there are disadvantages that do not correspond to the device management system. Thus, while our schemes can be readily available to users, the user cannot freely customize them, the user must leave all changes in the specifications and so on. For the client-side scheme, information on the middleware has the device management system and can be customized. Users can operate the device without going through the SNS. The user is only required to consider the relationship between the device and device management system. On the other hand, there is a need to manage information such as device information; the administrator of the device management system will need to manage information.

5. Conclusion

This paper proposed a new device management system to apply social graph information that is available in the SNS group to the device management system. The device management system allows multiple users to share information and manage network devices by using SNS group information. The device management system requires functions of user and group management. Group management handles the registration of the device, and user management handles the user attestation and information sharing. Two kinds of schemes are proposed and their validity was demonstrated.

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