

Applications of SIONet, an Advanced P2P Platform

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Abstract

The semantic information-oriented network SIONet is an advanced peer-to-peer platform. It enables the formation of communities for a wide range of situations, from people sharing the same hobbies to workers collaborating in an enterprise. This article introduces two SIONet-based applications. One enables easy creation of a general public community; the other offers a cost-effective business solution.

1. Free formation of communities

We have developed a P2P (peer-to-peer) information exchange community application based on SIONet (semantic information-oriented network). It is aimed at people who would like to be part of a community of like-minded people, with whom they can share information with confidence, or who have been seeking the kind of community where they can exchange only information of interest to them, or who wish they could start up a knowledge-sharing community, but find the storage and communications hardware requirements too expensive. Users can participate simply by obtaining an admission ticket to the community and plugging it into this application. The “ticket” is a kind of macro program, which can not only be designed and distributed by the community creator, but also created freely by ordinary users from elements matching their own preferences. It allows users to take the initiative in building communities with self-organizing capabilities.

2. System features

P2P networks, in which individual machines on the network communicate directly with each other, are attracting considerable attention, especially as users

increasingly upgrade to always-on broadband connections. Machines on a P2P network publish and share their own content. The “P2P information exchange community system” introduced here lets individual users store the content they want to publish on their own machine. Unlike the traditional client/server systems, in which content is stored centrally and high-speed links and large-capacity storage devices are necessary, this system can easily support scalable communities made up of user machines alone, so it holds true to the P2P principle. In this system, a “ticket” is used to link members (peers) having the same interests or objectives. This ticket is a GUI-based macro specifying the format of the information exchanged in the community (GUI: graphical user interface).

Suppose, for example, someone wants to form a community about noodle shops. A ticket to this community can be created by assembling GUI objects in the application, such as a set of radio buttons indicating different kinds of noodles, a pull-down menu for selecting ratings, or a textbox for freely typing in comments. A wide range of communities can be formed using these functions, enabling users to participate in communities of their own liking, which encourages the emergence of a self-organizing community model. Moreover, unlike conventional P2P networks, where information sharing is based only on fixed keywords such as the names of files to be exchanged, this system makes use of multiple metadata attached to the information to be published, for

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more flexible information searching and exchange (Figs. 1 and 2).

3. How it works

With this system, the community creator defines the information format and digest format (properties) to be used in the community. When participating members generate information, the information content is stored in their own personal computers (PCs), and only the digest is published in the community, as metadata (semantic information). This system is based on SIONet and uses the matching semantic information capabilities of SIONet to match members of the community. A user searches for matching users by sending a message to the community network. When a user sends a message with keywords set for each item, using the defined format, the system looks for matching keywords in the published digest information, and if it finds any it notifies the digest publisher by sending a message. If the user wishes to

deliver content at the time of the search, the content can be attached to a message and sent out with keywords (semantic information) included, so it will be delivered only to users who have indicated by their choice of keywords that they want to receive it.

4. Software configuration

The system is currently implemented as software running on Windows PCs. As shown in Fig. 3, this software (the P2P information exchange community system) consists of SIONet, community platform software (middleware), and a simple ticket processing module. The community platform software offers a framework of "tickets" to make it easy to create communities and can run tickets directly. The simple ticket processing module can run simple tickets created by the ticket creation tool.

A ticket is created by the community creator using the supplied offline tools. A user wishing to take part in a community obtains a community access ticket

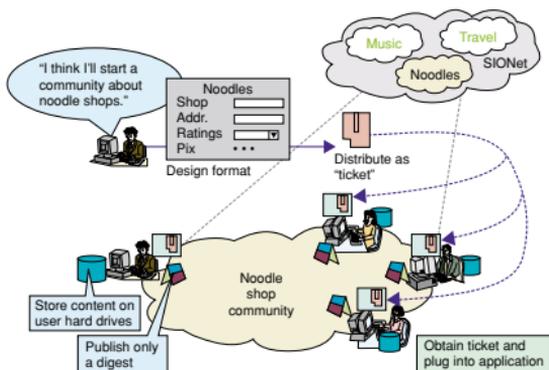


Fig. 1. Example of a self-organizing community.

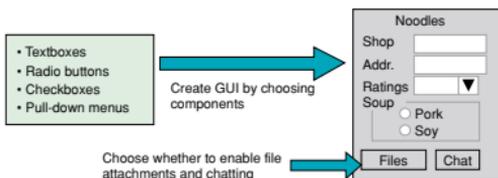


Fig. 2. Example of a ticket.

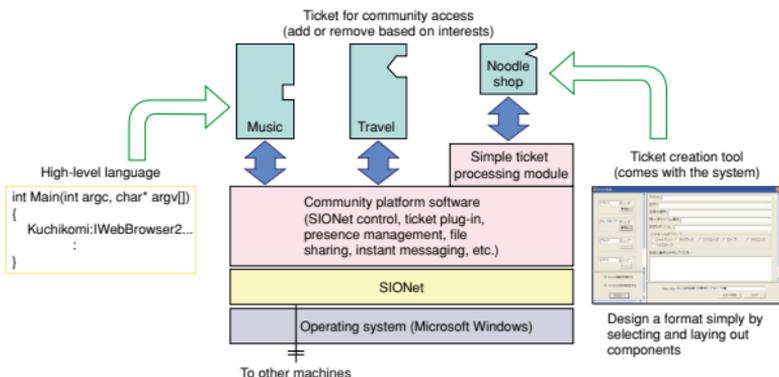


Fig. 3. Software configuration.

provided for that community and plugs the ticket into the above P2P information exchange community software. Tickets can be passed to members in various ways, depending on the type of community operation chosen. One way is to make tickets available on a Web site, in which case the community is an open one. Another way is to form a closed community, with tickets being shared only among a group of acquaintances. The ticket contains information for connecting to SIONet, the information content format and digest format, and the community GUI information. The ticket GUI portion can be written in Visual C++ or some other high-level programming language, or more simply using the ticket creation tool that is part of the community platform software.

5. Network configuration

The system takes a hybrid P2P approach, in which content searching is performed by a dedicated PC. Like similar P2P systems, files and other content are stored in the PCs of individual users. Users connect to the search PC by SOAP (simple object access protocol), a general-purpose Internet protocol. Measures are taken to allow communication even if a firewall or NAT (network address translation) is used between the parties. The search PC is located outside the firewall in the case of an Internet environment, or else in a DMZ (de-militarized zone), enabling queries from users to be accepted. If the community member peers are inside their own firewalls, relay peers called ren-

dezvous points are deployed, with communication turn taking being brokered through these points. An authentication server can also be introduced into this configuration if the service requires it. Currently RADIUS (remote authentication dial-in user service) authentication is supported (Fig. 4).

6. Typical applications

Some examples of applying the system to communities are introduced below.

6.1 Local community service

These days, with broadband network environments being widely available and ordinary households hooked up to the Internet day and night, it would be desirable to have services that enable citizens to obtain information of use in their daily lives. With conventional BBS (bulletin board system) services, however, it is difficult to limit the information to that closely geared to local residents; moreover, as the service expands, the costs for service provision and for server and network maintenance go up.

In contrast, since the community system introduced here uses P2P technology, it can be expanded easily without the need for high-end servers and the like. Large files are stored in the terminals of individual users. A low-cost community-run service can be provided simply by installing a search PC and rendezvous peers PC as needed. It is also possible to sell the equipment needed for a community as a logical

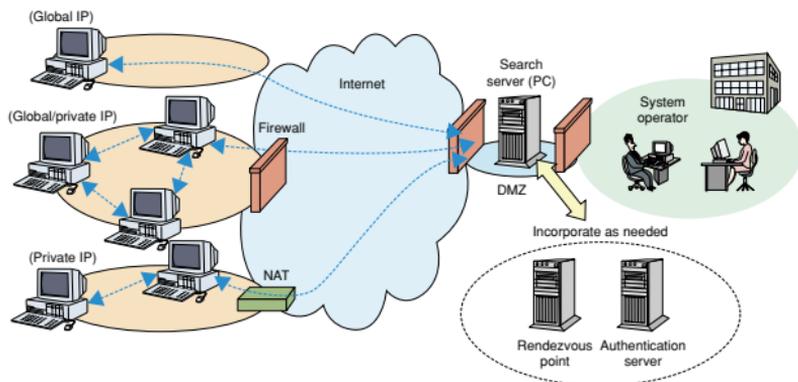


Fig. 4. Network configuration.

network to service providers, separately from the basic services.

The ticket-making function provided by this system simplifies the formation of communities in which users can exchange information of interest to them, making it easy to form communities based on all kinds of ideas. For example, there might be a community about good places to eat, or about good spots to catch fish, or about strategies to employ in exams. Tickets could be shared within a closed group, so as to maintain a well-ordered environment for sharing content with confidence. In ways like these, participants in this community system could themselves take the lead as community creators and have other members take turns to lead in the free community organization.

6.2 Knowledge-sharing in educational institutions

In schools and other educational institutions, courses could be taught more efficiently and made easier to understand by sharing the material created by instructors and their instructional expertise. Using this community system, it is possible to set up a seamless information exchange environment among teachers that is not limited by school or district boundaries, without the need to install large-scale servers. Authentication can be applied in each community to enforce the participation rules, such as whether only teachers may access the content or it is also open to students.

6.3 Street movies

Peer terminals connected to webcams located at particular spots in towns can record video images and exchange them using this system, with the aim of energizing communities. For example, a peer terminal might be placed at a noodle shop and broadcast information about the atmosphere and service at the shop. The impressions of customers themselves after eating at the shop could be recorded as video files. Digest information (metadata) about the person who shot the scene and summarized the customer impressions or ratings could be attached to the files for registration as community content. Similarly, video and still images of the cook preparing the noodles and of the noodles themselves could be recorded. Members of the community could then obtain fresh information about the shop by keyword-searching related to noodle shops. A chat function or the like might be used to give the service an even deeper sense of community.

In this system, the video files themselves are stored in user terminals, with only the digest information being published in the community. Thanks to the P2P architecture, the system can be configured from ordinary PCs having only modest storage capacities, processing power, and bandwidth, even though the video data handled is rather large. In other words, it takes full advantage of the high scalability of P2P. Moreover, it is possible to search for video files not by matching file names, but based on the file metadata, for greater flexibility and more details.

7. SIONet applications in the corporate arena

The communities suggested above are for the general public, with the emphasis on common interests, but there may also be a large potential demand for enterprise communities using P2P. One reason is that the server-less P2P configuration can cut costs compared with existing client/server solutions. A typical example is P2P file sharing among users in corporate offices. Today there is growing use of storage services, supporting file sharing among members in offices, and file backup by outside centralized storage equipment. These services allow files to be accessed not only in the workplace but also from home or while on the road. When the service is based on client/server technology, the cost burden increases as the number of users and access frequency grow. It should be possible to reduce these costs by having the file share processing handled by direct communication between individual peers. This would greatly reduce the disk capacity needs, processing load, and bandwidth needs. At the same time, by providing office members with the kinds of community functions described above, as groupware services, the system could be used for much more than simple file

management, with features like information and knowledge sharing, chatting, and other kinds of collaboration among members greatly increasing the attractiveness of the services.

As illustrated in Fig. 5, the storage access load can be alleviated by having files usually exchanged directly among users in an office, based on the P2P model. By limiting the use of the storage to cases where a worker is out of the office, one can reduce the facility and operation costs to a fraction of those for a conventional storage system. The system is made even more usable by its use of metadata rather than relying simply on file name matching for file searches.

8. Conclusion

This article gave some examples of community services and business models using the P2P architecture of SIONet, but these barely scratch the surface of the potential of P2P. SIONet is a platform that supports self-organizing communities. By incorporating applications created by users in actual field situations, we intend to actively promote P2P-based business.

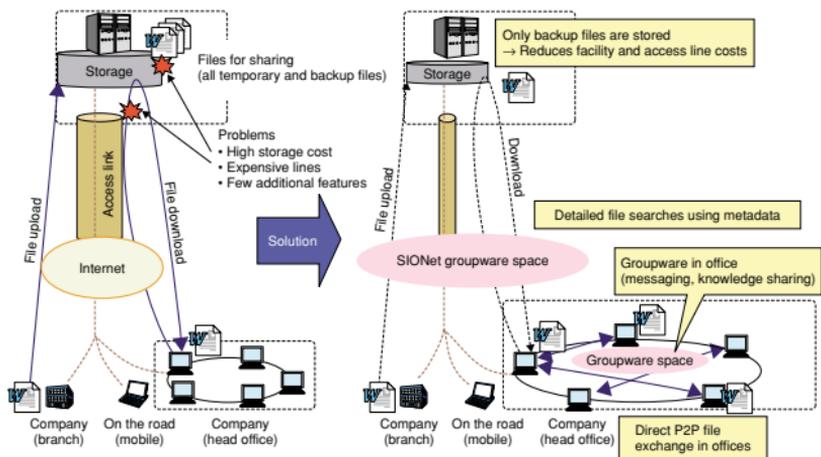


Fig. 5. File sharing system for enterprise communities.


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