A Study on the Formation of Communities Using Broadband Networks

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Abstract

The diffusion of optical-fiber networks in recent years has made it easy to provide broadband capability, thereby holding out the possibility of transforming the business sector and society at large. Because broadband networks support video and voice as means of communication, people are able to communicate even if their capabilities for information input and output are low. This article surveys customer networks and related technological trends in relation to the addition of functions supporting the formation of communities, so as to enable local communities to make effective use of broadband networks.

1. Trends in Community Networks

The term community network is used in a variety of ways: some typical examples are discussed here. Community networks are being examined at the local level, separate from commercial networks that use the Internet, e-mail, or some other technology as a means of communication. Linking these local community networks to global networks enables users to communicate with other people throughout the world. Such networks are referred to as community area networks (CANs), and the people who use them are called netizens.

Community networks are also being discussed in the context of e-democracy, which has been defined as representing the next generation of electronic government. This is indicative of the impact of the information technology (IT) revolution on everything, beginning with the economy and extending to government systems, political systems, medicine, social welfare, education, and communities, and its potential for radically transforming conventional personal and organizational relationships [1]-[4]. It is projected that the effects of the IT revolution will probably spread though all social systems in general in the next twenty years or so.

There have also been reports of various examples of community networks that are being considered as a means of countering the unilateral concentration of population in large cities Such networks are being examined with the aim of correcting regional disparities and revitalizing local communities, among other objectives. Moves are also being made toward the formation of new communities, including the construction of local CANs centered on schools.

Meanwhile, there are reports of communities being formed as a result of people congregating in certain particular places, notably condominium complexes [5]. Such communities are useful for enhancing the convenience of condominium residents with respect to security, disaster prevention, building repairs, and so on, and they improve the daily lives of people within their own respective areas. Priority is put on resolving issues of mutual concern to community members. As indicated here, community-based information systems are strongly expected to serve as next-generation networks.

2. Nascent New Communities

There are signs that new communities are needed in place of traditional physical ones, in conjunction with

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the aging of the population and advances in telecommunications.

(1) Fulfillment of communication needs

For retirees, communication with other people makes their lives much more worthwhile. There are demands for means and methods that facilitate even more seamless and simpler communication.

(2) Revival of community awareness by enhancing communication

Advances in telecommunications have brought about new modes of work, including working at home, and it is likely that more people will have closer ties to their local community in future. Even now, there are people who feel something is lacking in weakened human relations and desire new forms of community.

(3) Renewed awareness of communities as communal societies

In newly developed urban areas populated by a mixture of various sorts of people, there is a budding consciousness of the need to protect children, along with a renewed awareness of the need to have a community network as an emergency system for dealing with earthquakes and other disasters.

On the other hand, also important to the formation of society are ties consciously selected by people having similar interests stemming from their physical association with and connection to the local community. Accordingly, while the importance of the local community may be declining owing to the formation of networked communities, the value of the local community is once again being recognized.

3. Broadband Community Overview

Figure 1 illustrates the construction of a network that embodies functions for forming the communities mentioned above. Unlike traditional networks, it is envisioned here that a network is constructed as an amalgamation of several community networks. Individual users are conscious of building their own networks, and the community can determine what functions are necessary. Because networks are delineated on the basis of individual areas, they can incorporate a myriad of functions depending on the will of the community members, instead of being uniform as they were in the past.

For instance, installing optical fiber in a condominium complex achieves a sophisticated, high-speed communications environment. Various specific ways of constructing such a network are conceivable, such as by asking a telecommunications carrier to build it or by utilizing the carrier's service menu.

Community networks may take many diverse forms and several possibilities are conceivable for their scale. Here, we consider each network being constructed in a star-shaped configuration with external

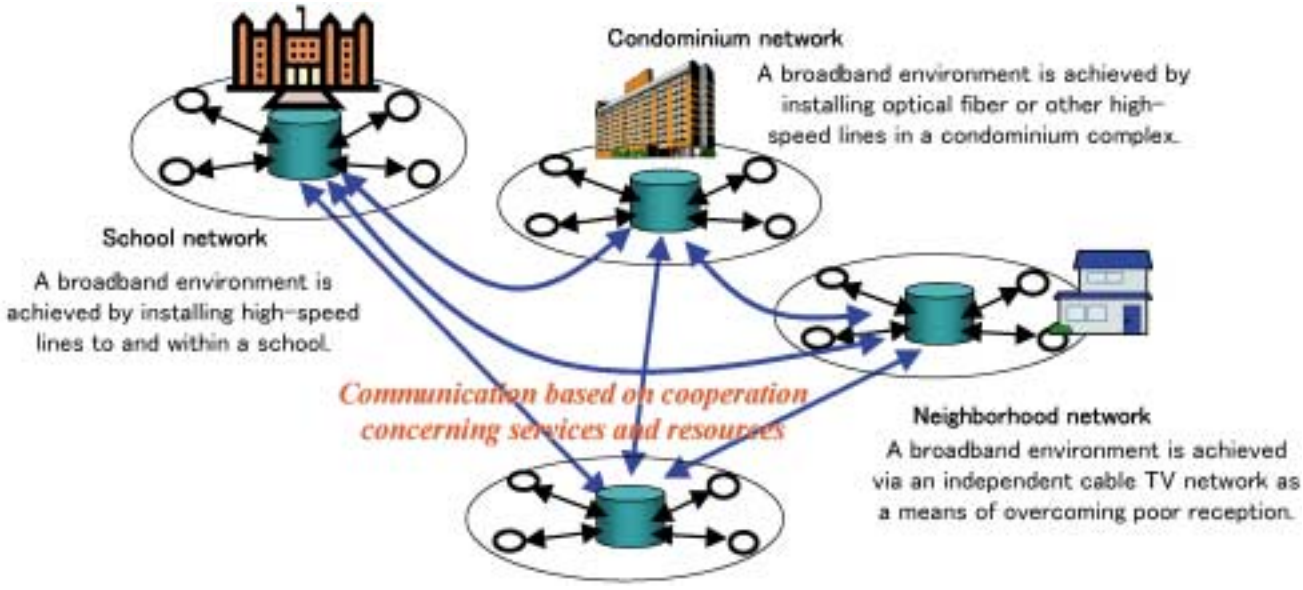

Fig. 1. Construction of a community network by linking small-scale networks.

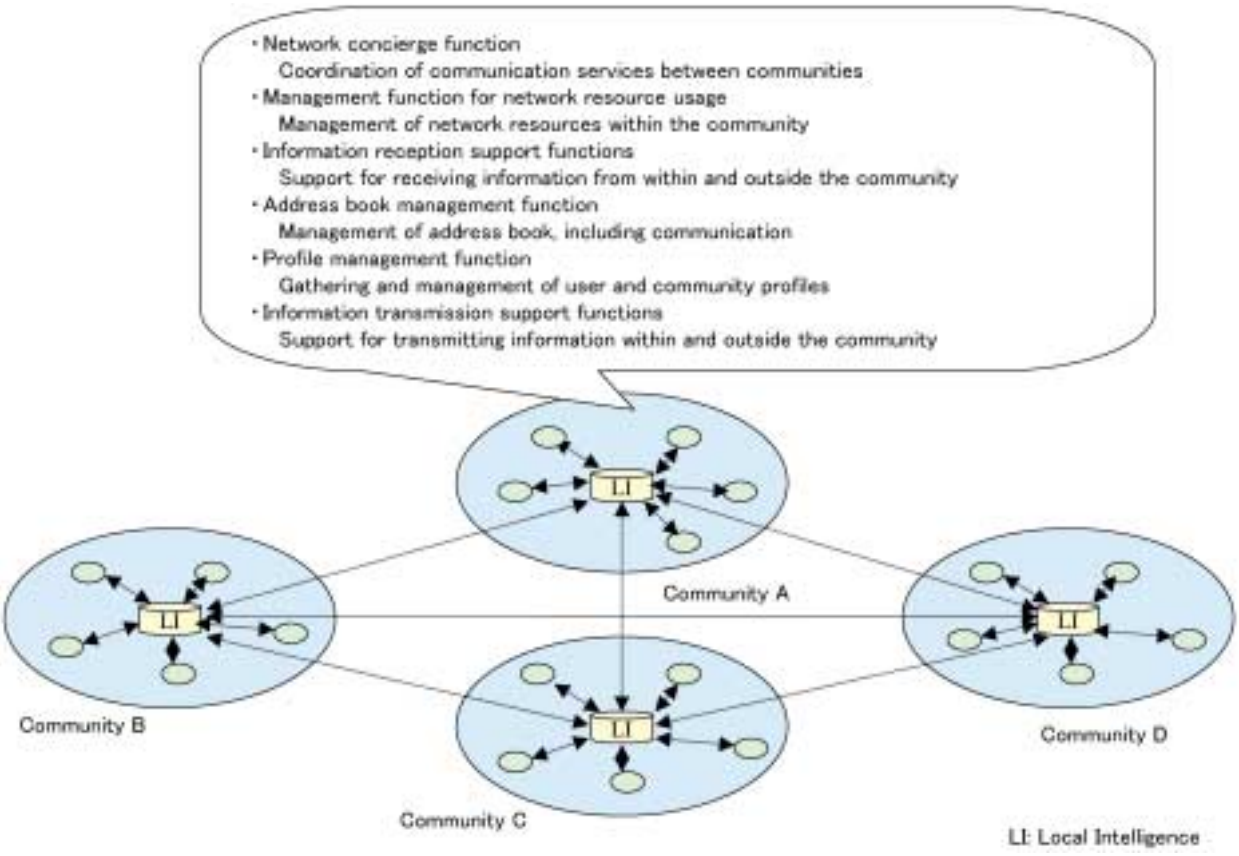

Fig. 2. Architecture of area community network.

connections made by means of Local Intelligence (LI)[*1]. A generic representation of the architecture is shown in Fig. 2. It is considered that LI embodies the functions needed to form communities.

By adopting a hierarchical structure within communities, it is also possible to construct them of sub-networks. For example, a home network is regarded as being one sub-network, and a condominium network is presumed to constitute a community network. Schools, offices, and other places also form similar communities. Additionally, an administrative division can be viewed as constituting an area community network as a result of combining a number of condominium networks. By constructing a community network with this type of hierarchical structure, it is possible to gather information from outside the area in response to a variety of needs and to provide information everywhere within the area in accordance with the desires of the area's residents, as outlined in Fig. 3.

*1 Local Intelligence (LI) is defined as server functions that support information exchanges and network maintenance and management, among other capabilities.

4. Study on the Formation of Broadband Communities

It is assumed that a broadband community can be represented with a three-layered model, as illustrated in Fig. 4.

Lower layer construction

The lower layer provides the network, which can be constructed of metallic cable, wireless links, optical fiber, or other technologies. A wireless or metallic cable network is simple to build, but there are limitations on the transmission distance and speed. Considering its properties, optical fiber [5] is recommended for forming communities.

Middle layer construction

The function of the middle layer is to promote the sharing of information between communities. Because communities are formed independently of one another, a function for enhancing the communication of information is necessary. A common framework must be built that enables communities to discover and utilize each other's resources, while at the

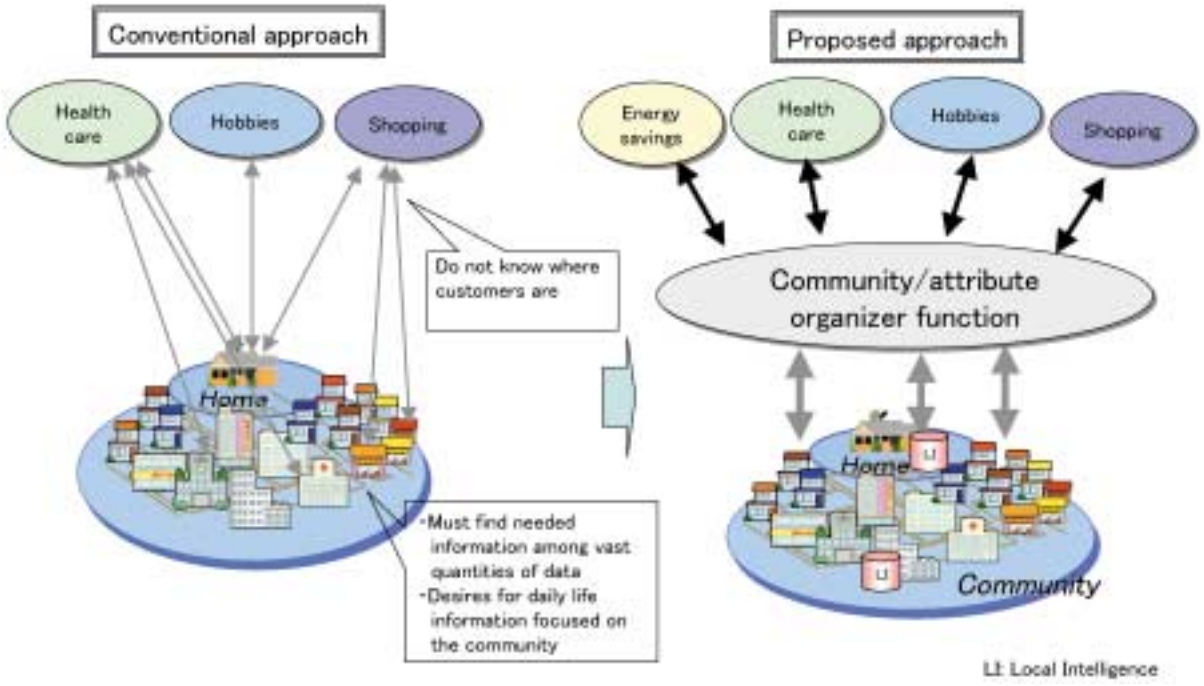

Fig. 3. Conceptual image of area-centered community formation function.

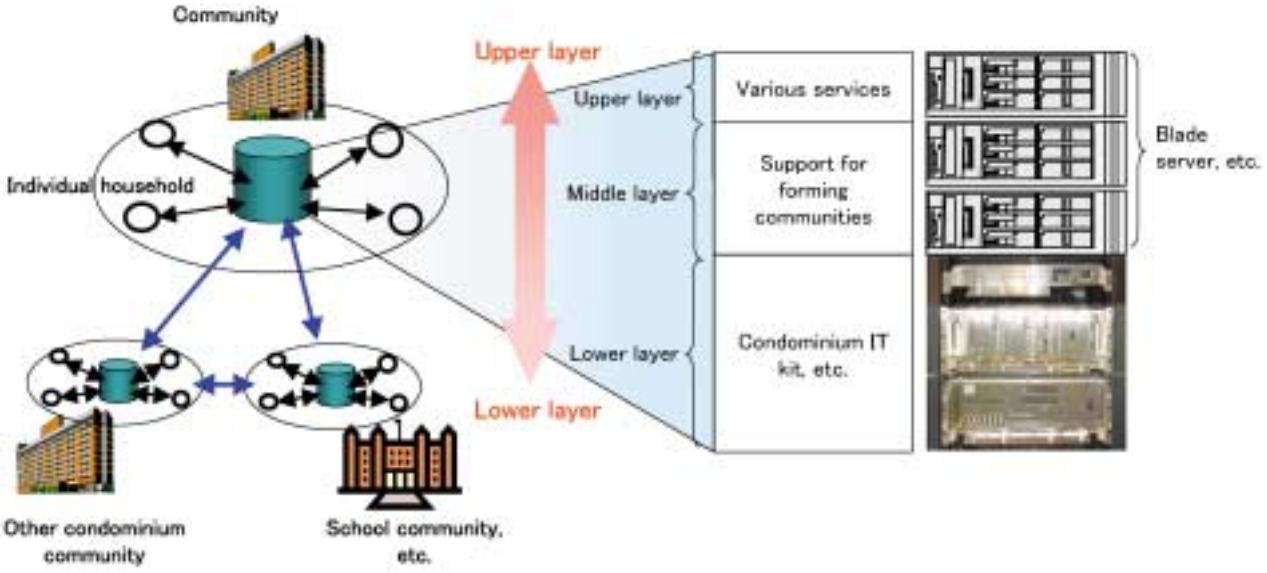

Fig. 4. Three- layered model of broadband community.

same time making effective use of their existing systems (protocols). In addition, this layer also incorporates a function that facilitates external management of network utilization via a centralized interface.

In this way, multiple communities (user networks) can complement each other's resources and combine their capabilities, enabling economical provision of sophisticated communications services. The facilities of communities are thus interconnected to achieve an environment that functions as the communications infrastructure.

Upper layer construction

The upper-layer functions for community formation are considered in terms of two aspects, namely, functions supporting the transmission of information

within and outside the community and operation-free functions supporting the reception of information.

Functions supporting information transmission

Support functions enabling individuals to transmit information within and outside the community must, of course, be simple to operate. They must also ensure anonymity and proper transmission of information so that individual recipients are not inconvenienced. One means of achieving such capabilities is a function for managing the community profile. This function would automatically generate and update the overall community profile in real time, based on information concerning the attributes of the recipients making up the community, such as their age and gender. A function is also needed for designating the attribute conditions and the sender's form of transmission (e.g., transmission of the actual data or notification of an alias only, transmission scheduling, etc.) and also for categorizing and revealing only the type of community to which the sender belongs, instead of attaching the sender's personal data to the

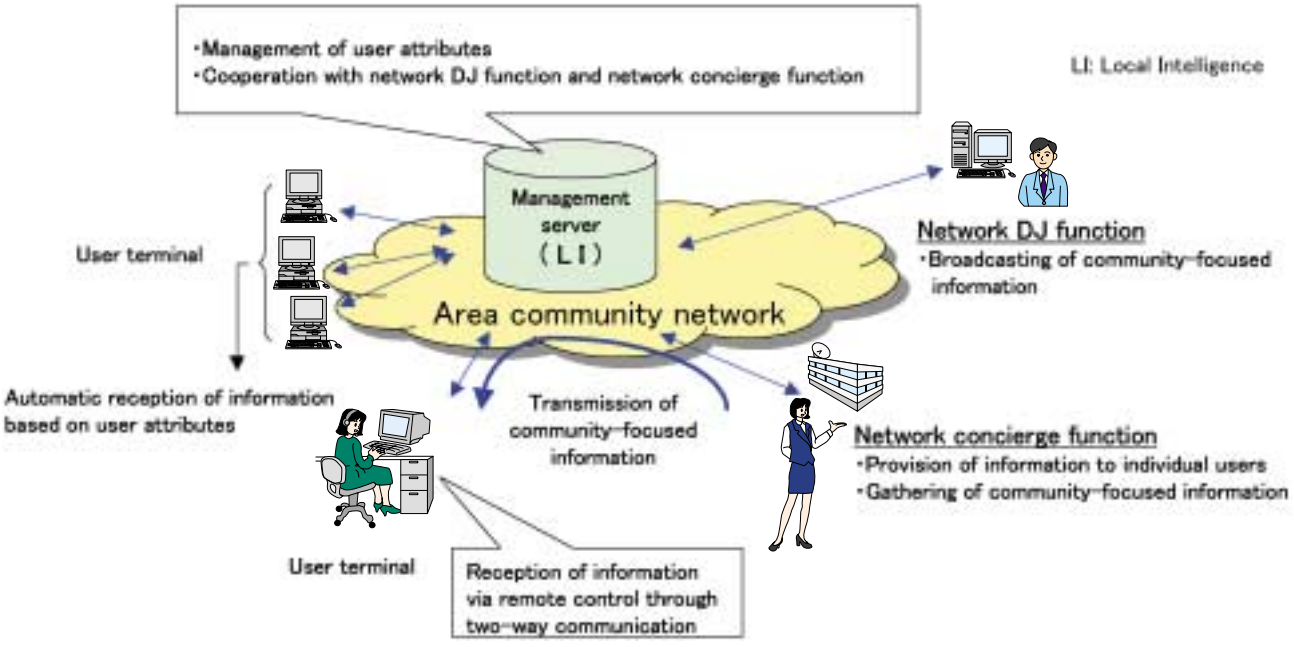

Fig. 5. Overview of functions supporting reception of information.

Fig. 6. Screenshot of area community system.

information that is transmitted. Furthermore, a function is needed for designating on the sender's side the type of information to be transmitted (e.g., text only, voice only, video and voice, etc.). It is envisioned that a concierge function will be provided to support a system that incorporates these capabilities and transmits and distributes to the community at large the intended information in cases where the sender is authenticated and the attribute conditions match.

Functions supporting information reception

Community members should be able to automatically receive essential information within their community, including information of local interest, regardless of their knowledge of the network. Automatic reception of emergency information in the event of a disaster is also necessary. Moreover, in as much as a community comprises a mixture of users with diverse attributes, all members should be able to enjoy the benefits of receiving information precisely tailored to their individual attributes and preferences. A user profile management function is seen as being a means to achieve these capabilities. With this function, all members would register their attribute data with the community in advance; they would filter the information that circulates within the community and receive only the information that they need. A network concierge function is further envisioned that would serve as an agent in providing the optimum information to recipients.

Support for forming communities

We are now working on the development of an area community system that embodies the above-mentioned functions and is intended to support the formation of communities. An overview of the functions supporting the reception of information is given in Fig. 5, and a screenshot of the system is shown in Fig. 6. As indicated here, the system can provide a highly secure communications environment with high functionality even when displaying video images.

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