# Chapter 3.4
# The Virtual Twin:
## A Socialization Agent for Peer-to-Peer Networks

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## ABSTRACT

As peer-to-peer computing finally reaches a critical mass, it triggers changes in the IT landscape that traditional network infrastructures, based on centralized, client/server topologies, cannot manage. Consequently, the ad hoc, self-organized, and loosely controlled nature of peer-to-peer networks needs to be supported by a new coordination layer representing the interests of the user. In order to define this new abstraction layer, this paper introduces the concept of the virtual twin — a kind of anthropomorphic representation of the networked person with whom the user can identify and feel comfortable. We discuss the inner structure of the virtual twin, first in an intuitive and informal way with an emphasis on its social aspect, then in a more detailed way with the analysis of its main components.

## INTRODUCTION

After many years of theoretical discussions and technical experimentations, peer-to-peer computing finally reached a decent level of acceptance and a critical mass (Wagner, 2003). The answer to many *why now?* questions is technology and money, and that is true here. On the one hand, technological advances allowed Internet access providers to bring low-cost, high bandwidth, and constant Internet connections within everyone's reach through DSL and/or cable subscriptions. Coupled with cheap WiFi appliances and a growing amount of wireless hotspots in public areas such as airports, hotels, parks, squares, coffee shops, fast food (Brewin, 2003b; Fleishman, 2003), airborne (Disabatino, 2003) or on the train (Brewin, 2003a), these Internet connections give computer users a new sense of mobility, virtual presence, and location awareness. On the other

hand, peer-to-peer collaborative software (i.e., Groove) or controversial file exchange tools (i.e., Napster or Kazaa) suddenly brought the possibilities of decentralized computing to the attention of many eager users of the network.

Interestingly enough, the advent of peer-to-peer technologies on a larger scale triggered changes in the IT landscape that were not necessarily foreseen. For example, the well-known characteristics of traditional client/server architectures (i.e., simplicity, security, centralized authority, clear connection status[1], replication, backup, and load balancing) are gradually being replaced by a set of features that turn the networks into groupings with fuzzy and unpredictable boundaries, as follows:

- Groups of users are formed today in an ad hoc fashion (i.e., informally and on-the-fly).
- In the new real-time economy, more and more relationships are established among individuals of different organizations, rather than of the same organization. This type of collaboration in which large numbers of geographically dispersed people quickly self-organize in a peer-to-peer network to deal with a problem or opportunity is called *swarming* (Melymuka, 2003).
- The centralized control of the almighty system administrator is replaced with new authorization mechanisms based on spontaneous invitations or "friend-of-a-friend" standards.
- Newer distributed technologies supporting these kinds of groupings are increasingly dynamic, self-forming, self-managed, and self-healing.

In many ways, these characteristics free users from many constraints related to system configuration and management. However, peer-to-peer technologies also weaken the sense of control that users previously had on their networked transactions, as it becomes more difficult to know precisely who is connected with whom, when, how long, and for what exact purpose. As a result, users come with newer questions: Who manages the knowledge that I put into a network available environment? Who takes care of my personal objectives in the overall community? Who checks that my preferences are respected during interactions? Who supervises my communications with other users? As a matter of fact, the concepts of identity, reputation, reciprocity, cooperation, boundaries, and social networking are growing more and more important in order to avoid being the target of free riders (Rheingold, 2002). In other words, the actors of traditional client/server networks trust the system administrator, who represents the central authority screening the network activity, punishing those who do not stick to the rules. It is crucial to know who or what replaces this role in a distributed, decentralized system.

The emergence of peer-to-peer technologies also impacts the representation of the individuals in the network. The virtual counterpart of a person in a traditional network is usually called a client, defined by one or several well-defined roles and by precise capabilities managed on the server. The advent of peer-to-peer computing and wireless networking now inspires the vision of "mobile devices [that] will broadcast *clouds of personal data* to invisible monitors all around us as we move from place to place" (Rheingold, 2002, p. xviii). The "clouds of data" image gives a good idea of the blurred boundaries of an individual's virtual representation in a peer-to-peer network. The "invisible monitors all around us" vividly expresses the fact that we are losing awareness of our connections. Even stronger, the person is referred to as a "personal area network," an interconnected network of devices worn or carried by the user (Zimmermann, 1996). Identifying an individual as a personal area network certainly opens new opportunities on the technical level, but it also is much more intimidating and less intuitive for the user.

Even if it is not exclusively related to peer-to-peer computing, the recent surge of identity theft cases clearly shows how the real-world and virtual identities of individuals are decoupled in today's widely networked environment. With 27.3 million