Building and Management of Trust in Networked Information Systems

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INTRODUCTION

Thanks to rapidly developing information and communication technologies, the complexity of networked organizations has become very high, so the representation of their structure and the description of their operation and their control need new technologies, new approaches. The availability of individuals independently from location and time means mobility, and that is an important attribute of today's society. This mobility can be achieved by using different types of mobile wireless networks as wireless wide area networks (WWANs, e.g., GSM, GPRS, and UMTS), wireless local area networks (WLANs, e.g., WiFi 802.11a-g), and wireless personal area (or pico) network (WPAN, e.g., Bluetooth, IrDA2).

In spite of the application of high-tech approaches, tools, and methodologies, there is a common point in all of the organizations: human beings make most of the important decisions, and they operate and use systems. Experience shows that improper application of this human factor can make operation very inefficient even in the case of the technically most advanced systems. The lowest level of connection among systems is made through protocols; the highest contact level is among decision makers, users namely among human beings. A very important element of this human contact is trust. In a networked organization, trust is the atmosphere, the medium in which actors are moving (Castelfranchi & Tan, 2001). Only trust can bridge cultural, geographical, and organizational distances of team members (and even of firms) from turning to unmanageable psychological distances. Trust is the base of cooperation, the normal behavior of the human being in the society. The ability of enterprises to form networked systems depends on the existing level of trust in the society and on the capital of society (Fukuyama, 1995). As the rate of cooperation is increasing in all fields of life, the importance of trust is evolving even faster.

Lack of trustworthy security services is a major obstacle to the use of information systems in private, in business (B2B), as well as in public services. Trust is intimately linked to consumers' rights, like security, identification, authentication, privacy, and confidentiality. Secure identification, authentication of the users, and communication security are main problems in networked systems.

Information management (IM) is a fuzzy term covering the various stages of information processing from production to storage and retrieval to dissemination towards the better working of an organization, where information can be from internal and external sources and in any format. The role of trust in these processes is definitive as human-to-human and human-to-system communication forms the base of information management.

BACKGROUND

Definitions of Trust

The word "trust" is used by different disciplines, so there are many definitions of the term fulfilling the demands of the actual theory or application. In everyday life without trust, one would be confronted with the extreme complexity of the world in every minute. No human being could stand this, so people must have fixed points around them: one must have trust in family members, in partners, in the institutions of a society and between its members, and within and between organizations partners. The diversity of approaches is one reason that trust has been called an "elusive concept to define" (Gambetta, 1988).

Trust can be defined as a psychological condition comprising the trustor's intention to accept vulnerability based upon positive expectations of the trustee's intentions or behavior (Rousseau, Sitkin, Burt, & Camerer, 1998). Those positive expectations are based upon the trustor's cognitive and affective evaluations of the trustee and the system/world, as well as of the disposition of the trustor to trust. Trust is a psychological condition (interpreted in terms of expectation, attitude, willingness, perceived probability). Trust can cause or result from trusting behavior (e.g., cooperation, taking a risk), but is not behavior itself.

According to Luhmann (1979), trust can be viewed as a cognitive and social device able to reduce complexity, enabling people to cope with the different levels of uncertainty and sometimes the risks that, at different degrees, permeate our life. Without trust, an individual would freeze in uncertainty and indecision when faced with the impossibility of calculating all possible outcomes of a situation. Engaging trust automatically can reduce the number of decision nodes that are being analyzed and facilitate the decision-making processes. From a social perspective, trust permits the necessary knowledge sharing of delegation and cooperative actions.

The following components are included in most definitions of trust (Harrison, McKnight, & Chervany, 1996):

- willingness to be vulnerable/to rely;
- confident, positive expectation/positive attitude towards others; and
- risk and interdependence as necessary conditions.

Trust has different forms such as:

- **Intrapersonal trust:** Trust in one's own abilities; self-confidence/basic trust (in others).
- **Interpersonal trust:** Expectation based on cognitive and affective evaluation of the partners; in primary relationships (e.g., family) and non-primary relationships (e.g., business partners).
- **System trust:** Trust in depersonalized systems/world that functions independently (e.g., economic system, regulations, legal system, technology); requires voluntary abandonment of control and knowledge.
- **Object trust:** Trust in non-social objects; trust in its correct functioning (e.g., in an electronic device).

Trust Is a Multi-Faceted Construct

There is compelling evidence originating from the organizational research community to support the idea that trust is a many-sided, complex construct. McAllister (1995) has proposed two critical dimensions: emotional trust and cognitive trust. Emotional trust is the development of non-calculative and spontaneous emotional bonds and effect among two or more people. Emotional trust is demonstrated through confidence and openness in sharing ideas, feelings, and concerns. Cognitive trust refers both to judgments of competence (predictably professional behavior) and reliability (the congruence between words and actions) about the other members of a team.

Representation Forms of Trust

There are two basic modeling approaches in describing trust: the cognitive approach (Castelfranchi & Falcone, 1999) and the mathematical approach (Marsh, 1994). In case of applying cognitive models, trust is made up of underlying beliefs, and trust is a function of the value of these beliefs. The mathematical modeling approach ignores the role of underlying beliefs and uses a trust metric, based on variables like *perceived_competence, perceived_risk, utility of a situation for the agent involved, importance of a situation,* and so forth. These models incorporate some aspects of game theory and the evolution of cooperation models. Both modeling approaches see trust as a variable with a threshold for action. When the value of the variable crosses the threshold, the agent executes an action. In the Marsh model, the action is cooperation; in the Castelfranchi model, the action is delegation. The action is Boolean in nature — the agent either delegates or not, or the agent either cooperates or not.

Classification of the Meanings of Trust

Harrison et al. (1996) made a very deep and thorough analysis of the word "trust" from many aspects in their working paper. The goal of the paper was to develop a classification system for the types of trust and develop trust definitions/types that can be accepted by most of the disciplines.

The main groups of the classification system for trust constructs are as follows:

- **Impersonal/structural trust:** Those definitions of trust that differentiate it from being a property or state of a person or persons.
- **Dispositional trust:** Trust is based in the personality attributes of the trusting party.
- **Personal/interpersonal trust:** Trust in which one person trusts another person, persons, or thing(s) in the situation.

Guided by the classification system, six related types of trust have been defined in the working paper. The six constructs are as follows: Trusting Intention, Trusting Behavior, Trusting Beliefs, System Trust, Dispositional Trust, and Situational Decision to Trust. Both cognitive and affective components are included in Trusting Beliefs, Trusting Intention, and Trusting Behavior. The six constructs cover the more common of the dictionary definitions of trust. This multi-dimensional view of trust provides a parsimonious way to organize measurable trust types, while clearly distinguishing one type from another.

BUILDING TRUST

Connection of Trust and Information Management

Information technology management deals with the management of the different steps of information processing, and trust has a role where human beings are involved in this process. Human beings basically have two types of connections in these processes: human-to-human relationship through networks, and human-to-computer system communication through interfaces. In the first case trust management of virtual teams can be analyzed; in the second case special effects of computer interfaces and the role of security technologies in trust building and maintenance can be studied (Mezgar & Kincses, 2002). Information management must take into consideration the aspects of the trust-building process, to