

An Overview of the interpretations of trust and reputation

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Abstract—In this paper we present an overview of the definitions of the terms of trust and reputation from the literature. Trust and reputation have been defined in different ways by the various researchers. As a result of these various definitions of trust and reputation there is a lot of confusion regarding what these terms actually mean. Additionally in the literature there is no work towards collecting all the definitions of trust and reputation. In this paper we discuss and present an overview of the terms of trust and reputation from the literature.

Index Terms—trust, reputation, definitions.

I. INTRODUCTION

In this paper we present and subsequently discuss all the proposed definitions of trust and reputation from the literature. The discussion in this section is divided into two parts. In the next section, we present the existing definitions of trust in the literature. Subsequently, in Section 3, we present the existing definitions on reputation from the literature and discuss them subsequently. We point out the shortcomings with the definitions of trust and reputation in the literature in Section 2 and Section 3 respectively. Finally Section 4 concludes the paper.

II. DEFINITIONS OF TRUST

Deutch et al [1,2] state that “trusting behaviour occurs when a person encounters a situation where she perceives an ambiguous path. The result of following the path can be good or bad and the occurrence of the good or bad result is contingent on the action of another person”.

Deutch et al’s definition applies to the scenario when an entity is placed or forced into a situation of having to trust another entity. Specifically, they state that an entity is forced into a situation of having to trust another entity whenever it encounters an uncertain position that it does not know how to handle. However, it does not describe or define trust at all.

Sztompka et al [3] define trust as “Trust is a bet about the future contingent actions of others”.

The above definition of trust by Sztompka et al presents a probabilistic view of trust and states that trust can be regarded as the probability with which an entity A can be expected to perform an action or a collection of actions. The above definition by Sztompka et al, however, fails to consider that trust is rather a belief (and not a

probability per se) that an entity A has in another entity B. The belief can, however, be converted and interpreted as probability. Additionally, the definition by Sztompka et al fails to consider that the ‘bet’ that the entity A is wagering by interacting with the entity B is specific to a given context at a given point in time. In other words, the above definition of trust by Sztompka et al fails to define trust in terms of its context dependent nature and time dependent nature. Finally, a service-oriented environment is a setting for carrying out business activities (a definition for service-oriented environment and business activities is presented in [4] and [5]). Entities interact with each other in a service-oriented environment and carry out business activities with each other in the hope that its interacting partner would act in a mutually agreed manner [4,5]. An appropriate definition of trust for a service-oriented environment would encompass or reflect that trust by an entity A in entity B originates due to the competence and the willingness of the entity B to act in a mutually agreed manner (a manner which is acceptable to both entity A and entity B), in a given context and at a given point in time [4,5]. The definition of trust by Sztompka et al fails to consider or point out that trust in an entity originates due to the willingness and the capability of that entity to act in a mutually agreed manner and hence the definition of trust by Sztompka et al is not suitable for a service-oriented environment.

Luhmann et al [6] define trust as “a solution for specific problems of risk”. Luhmann et al’s definition is similar to the definition proposed by Deutch et al, in the sense that it states and describes the scenario where trust is used. Additionally, the semantics and the interpretation of the definition of trust by Luhmann et al and Deutch et al are same. Specifically, the definition proposed by Luhmann et al states that the trust that an entity A has in another entity B can be used by the entity A in order to mitigate the risk involved in dealing(s) with entity B. It, however, in no way describes or defines trust itself.

Gambetta et al [7] define trust as “trust (or, symmetrically, distrust) is a particular level of the subjective probability with which an agent will perform a particular action, both before [we] can monitor such action (or independently of his capacity of ever to be able to monitor it) and in a context in which it affects [our] own action”.

This definition of trust is similar to the definition proposed by Sztompka et al in the sense that it treats trust as a probabilistic variable from an entity A to entity B.

However, in contrast to the definition given by Sztompka et al, the definition of trust by Gambetta et al states that the subjective probabilistic variable denoting the trust that an entity A has in entity B is applicable in a given context only. One of the main focuses of the definition of trust by Gambetta et al is that trust by an entity A in another entity B is independent of entity A monitoring or being able to monitor or supervise the action(s) of entity B. However, this definition of trust by Gambetta et al fails to take into account the time dependent nature of trust. Moreover, the above proposed definition of trust by Gambetta et al fails to define trust in an entity as having originated due to the willingness and capability of that entity to act in a mutually agreed manner.

Josang et al [8] define trust in a passionate entity as “the belief that it will behave without any malicious intent”. Additionally, Josang et al [8] define trust in a rational entity as “the belief that it will resist malicious manipulation by a passionate entity”. Josang et al [8] take the view that in the computing world, trust can be directed towards two groups of entities, namely human entities (also termed as passionate entities) and rational entities like software agents, algorithms etc. The interpretation of the proposed definition of trust in a passionate entity by Josang et al is that trust corresponds to the belief that a human entity A has in another human entity B which states that entity B will not behave in a malevolent manner. This definition of trust is too general and broad since, according to this definition, an entity B cannot be regarded as being trustworthy even if it acted once in a malevolent manner or acted in a malevolent manner in a single given context. In fact, entity B can be regarded as being trustworthy in a given context C by entity A if it has acted in a benign or benevolent manner in context C irrespective of how it has acted in other contexts [4,5].

Similarly, it may be the case that entity B had acted in a malevolent manner with entity A previously but has now rectified its behaviour and is acting in a benevolent manner. Similarly, it may be the case that entity B had acted in a benevolent manner with entity A previously but is now acting in a malevolent manner. In other words, Josang et al’s definition of trust in a passionate entity by does not take into account the context dependent nature of trust and the dynamic nature of trust. Additionally, the definition of trust by Josang et al fails to define trust in passionate entity as having originated from the willingness and capability of the passionate entity to act in a mutually agreed manner. A similar argument applies to the above definition of trust in a rational entity proposed by Josang et al.

Dasgupta et al [9] define trust as “the expectation of one person about the actions of others that affects the first person’s choice, when an action must be taken before the actions of others are known”. The definition proposed by Dasgupta et al is from a game theoretic point of view. The main underlying idea in above definition of trust by Dasgupta et al is that trust by an entity A in another entity B corresponds to the expectation that entity A has of entity B, which signifies that entity B will not act in a malicious way or in a manner detrimental to entity A. This definition states

that it is this expectation that entity A has about entity B, which dictates entity A’s actions with entity B. The definition however, fails to address the context dependent nature of trust and the dynamic nature of trust. Additionally, the definition of trust by Dasgupta et al fails to define trust as originating from the willingness and capability of another entity to act in a mutually agreed manner. On the contrary, it defines that trust in an entity originates from the belief that the given entity will not act in a detrimental manner.

Golbeck et al [10], define trust as “trust in a person is a commitment to an action based on a belief that the future actions of that person will lead to a good outcome”.

The definition proposed by Golbeck et al states that the trust that an entity A has in entity B corresponds to the belief that the future actions of entity B will not be detrimental to entity A and will lead to a good or positive outcome. The main shortcoming of this definition is that it considers trust as always leading to a positive or good outcome. The above definition fails to consider the context dependent nature of trust and the dynamic nature of trust. Finally, the definition of trust by Golbeck et al fails to define trust in an entity as originating from the willingness and capability of that entity to act in a mutually agreed fashion but rather defines trust as originating from the belief that the behaviour of the interacting partner will always lead to a good outcome.

Buist et al [11], define trust as “To trust is to willingly relinquish control, making yourself vulnerable to someone else for a certain outcome or consequence. Trust grows as a result of positive experiences accumulated over time”. This definition describes the outcome when an entity is put into or forced into a scenario requiring the placement of trust in another entity. Specifically, they state that when an entity A is forced to trust another entity B, then entity A is surrendering itself to entity B and it is at the mercy of the actions performed by entity B. This viewpoint corresponds more to a definition of ‘control’ or ‘power’ or ‘authority’ rather than trust.

Mui et al [12-14] define trust as “a subjective belief an agent has about another’s future behaviour based on history of their encounters”. This definition of trust by Mui et al is widely used in the literature by various researchers. The interpretation of this definition of trust is that trust that an entity A has in entity B, is a subjective belief that entity A has about how the future behaviour of entity B would be. According to this definition, the subjective belief is derived from past experience(s) that entity A has with entity B. The definition of trust by Mui et al fails to state that the subjective belief that entity A has in entity B is specific to certain context(s). Their definition fails to define trust as being a function of, or being dependent on, time. Finally, the definition of trust by Mui et al does not state how trust in another entity originates.

Wang et al [15, 16] define trust as “a peer’s belief in another peer’s capabilities, honesty and reliability based on its own direct experiences”. The definition of trust by Wang et al states that trust corresponds to the belief that a Peer A has

in another Peer B. The belief that Peer A has in Peer B, originates from and reflects the capability, honesty and reliability of Peer B and is derived as a result of the direct experience(s) that Peer A has had with Peer B. The definition of trust by Wang et al, however, fails to consider that the belief that Peer A has in Peer B is applicable only in a given context and may not necessarily be extrapolable to other context(s). Similarly, the definition of trust by Wang et al fails to consider that the belief that Peer A has in Peer B is applicable only at a given point in time and may not necessarily be valid at any other point in time. Moreover, the terms capability, honesty and reliability are fuzzy terms in themselves and the authors do not define these terms formally. Finally, the definition of trust by Wang et al does not state how trust in another entity originates.

Babak et al [17] define trust as a mathematical function T , between agents, from a set (A) of agents

$$T: A \times A \rightarrow [0, 1]$$

Babak et al present a simplistic and an abstract view of trust. They define the trust that an entity A has in entity B as having a numerical value in the continuous range of [0-1].

They do not state whether this numerical value is a probabilistic measure or belief measure. Additionally, their definition fails to define trust as a function of both context and time. Finally, the definition of trust by Babak et al does not state how trust in another entity originates.

Mezzetti et al [18,19] define trust as “a measure of how much reliance a trustor can justifiably place on the dependability of the trustee’s behaviour with in a specific context”. Additionally they define trustworthiness as “to be a private and secret property of an entity and therefore neither known to entities nor provable”. This definition states that the trust of an entity A in another entity B, corresponds to the extent to which entity A can rely on entity B to deliver on a given behaviour in a given context. However, this definition of trust by Mezzetti et al defines trust as being a function of context only, ignoring the dynamic nature of trust. Additionally, the terms reliance and dependability are fuzzy terms in themselves and the authors do not define these terms when proposing a definition of trust. Finally, the definition of trust by Mezzetti et al does not state how trust in another entity originates.

III. DEFINITIONS OF REPUTATION

Sabater et al [20, 21,22] define reputation as the “opinion or view of one about something”.

They present a simplistic and abstract definition of reputation. According to their definition of reputation, the reputation of an entity A is simply an ‘opinion’ held by other entities about entity A, in a given context (although the authors do not make use of the term context in their definition of reputation, the term ‘something’ probably refers to ‘con-

text’). However, their definition of reputation fails to address the dynamic nature of reputation. Additionally, the definition of reputation does not state how the reputation of an entity originates.

Abdul Rahman et al [23-26] define reputation as “an expectation about an agent’s behaviour based on information about its past behaviour”. Abdul Rahman et al’s [23-26] interpretation, according to this definition, is that the reputation of an entity A is an expectation held about it by other entities, which is computed based on its past behaviour. However, their definition of reputation fails to address the notion that the ‘expectation’ from entity A held by other entity (ies) is dependent on the context and the time of the past behaviours of entity A. Reputation of an entity is context specific because the trust value (of the entity in question) is context specific as well. A similar argument also applies to the dynamic nature of reputation. The reasons for the context dependent nature of reputation and the dynamic nature of reputation will be explained in detail in [4] and [5].

Mui et al [12-14] define reputation as “a perception that an agent creates through past actions about its intentions and norms”. This definition is similar to the definition of reputation by Abdul Rahman et al, in that it states that the reputation of an entity A is a perception or expectation held about it by other entity (ies), which is computed based on its past actions. Similar to the shortcomings of the definition of reputation proposed by Abdul Rahman et al, the definition of reputation proposed by Mui et al also fails to address the context dependent nature of reputation and the dynamic nature of reputation.

Miztal et al [27] state that “reputation helps to manage the complexity of social life by singling out trustworthy people in whose interest it is to meet promises”. Miztal et al present a definition of reputation from the perspective of social science. They consider that reputation is a means of selecting trustworthy interacting partners, who deliver on the mutually agreed behaviour or their promises. However, similar to the shortcomings of the definition of reputation proposed by Abdul Rahman et al and Mui et al, the definition of reputation proposed by Miztal et al also fails to address the context dependent nature of reputation and the dynamic nature of reputation.

Grishchenko et al [28,29] define reputation as “an expectation about compliance of an expected event to be near to an average compliance level of a set of past events”.

They explain this definition of reputation as: the reputation of entity A manifests the ‘extent’ to which it would comply with its expected behaviour in a given event. The ‘extent’ to which entity A would comply in delivering on the expected behaviour from it in a given event is derived by averaging the extent to which it has complied on all the past events carried out by it. From the above definition, since the level of compliance by an entity A in a given event is computed as an average of the level of compliance by entity A in all the events carried out by it in the past, the proposed definition of reputation is not context dependent. Additionally,

their proposed definition of reputation does not define reputation of an entity as a function of time as well.

Wang et al [15, 16] describe reputation as “a peer’s belief in another peer’s capabilities, honesty and reliability based on recommendations received from other peers”. Their interpretation of reputation is that reputation of a Peer B (which is computed based on recommendations about Peer B) as computed by Peer A reflects the belief of Peer A in Peer B. Consistent with the definition of trust proposed by Wang et al, the belief or rather the derived belief (in case of reputation) that Peer A has in Peer B originates due to Peer B’s capability, honesty and reliability. However, similar to the shortcomings of the definitions of reputation proposed by Abdul Rahman et al, Mui et al and Miztal et al, Wang et al also fail to take into account the context dependent nature of reputation and the dynamic nature of reputation.

Kreps et al [30] define reputation as “a characteristic or attribute ascribed to one person by another person (or community)”. Kreps et al define reputation from a social science perspective. The interpretation of this definition of reputation by Kreps et al is that the reputation of an entity is a characteristic or an attribute that is credited to that entity by others. However, Kreps et al fail to consider that this given attribute may be applicable in certain scenario(s) or context(s) only. Additionally, they fail to consider that the given attribute that has been credited to an entity can be taken away or discredited from it at a later point in time. Similar to the shortcomings of the definition of reputation proposed by Abdul Rahman et al, Mui et al and Miztal et al and Wang et al, the definition of reputation proposed by Kreps et al fails to take into account the context dependent nature of reputation and the dynamic nature of reputation.¹¹

IV. CONCLUSION

In this paper we discussed the definition of trust and reputation from the literature. In Section 2, we listed all the definitions of trust in the literature and discussed them. The shortcomings with these definitions of trust were presented in Section 2.

Subsequently, in Section 3, we listed all the definitions of reputation in the literature and discussed them. The shortcomings with these definitions of reputation were presented in Section 3.

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