



State of the Art in Trust and Reputation System: The Comparison Framework

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ABSTRACT

We introduce a framework for classifying and comparing trust and reputation (T&R systems). The framework dimensions encompass both hard and soft features of such systems including different witness location approaches, various reputation calculation engines, variety of information sources and rating systems, which are categorised as hard features, and also basic reputation measurement parameters, context diversity checking, reliability and honesty assessment and adaptability which are referred to as soft features. Specifically, the framework dimensions answer questions related to major characteristics of T&R systems including those parameters from the real world that should be imitated in a virtual environment.

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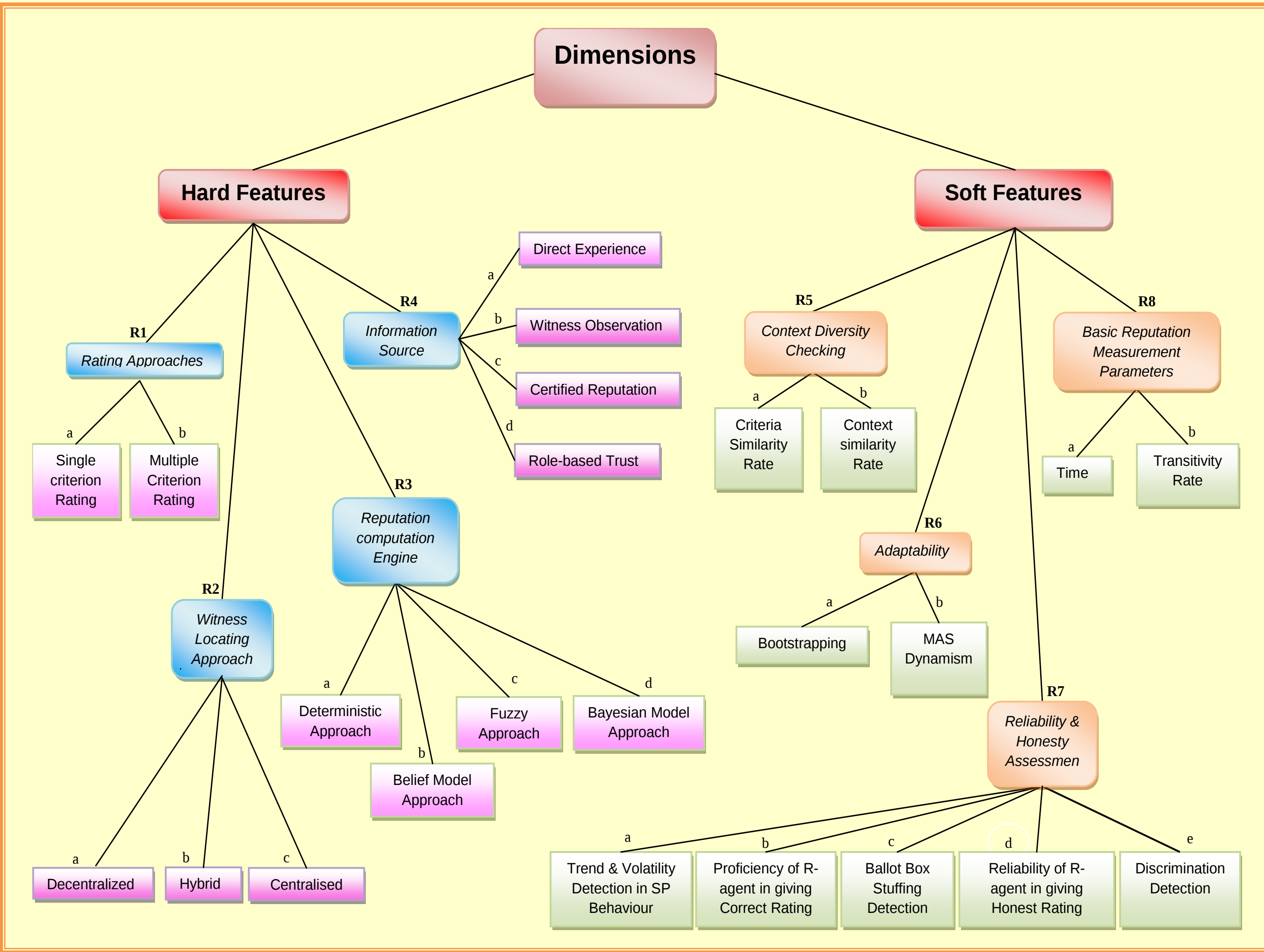
INTRODUCTION

Overcoming the inherent uncertainties and risks of the open electronic marketplace and online collaboration systems requires the establishment of mutual trust between service providers and service consumers. In fact, one of the main concerns of such environments is how the systems' resistance against self-interested participants can be enhanced and in what way their actual deceitful intentions can be understood and revealed. To address these concerns, Trust and Reputation (T&R) systems are developed to evaluate the reliability and credibility of the participants such that recommendation can be made when needed. Generally stated, the underlying goal of all T&R systems is to predict the trustworthiness and proficiency of peers in future actions based on the information gathered from their past behaviour in the environment and their peers' view towards their history. Trust can be deduced from both *individual* and *social* perspectives. Individual trust is due to direct experiences of transaction partners while social trust is calculated from third-parties experiences, which might include both honest and misleading opinions. T&R systems provide individuals with tools and techniques to deliberately solicit reputation information from peers in order to construct reasonable models of reputation for each participant. In this paper, we first give an extensive overview of five well-known trust and reputation systems. Then , we present the comparison framework and its respective dimensions. Afterwards, we thoroughly compare the existing T&R systems based on the proposed framework and analyze their pros and cons by effectively addressing some advanced features of the framework.

Summery of the Current T&R Systems

T&R System's Name	References	Distinguishing Features
<i>FIRE</i>	(T.D Huynh, N.R. Jennings, N.R.Shdbolt,2006)	Designed for Multi-agent system, exploits four information sources, handles the bootstrapping problem of newcomers, filters out inaccurate reputation information, attempts to differentiate between dishonest and mistaken agents, provides compound reliability measures, employs a multi-criterion rating system ,supports dynamism in open MAS.
<i>REGRET</i>	(Jordi Sabater and Carles Sierra, 2002)	Designed for complex e-commerce systems, develops <i>sociogram</i> to model social relationships, supports neighbourhood & system reputation, and provides ontological dimensions to combine various behavioural aspects of reputation. Evaluates witness honesty through fuzzy rules. Provides reliability measure; employs a multi-criteria rating system.
<i>Model by Yu& Singh</i>	(B. Yu, M.P. Singh,2003)	Suitable for MAS, proposes novel trust & referral network, detects three models of deceptions. Provides credibility measures pertaining to each model. Differentiate between agents having bad reputation or no reputation using Dempster-Shafter theory of evidence. Supports dynamism in open MAS.
<i>TRAVOS</i>	(W. T. L. Teacy, J. Patel, et al,2006)	Designed for large-scale open system, provides two information sources, exploits a probabilistic approach to determine credibility of witnesses, provides confidence metric and reliability measure for direct interaction information sources; Employs a single-rating system.
<i>PeerTrust</i>	(L. Xiong and L. Liu,2004)	Designed for P2P e-commerce systems, provides two methods as credibility measures, supports transaction context and community context factors in trust metric, and employs an adaptive architecture for peer location. Supports dynamism in peer2peer systems. Attempts to address bootstrapping problem. Support a single-rating system.

The comparison Framework and Its Dimensions



Comparing the Current T&R Systems Using the Framework

The meanings of symbols used in the comparison Table are as follows:

N/S the model does not satisfy the corresponding feature.

P: the model attempts to address corresponding feature and has partly succeed.

Y: the model satisfied the corresponding feature.

A: the model assumes the particular feature exist and do not provide any method to address it.

N/A: the corresponding requirement is not applicable

	R1		R2		R3			R4				R5		R6		R7					R8			
	a	b	a	b	c	a	b	c	d	a	b	c	d	a	b	a	b	a	b	c	d	e	a	b
FIRE		Y	Y			Y				Y	Y	Y	Y			Y	Y	P	P	Y	Y	P	Y	P
REGRET		Y	A				Y			Y	Y		Y	Y		Y				Y	Y			
Model by Yu & Singh			Y			Y				Y	Y					P	Y			P	Y		Y	
TRAVOS	Y		A					Y	Y	Y				N/A	N/A					Y	Y	P	Y	
PeerTrust	Y		Y			Y				Y	Y			N/A	N/A	Y	Y	P		Y	Y	P	Y	

Conclusion

In this paper, we have introduced a framework for classifying and comparing Trust and Reputation systems and provided an overview of some prominent trust and reputation systems according to this framework pointing to ways to choose one over another for particular applications. The dimensions of this framework help system-developers to choose or build their desired T&R system with appropriate features according to their requirements. Inspired by the framework's dimensions, we intend to develop a novel trust model which can possibly satisfy the requirement of evolving environments. More explicitly, we want to introduce a decentralised adaptive model with an optimistic approach which minimise the exclusion of participants by providing suitable mechanism for differentiating between incompetence, mislead, victims of discrimination and dishonest participants.