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Computer-Aided Decision-Making for Formal Relations and Domains of Trust, Distrust, and Mistrust with Cryptographic Applications

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Abstract: We propose generic declarative definitions of the concepts of weak and strong trust relations between interacting agents, and trust domains of trust-related agents in distributed or multi-agent systems. Our definitions yield (1) transitivity results for trust relationships, (2) computational complexity results for deciding potential and actual trust relationships and membership in trust domains, (3) a positive (negative) compositionality result for strong (weak) trust domains, (4) a computational design pattern for building up strong trust domains, and (5) a negative scalability result for trust domains in general. We instantiate our generic trust concepts in five major cryptographic applications of trust, namely: access control, Trusted Third Parties, the Web of Trust, Public-Key Infrastructures, and Identity-Based Cryptography. We also demonstrate that accountability induces trust. In particular, accountable access control and cryptographic-key management are trustworthy. Our defining principle for weak and strong trust (domains) is (common) belief in and (common) knowledge of agent correctness, respectively.

Category / Keywords: foundations / cryptographic-key management; TTP; Web of Trust; PKI

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