

Abstract

Intelligent systems in an open world must reason about many interacting entities related to each other in diverse ways and having uncertain features and relationships. Probability is the best understood and most widely applied technique for reasoning under uncertainty. But traditional probabilistic languages lack the expressive power to handle relational domains. And moreover, classical first-order logic is sufficiently expressive, but lacks a coherent plausible reasoning capability. So, an effort made to combine both the uncertainty reasoning capability of probabilistic languages and expressive power of first order languages in a single approach, using them at the appropriate interfaces may turn much fruitful in applications involving uncertain domains.

This report presents an approach to look into the future and prevent certain categories of attacks on a network formulating an architecture for a firewall using advanced probabilistic measures. We use a new approach to probability by introducing MEBN (Multi Entity Bayesian Networks) logic which is a combination of First Order Logic and Probability theory. MEBN extends ordinary bayesian networks to allow representation of graphical models with repeated sub-structures, and can express a probability distribution over models of any consistent first-order theory. This report will discuss a novel approach by which MEBN logic can be applied for the prevention of future attacks.

The framework presented here uses both the expressiveness of Description Logic through a concept called the Semantic Threat Graphs as well as reasoning under uncertainty property of MEBN logic to fulfill the required objective of providing futuristic threat prevention technique in a dynamic firewall.

Key words: Stateful firewalls, Ontology, Semantic Threat Graphs, PR-OWL, MEBN