DOCTOR OF PHILOSOPHY

A COMPUTATIONAL MODEL AND MULTI-AGENT SIMULATION FOR INFORMATION ASSURANCE

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The field of information assurance (IA) is too complex for current modeling tools. While security analysts may understand individual mechanisms at a particular moment, the interactions among the mechanisms, combined with evolving nature of the components, make understanding the entire system nearly impossible.

This dissertation introduces a computational model of IA called the Social-Technical Information Assurance Model (STIAM). STIAM models organizations, information infrastructures, and human actors as a complex adaptive system. STIAM provides a structured approach to express organizational IA issues and a graphical notation for depicting the elements and interactions. The model can be implemented in a computational system to discover possible adaptive behavior in an IA environment. A multi-agent simulation is presented that introduces several innovations in multi-agent systems including *iconnectors*, a biologically inspired visual language and mechanism for inter-agent communications.

The computational model and simulation demonstrate how complex societies of autonomous entities interact. STIAM can be implemented as a hypothesis generator for scenario development in computer network defensive mechanisms.

KEYWORDS: Information Assurance, Information Security, Computer Security, Security Model, Modeling, Agents, Multi-Agent System, Multi-Agent Simulation