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NICCI: A Multi-agent Cognitive Formation

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Abstract

The demand for effective and expediently made decisions is always in vogue. This is not surprising since making correct decisions is essential for successful operations in both the military and business environments. Decisions require data processed for quality, concept and context. The time is spent to weigh information for quality, to fuse information into concepts, and to package information for contextual relevance. The goal of information gathering and processing is focused on existing or arising problems. The network-centric paradigm allows for access to additional, previously unreachable, sources of information. While there is a benefit of getting more information, the time spent to weigh information for quality, to fuse information into concepts, and to package for contextual relevance is also increasing. Without a dramatic decrease in information-processing time, the network-centric paradigm¹ will not achieve its full potential.

The purpose of this paper is to propose a potential solution to the information overflow problem. The solution is proposed in a form of a system of cognitive agents, where cognitive agents are located at every information-processing node. These cognitive agents we will call Intelligent Nodes. The Intelligent Nodes [4] consist of machines and human-machine hybrids. Military processes are used in this paper to illustrate the application of a multi-agent cognitive framework as decision-maker assistants for making collaborative decisions better and faster.

Introduction

¹ Command and Control are responsible for making decisions in transforming goals into actions. The Intelligence supplies the information in regard to enemy positions and analysis of enemy courses of action (COA). In 2001, Dr. John Salasin has coined an appropriate name for the Joint DARPA program as Network-centric Infrastructure for Command, Control and Intelligence (NICCI).

The battlespace today and in the future is different from what we know based on the history of Twentieth century campaigns which manifested themselves as trench warfare of World War I and blitzkriegs of World War II. While the military is trained to fight twentieth century style campaigns, they find themselves today involved more and more in smaller conflicts where asymmetric warfare tactics are playing a bigger role. Stability and support operations (SASO) are the predominate type of operations conducted by the United States and coalition forces today.

With the emerging new technologies and tactics of this new type of warfare, 'bigger guns' do not always lead to a decisive victory and the need for a faster and more agile force has been recognized [3]. This new force, in addition to conventional weapons, will be armed with the latest information technology, where radios and computers are only part of the solution.

In this new warfare, the warfighter is no longer an isolated entity. The warfighter becomes a part of the operational environment where socioeconomic and physical laws play a greater role in the success or failure of a particular mission or even the war itself. The Network-centric warfare paradigm [2] is a new way of looking at this type of future battlefield. The Network-centric Infrastructure for Command, Control and Intelligence (NICCI) program is an attempt to find an out-of-the-box solution to an out-of-the-box problem.

Solutions to complex real world problems require looking at the problem space as a whole. If the solution is focused only on satisfying a few constraints, the solution will have weaknesses, which will be exploited by the opponent. The solutions emerge in a planning process as elements of a plan [1]. The incoming information influences and transforms earlier constraints, or produces new ones. This dynamic aspect of dealing with the real world complicates the planning process. Decisions are always focused on producing solutions which best satisfy the goals of achieving a certain effect based on current and anticipated

conditions or states. The exchange of information relevant to the process therefore becomes very important.

NICCI introduces a novel concept called the habitat. The habitat in the conventional warfare schema is a set of combat, and combat support entities focused on achieving a given mission. Today habitats are more complex clusters of military and civilian entities; where information interchange is influenced by cultural, political, and socioeconomic realities. The military, paramilitary and civilian constituents

of a habitat need a network-centric infrastructure to effectively communicate and collaborate in an attempt to focus in finding mutually benefiting solution. Due to the associated complexities, a multi-agent framework imbedded into the nodes of a communication network can assist members of a particular habitat with resolving issues such as information transformation, security, policy management and policy enforcement.

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