12TH ICCRTS

"Adapting C2 to the 21st Century"

Title:
Distributed Planning in a Mixed-Initiative Environment

Track 1: C2 Concepts, Theory, and Policy
Track 8: C2 Technologies and Systems
Track 5: Organizational Issues

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ABSTRACT

The USAF command and control (C2) is undergoing a transformation to enable the application of air and space power across the full range of military operations in support of the Joint Forces Commander. To be able to meet the future challenge of employing forces anywhere in the world in support of national security objectives, the USAF requires C2 processes that are flexible to adapt to any level of conflict. This paper describes an in-house program underway at the USAF Research Laboratory Information Directorate that is researching technologies to support the concepts of distributed C2. The research focus is on distributed mixed-initiative planning where dispersed human planners interact with the automated planning services. The automated planning services are built on distributed blackboards and multi-agent systems. The vision of this research is for an extensible UML model of plans and a planning process language to reduce the level of human to human collaboration, allowing machine mediation of distributed human planning. This work is consistent with the future USAF vision of C2 air operations that are distributed, scalable, leverage other Air Operations Centers to optimize manpower requirements, offer redundancy in the event of catastrophic failures, and reduce the forward foot-print.

Title:
Mixed-Initiative Distributed Planning Outline

I. Introduction

    A. Importance of applying a Mixed-Initiative Distributed Planning tool to C2
    B. System Architecture
        i. Brief overview of the individual components
            a. Distributed Blackboard
            b. Agents
            c. Unified Planning Model

II. Distributed Blackboard

    A. Architecture of the Distributed Blackboard
        i. Components of the Blackboard
            a. Data Structure
            b. Knowledge Sources
            c. Control Mechanism
    B. Features provided by the Blackboard
    C. Inherent distributed systems problems and design issues
        i. Synchronization concerns
        ii. Bandwidth issues
        iii. Persistence of the system
        iv. Scalability

III. Multi-Agent Systems

    A. Why a Multi-Agent system?
    B. Agent architecture
    C. Agent communication
        i. Agent to agent
        ii. Agents to components
    D. Developing Plans
        i. Using Commander objectives
        ii. Developing new plans based off encoded knowledge
    E. Critiquing Plans
        i. Critic Agents
        ii. How do critic agents score plans?
        iii. Plan selection

IV. Demonstration

    A. Description of objectives to be solved
    B. Input of objectives to the System
    C. Plan development based on objectives
    D. Plan selection based on critique of plans by agents

V. Conclusion

    A. Challenges to progress and how to get by them
    B. Where to go now?