Distributed Embedded Real-Time Agent Resource Management

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Abstract:

This presentation describes an embedded intelligent agent architecture for distributing the real-time allocation and management of resources throughout networked systems. The solution is general purpose, and has been developed for several applications, including shared electronic systems and spectrum allocation. The agent architecture was derived from a combination of prior agent and resource management developments from Lockheed Martin ATL.

To guide development and evaluate the distributed agent concept prior to detailed implementations, simulation models were constructed. A successful agent architecture was derived which relies on agent to agent negotiation for resolving allocation decisions in a distributed and parallel context. The simulations led to new methods for developing agents having sufficiently small program code and data structures consistent with embeddable implementations. Further developments led to highly scalable computing solutions.

On DARPA's Next Generation Communications (XG-Comms) project, the agent technology was studied to leverage Software Defined Radios (SDR) and related emerging wireless systems of the future, for improving total spectrum utilization, especially for the continuously changing heavy traffic on the battlefield.

The XG-Comms program goals require re-using spectrum in time, space, frequency, and modulation, while minimizing interference to adjacent systems. The real-time distributed nature of the challenge was well suited to agent solutions. Results from the simulations of agents allocating spectrum will be shown. The simulations showed that the unique developments in the agent design enable the embedded agents to increase spectrum usage by more than 10x, while consuming less than 0.2% spectral overhead for control and negotiation under very high demanded loads.