BRINGING COGNITION TO TACTICAL NETWORKS

AS THE DEMAND rises for sophisticated tactical wireless communication networks to aid in modern warfare, security, and disaster relief, wireless-network designers must find creative solutions to handle the immense amount of wireless traffic arising in tactical situations. A wireless network with the ability to assess its environment and make resource-allocation decisions based upon the conditions in the field could be the next step in advancing tactical communications. Getting the most out of crowded wireless resources is a forte of cognitive-radio (CR) technology and the topic of the white paper by Elektrobit (EB) titled "Cognitive Tactical Communication Networks."

The official definition of CR by the International Telecommunications Union (ITU; www.itu.int) is as follows: "A radio system employing technology that allows the system to obtain knowledge of its operational and geographical environment, established policies and its internal state; to dynamically and autonomously adjust its operational parameters and protocols according to its obtained knowledge in order to achieve predefined objectives; and to learn from the results obtained." This directive is the backbone of what EB is currently developing: technology to deploy CR radios in practical situations. An example of EB's research and development is the EB Tactical Wireless IP Network (TAC WIN), a mobile ad-hoc network (MANET) with wireless-broadband connectivity designed for deployment in any location.

The goal of this development is to produce a CR with spectrum awareness, collaborative sensing, fast response time, awareness/collaboration with other network resources, algorithms for resource management, and an artificial-intelligence-based cognitive engine. Compared to civilian cognitive networks, which use present resources to enhance system capacity, a tactical cognitive radio would need to incorporate more flexible systems of resource utilization. This approach includes wireless links from satellites, UAVs, and wired connections that can use a variety of stealth and anti-interference methods to compensate for hostile environments.

This enhanced communications method would require detailed data from a variety of sensors across several wireless networks. The data would then be processed centrally and routed intelligently using adaptive antennas with specific localization within a MANET. The TAC WIN system is designed around a modular software core that can support future upgrades. Such improvements could include advanced data capacity, smarter resource allocation, new waveforms, increased cognitive functionality, and increased throughput.

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MULTI-CHIP MODULES DEMAND EDA SOFTWARE WITH INTEGRATED DESIGN FLOW

MULTICHIP MODULES (MCMS) are a miniaturized combination of several integrated circuits (ICs), semiconductors, and discrete components, which are unified on a substrate as a single-module component. MCMs are designed to offer superior performance for complex and high-performance systems, such as RF and microwave technologies. MCMs accomplish this enhancement by combining the bias circuitry, filters, passive components, antennas, and interconnects on a common, multilayered printed-circuit board (PCB). Naturally the benefits of superior performance come with a tradeoff of increased design complexity. In the white paper, "EDA Software Design Flow Considerations for the RF/Microwave Module Designer," AWR Corp. shares how modern electronic-design-automation (EDA) software could incorporate each integration point in the RF/microwave-module design flow.

Traditionally, each module in an MCM design is given performance specifications that it must meet. In addition, the specifications for the interconnections between these modules are agreed upon by the design team prior to design. This decentralized design flow could lead to challenges as the design of a module is being completed.

A potential solution to these challenges is to incorporate each aspect of the MCM design flow into a single software environment with a unified database. That database, in turn, is synchronized between the different design stages. A benefit of this solution would be the ability to integrate a simulation from the transistor level with the process design kit (PDK) for the IC elements all the way to the other modular components. Additionally, electromagnetic (EM) verification using an EM simulator, optimizations, and yield analysis could be performed on the complete system.

AWR suggests that its AWR Microwave Office has these capabilities along with several other enhancement features, like module-level sub-circuit design systems. An example of an integrated MCM design flow of a microwave monolithic integrated circuit (MMIC) using a 2.5-GHz gallium-arsenide (GaAs) power amplifier with a microwave laminate module for output match is provided.

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