

**Swarm Autonomous Routing Algorithms**

# Swarm Routing Algorithm Opens Scalable Ways to Connect Battlefield or Emergency Communication Networks



## Technology and Innovation

With the advent of portable computing and wireless communication, there has been increased attention to military and civilian applications for mobile ad hoc networks (MANETs) — infrastructureless, dynamic networks, formed spontaneously by wireless mobile nodes that communicate directly through each other. Most existing MANETs have performance shortcomings because their standards and routing protocols are based on those of wired and small, non-moving wireless networks. Therefore, they do not deal well with mobility, change, or the absence of a fixed network structure.

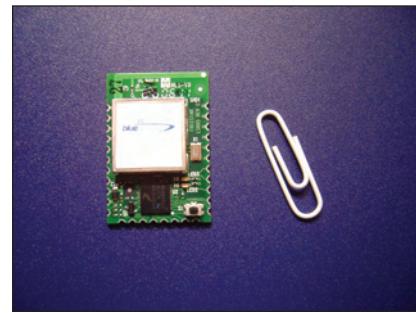
With DARPA SBIR support, along with matching funds from the U.S. Army Communications-Electronics Research, Development and Engineering Center (CERDEC), Bluetronix has developed a simple, reliable solution to a nagging challenge, Swarm Autonomous Routing Algorithm (SARA), to address shortcomings in MANETs. SARA's unique approach uses local data with neither a center point of control nor routing tables. By executing in a purely autonomous, distributed manner, SARA enables scalability to tens of thousands of nodes in a network, rapid initialization, and greater network efficiency. Bluetronix swarm differs from other approaches in that it needs no prior knowledge, learns as it communicates, is distributed in nature,

and uses no access points, control points or routing tables.

With the swarm autonomous routing, MANETs offer many potential advantages over infrastructure-based networks. For example:

- They self-organize, so they require no setup or configuration.
- They are efficient, using minimal battery power to handle large volumes of data quickly without routing tables.
- They are flexible (able to handle a dynamic topography), adaptable (able to handle nodes joining and leaving the network), scalable (able to handle increasing and decreasing numbers of nodes without modification), mobility capable (able to handle mobility and high speeds) and robust (able to withstand losses and continue functioning effectively).
- They heal quickly through self-reorganization.

Current and future uses of MANETs include battlefield communications, on-site disaster relief management (particularly in areas where the existing communications infrastructure has been destroyed), low-cost relay points for Cellular and WiFi, and sensor networks to enhance homeland security. An 8-bit stamp-sized module for sensor networks



The ant-inspired Swarm Autonomous Routing Algorithm is built into Bluetronix's 802.15.4 swarm module.

has been developed and FCC approved and a 3-D graphic visualizer has been developed for sensor networks.

## Joint Collaborations

Bluetronix collaborated with the Army SBIR office for matching funds in the development of this technology.

## Lessons Learned

- Continuing proof of technology performance is needed to open new doors
- Getting others to support a new approach to an old problem sometimes takes great effort, tenacity and strong collaborators.
- Focus on one or two specific applications for validation and commercialization
- Don't rely on any one sponsor but rather establish a network of believers in your technology through collaborators.

## Economic Impact

As a result of SBIR funding, Bluetronix has developed both simulations and prototype systems to demonstrate performance and proof of concept. The swarm routing algorithms and prototypes developed in this program have advanced Bluetronix from concept to several pending tangible products. With the direct feedback from DARPA and other agencies, Bluetronix plans to further their product development in both DoD and commercial organizations in 2007 and 2008. Bluetronix is currently pursuing contract work beyond the SBIR program for Phase 3 and commercial developments that can be paralleled back to DoD for leveraged design and product with only necessary modifications.

As a result of this DARPA SBIR, Bluetronix has filed several patents and intends to submit a third early in 2007.

## About the Company

Bluetronix, headquartered in Chagrin Falls, Ohio conducts research, development, product development and commercialization for advanced algorithms for use by government agencies (e.g., DoD), and high-growth commercial industries. The company's areas of focus include: mobile communications, intelligent computing, network optimization, micro-electromechanical systems, sensor networks, energy optimization and internetworking. ■

## Company Information

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