



Joint Chapter, Rochester New York

## Synchronization in Sensor Networks: Self-Organization and Boolean Networks

**Dr. Stephen F. Bush**

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**Date:** Tuesday, June 7<sup>th</sup> 2005

**Location:** IT Conference Room 70-2400, Rochester Institute of Technology

**Time:** 6:30 – 7 pm Pizza and Social, 7:00 – 8:00 pm Technical Presentation.

**RSVP:** Nirmala Shenoy at [ns@it.rit.edu](mailto:ns@it.rit.edu) (for pizza count)

**For other details:** [http://ewh.ieee.org/r1/rochester/comm\\_aero/](http://ewh.ieee.org/r1/rochester/comm_aero/)

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### Abstract

A key component in efficient and intelligent sensor networking is inducing collaborative behavior. We examine collaboration from the point of view of synchronizing activity. Power consumption and pulse-coupled oscillation are explored in terms of low power time synchronization. More complex synchronous patterns are examined via Boolean Network state trajectories. Boolean Networks have the characteristic of simple components, namely Boolean functions, with localized sets of inter-connections. The result, even with a random density of interconnections, can be a stable self-regulating system whose state settles into organized patterns. Such systems can be analyzed for their basins of attraction, attractor state cycles, and stability. In fact, known systems can be reverse engineered as a Boolean Network. Boolean networks can also be constructed to solve arbitrary computational problems, such as K-SAT. The self-regulating group behavior exhibited by Boolean Networks and their localized interactions makes them an enticing model for studying self-organization and self-configuration in complex systems.

### Speaker Biography

**Dr. Stephen F. Bush** is a researcher in Active Networking and Algorithmic Communications Network Theory with over 30 peer-reviewed publications. Dr. Bush has implemented a toolkit capable of injecting predictive models into an active network. Stephen continues to explore novel concepts in complexity and algorithmic information theory to refine the toolkit for applications ranging from network management and ad hoc networking to DNA sequence analyses and Nanotechnology-based networking concepts. Dr. Bush has been the Principal Investigator for many DARPA and Lockheed Martin sponsored research projects including: Active Networking (DARPA/ITO), Information Assurance and Survivability Engineering Tools (DARPA/ISO), Fault Tolerant Networking (DARPA/ATO) and most recently, Connectionless Networks (DARPA/ATO) an Energy Aware Sensor Network research project. Before joining GE Global Research, Stephen was a researcher at the Information and Telecommunications Technologies Center (ITTC) at the University of Kansas. He received his B.S. in Electrical and Computer Engineering from Carnegie Mellon University and M.S. in Computer Science from Cleveland State University. He has worked many years for industry in the areas of computer integrated manufacturing and factory automation and control. Steve received the award of Achievement for Professional Initiative and Performance for his work as Technical Project Leader at GE Information Systems in the areas of network management and control while pursuing his Ph.D. at Case Western Reserve University. Steve completed his Ph.D. research at the University of Kansas where he received a Strobel Scholarship Award. Stephen is currently a Computer Scientist at General Electric Global Research in Niskayuna, NY. Stephen is has been a DARPA Principle Investigator for Active Networking, Information Assurance, and Fault Tolerant Networking and has won a gold cup trophy from DARPA for outstanding research in Active Networking. Stephen has co-authored a book on Active Networking: [ [newp://www.crd.ge.com/~bushsf/an/anabstract.html](http://newp://www.crd.ge.com/~bushsf/an/anabstract.html) ] Active Networks and Active Network Management: A Proactive Management Framework by [ [newp://www.crd.ge.com/~bushsf/](http://newp://www.crd.ge.com/~bushsf/) ] Stephen F. Bush and Amit Kulkarni, Kluwer Academic/Plenum Publishers, New York, Boston, Dordrecht, London, Moscow, 2001, 196 pp. Hardbound, ISBN Network 0-306-46560-4.