

### A Copper Bullet for Software Quality Improvement

pp. 21-25

*Michael Blaha*

Red Brooks long ago observed that there is no silver bullet to improve software quality. However, there are copper bullets—lesser steps that improve quality over time. One of these is the notion of software engineering, the practice of thinking carefully before immersing yourself in the minutia of coding.

The author offers a summary of his experience indicating that database reverse engineering offers a quality improvement strategy that could benefit the entire software community.

### Cooperative Cache-Based Data Access in Ad Hoc Networks

pp. 32-39

*Guohong Cao, Liangzhong Yin, and Chita R. Das*

Cooperative caching, in which multiple nodes share and coordinate cached data, is widely used to improve Web performance in wired networks. However, resource constraints and node mobility have limited the application of these techniques in ad hoc networks. The authors propose caching techniques that use the underlying routing protocols to overcome these constraints and further improve performance.

### Energy-Efficient Area Monitoring for Sensor Networks

pp. 40-46

*Jean Carle and David Simplot-Ryl*

The nodes in sensor networks must self-organize to monitor the target area as long as possible. Researchers at the Fundamental Computer Science Laboratory of Lille are developing strategies for selecting and updating an energy-efficient connected active sensor set that extends the network lifetime. The authors report on their work to

optimize energy consumption in three separate problems: area coverage, request spreading, and data aggregation.

### Cross-Layering in Mobile Ad Hoc Network Design

pp. 48-51

*Marco Conti, Gaia Maselli, Giovanni Turi, and Silvia Giordano*

Mobile ad hoc network researchers face the challenge of achieving full functionality with good performance while linking the new technology to the rest of the Internet. A strict layered design is not flexible enough to cope with the dynamics of manet environments, however, and will prevent performance optimizations.

The MobileMan cross-layer architecture offers an alternative to the pure layered approach that promotes stricter local interaction among protocols in a manet node.

### Group Communications in Mobile Ad Hoc Networks

pp. 52-59

*Prasant Mohapatra, Chao Gui, and Jian Li*

Efficient support of group communications is critical for most ad hoc network applications. However, manet group communications issues differ from those in wired environments because the wireless communications medium has variable and unpredictable characteristics, and the signal strength and propagation fluctuate with respect to time and environment.

The authors provide an overview of group communications issues such as protocol design, state maintenance, and performance. They also discuss representative protocols and examine related issues such as reliability, power conservation, quality of service, security, and areas requiring additional research.

### Routing and Security in Mobile Ad Hoc Networks

pp. 61-65

*Nikola Milanovic, Miroslaw Malek, Anthony Davidson, and Veljko Milutinovic*

Mobile ad hoc networks remove the dependence on a fixed network infrastructure by treating every available mobile node as an intermediate switch, thereby extending the range of mobile nodes well beyond that of their base transceivers.

The authors present four manet routing algorithms along with a hybrid approach, discuss their advantages and disadvantages, and describe security problems inherent in such networks.

### Prioritized Overlay Multicast in Mobile Ad Hoc Environments

pp. 67-74

*Li Xiao, Abbasbek Patil, Yunbao Liu, Lionel M. Ni, and Abdol-Hossein Esfahanian*

Many proposed routing protocols for manets require nodes to maintain and update complicated route information, which incurs significant overhead when groups have different priorities.

To address this problem, some researchers have begun focusing on application-layer, or overlay, multicast in which an overlay network forms a virtual network consisting of only member nodes atop the physical infrastructure. The authors propose a prototype of prioritized overlay multicast for manets in which participating nodes can carry out multiple functions and thus be associated with more than one overlay tree.