TECHNOLOGY

A Distributed Bandwidth Allocation and Transmission Coordination Method for Quality of Service Provision in Wireless Ad Hoc Networks

OVERVIEW

In contrast to the centralized cellular communication model, ad hoc networks consist of small and inexpensive wireless routers that can form distributed all-wireless infrastructures on the fly. They are currently being considered as complements or alternatives for wireless broadband data access to existing 3G networks. Ad hoc networks can operate in unlicensed bands, have minimal deployment cost, and hold the potential to offer increased network capacity and robustness as more wireless nodes are added to the network.

To harness the potential of distributed wireless architectures requires addressing the challenge of providing quality of service (QoS) guarantees to the end-user. Due to the multi-access nature of the wireless medium, QoS in ad hoc networks depends heavily on the underlying medium access (MAC) protocol. Such a protocol must use local information and coordinate transmissions so that bandwidth is shared among users in a controlled fashion. Currently, no MAC protocol satisfies both requirements. Random access methods (like the one used by the 802.11 WLAN standard) use local information at the expense of unpredictable transmission conflicts and lack strict allocation guarantees. On the other hand, scheduled access methods (like TDMA) achieve deterministic allocations through perfect coordination of transmissions, but typically need global network knowledge to reach their goal.

Researchers at the University of Maryland at College Park have developed a scheduled access protocol that operates using only local information. This distributed protocol avoids transmission conflicts and provides QoS to the participants of the ad hoc network. Being distributed, it naturally adapts to changes in network topology or QoS traffic requirements.

It consists of two key components that operate in parallel:

- A bandwidth allocation algorithm that steers the network to any desired QoS objective
- A coordination mechanism that keeps the network free of transmission conflicts

It can be applied to:
- Wireless routers of backbone ad hoc networks aimed at providing high-bandwidth and low-cost solutions for the end-user
- Mobile end-user devices that can either become part of the backbone or form autonomous ad hoc networks
This invention directly addresses the current market need for a distributed medium access protocol providing QoS in the distributed wireless ad hoc network setting. Contrary to fixed single-hop broadband wireless systems, ad hoc networks are self-configuring, multi-hop wireless
communication infrastructures.

Current approaches implemented by MeshNetworks, Nokia, and Mitsubishi-Detecon (to name a few) use either the random access-based 802.11 standard (unable to provide QoS) or proprietary, non-scalable TDMA-based schemes that rely on global topology information. The invention integrates the best of both worlds: it is TDMA-based yet fully decentralized, providing QoS by dynamically accessing the wireless medium in a conflict-free manner. Furthermore, it can be readily implemented using Bluetooth, a current wireless standard.

For additional information, please contact the Office of Technology Commercialization, University of Maryland,

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Additional Information

INSTITUTION

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Patent(s) pending

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CATEGORIES

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- Information Technology

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- US Patent 7,961,702

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