IGI PUBLISHING
701 E. Chocolate Avenue, Hershey PA 17033-1240, USA
Tel: 717/533-8845; Fax 717/533-8661; URL-http://www.igi-global.com

ITJ 5186

This paper appears in the publication, International Journal of Ambient Computing and Intelligence, Volume 1, Issue 3
edited by **Kevin Curran © 2009, IGI Global**

Routing in Opportunistic Networks

Hoang Anh Nguyen, University of Applied Sciences (SUPSI), Switzerland
Silvia Giordano, University of Applied Sciences (SUPSI), Switzerland

ABSTRACT

In Opportunistic Networks (OppNets), mobile devices transmit messages by exploiting the direct contacts, without the need of an end-to-end infrastructure. Disconnections of nodes and high churn rates are normal features of opportunistic networks. Hence, routing is one of the main challenges in this environment. In this article, we provide a survey of the main routing approaches in OppNets and classify them into three classes: context-oblivious, mobility-based, and social context-aware routing. We emphasize the role of context information in forwarding data in OppNets, and evaluate the relative performance of the three routing techniques. Finally, we present how context-based information is used to route data in a specific subclass of OppNets: Sensor Actor Networks (SANETs). [Article copies are available for purchase from InfoSci-on-Demand.com]

Keywords: Context-Aware Routing; Context Information; Delay-Tolerant Networks; Mobility Pattern; Opportunistic Networks; Routing in Mobile Networks; Routing in Mobile Sensor Networks

INTRODUCTION

In the last decade, mobile ad hoc networking has been suggested as a technology for realizing the ubiquitous computing vision. However, after more than ten years of research in this field, this promising technology has not yet entered the mass market. One of the main reasons for this is the lack of a pragmatic approach to the design of infrastructure-less multi-hop ad hoc networks (Conti et al., 2007: The Theory). In current networks, the network layer has become the interface (and thus the bottleneck) between a growing multitude of applications and an increasing number of technologies. In terms of mobile ad hoc networks, this has resulted in the exponential grow of complexity at the network layer, which has further complicated practical realization.Opportunistic networking tries to simplify this aspect by removing the assumption of physical end-to-end connectivity while providing connectivity opportunities to pervasive devices when no direct access to the Internet is available. Pervasive devices, equipped with different wireless networking technologies, are frequently out of range from a network but are in the range of other networked devices, and sometimes cross areas where some type of connectivity is available (e.g. Wi-Fi hotspots). Thus, they can opportunistically exploit their mobility and contacts for data delivery (Conti et al., 2007: The Reality).

The elimination of the need to build paths drastically simplifies the routing in opportunistic networks; however, challenges remain that are distinct from those of conventional network routing methods. A routing scheme in OppNets has to provide data with some reliability[1] (ideally with full reliability) even when the network connectivity is intermittent or when an end-to-end path is temporally nonexistent. Moreover, since "contacts" in an opportunistic network may appear arbitrarily without prior information, neither scheduling routing nor mobile relay approaches can be applied. In such environments, flooding-based routing protocols appeared for some time to be popular design choice. However, this approach tends to be very costly in terms of traffic overhead and energy consumption. Routing performance improves when knowledge regarding the expected topology, the behavior of the participants, and the information about the participants themselves in the networks can be exploited: that is, the context information of the networks.

Context information can cover various ranges, depending on the specific routing protocols. It could be the workplace, home address, profession, and email address, the mobility pattern of nodes, or the communities that the nodes belong to, and so on. All information that aids in making decisions to route messages is context information. For example, to identify those hops best suited for communication towards the eventual destination, the home address of a user is a valuable piece of context information.

In the following section, we provide a brief description of the primary routing approaches in OppNets available in the literature, from "naïve" approaches to "intelligent" ones. Specifically, we emphasize the role of context information as well as social aspects in routing messages, where the classification of routing approaches is based on the amount of context information used as given in (Conti et al, 2008). Based on the context information exploited we classify routing in OppNets into three classes: context-oblivious, mobility-based and social context-aware protocols. Finally, we present the context-based routing

Related Content

Hierarchical Reinforcement Learning
Carlos Diukand Michael Littman (2009). *Encyclopedia of Artificial Intelligence (pp. 825-830).*
www.irma-international.org/chapter/hierarchical-reinforcement-learning/10339

Using Business Ontology to Integrate Business Architecture and Business Process Management for Healthcare Modeling
Bonnie S. Urquhartand Waqar Haque (2018). *International Journal of Conceptual Structures and Smart Applications (pp. 18-41).*
www.irma-international.org/article/using-business-ontology-to-integrate-business-architecture-and-business-process-management-for-healthcare-modeling/233533

Secure In-Network Aggregation in Wireless Sensor Networks
Radhakrishnan Maivizhiand Palanichamy Yogesh (2020). *International Journal of Intelligent Information Technologies (pp. 49-74).*
www.irma-international.org/article/secure-in-network-aggregation-in-wireless-sensor-networks/243370

A Dynamically Optimized Fluctuation Smoothing Rule for Scheduling Jobs in a Wafer Fabrication Factory
Toly Chen (2013). *Organizational Efficiency through Intelligent Information Technologies (pp. 265-284).*
www.irma-international.org/chapter/dynamically-optimized-fluctuation-smoothing-rule/71972

Browsing Large Concept Lattices through Tree Extraction and Reduction Methods
Cassio Melo, Bénédicte Le-Grandand Marie-Aude Aufaure (2013). *International Journal of Intelligent Information Technologies (pp. 16-34).*
www.irma-international.org/article/browsing-large-concept-lattices-through-tree-extraction-and-reduction-methods/103877