Capsule Reviews

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The Capsule Reviews are intended to provide a short succinct review of each paper in the issue in order to bring to a wider readership. The Capsule Reviews were compiled by Fairouz Kamareddine. Professor Kamareddine is an Associate Editor of *The Computer Journal* and is based in the Department of Mathematical and Computer Sciences at Heriot-Watt University, Edinburgh, UK.

A Predictive Video-on-Demand Bandwidth Management Using the Kalman Filter over Heterogeneous Networks.
HUANG, LIN AND LIN

Multimedia data streamed over WLAN/3G networks suffer performance degradation due to packet loss, unreliable transmission medium and unsmooth playback. A predictive bandwidth management is needed to avoid such problems. This paper proposes a predictive video-on-demand (VoD) bandwidth management using the improved Kalman filter for streaming fine granular scalability (FGS) videos over the heterogeneous networks. The method is called U-BEKF (ubiquitous bandwidth estimation using the Kalman filter). First, the Kalman filter theory is introduced. Briefly, this is a recursive method, which addresses a discrete-data linear filtering problem and can correct/estimate past, current and future states of a process by simply using the latest states data. A number of earlier uses of the Kalman filter are discussed. Next, the architecture of the proposed U-BEKF model is explained including the network-monitor module, a Kalman filter module, a rate-adaptation module and an FGS-truncate module. Thereafter, the authors introduce the network-aware bandwidth estimation using the scalar Kalman filter over wired/WLAN/3G networks ubiquitously and follow the network monitoring and bandwidth estimation by a rate adaptation module. Numerous experimental results are carried out, which help analyse the proposed U-BEKF and compare it to other existing software. These experiments show that U-BEKF can efficiently decrease the packet loss-rate.

Design and Performance Evaluation of a Transport Protocol for *Ad hoc* Networks.
ANASTASI, ANCILLOTTI, CONTI AND PASSARELLA

Transmission control protocol (TCP) cannot efficiently deal with the unstable and dynamic environment of multi-hop *ad hoc* networks. This paper advocates that since TCP inefficiencies are numerous, an entirely different design approach is needed. The new framework proposed in the paper is referred to as the new transport protocol for *ad hoc* (TPA) networks. Section 2 gives an overview of the literature written to improve TCP and to avoid some of its inefficiencies. This overview divides the literature into five categories: (1) those that distinguish between losses due to route failure, (2) those that reduce the effect of route failure, (3) those that reduce wireless channel contention, (4) those that improve TCP fairness and (5) those that design new transport protocols. In the last categories, one finds TPA, which conserves some TCP characteristics that are suitable for *ad hoc* environments. TPA was presented in earlier papers by the authors. In this paper, the authors extend their earlier experimental analysis to different topologies, consider large topologies, mobile scenarios and discuss fairness. In Section 3, TPA is described in detail concentrating on its segment structure, its data transfer, its route change and failure management, its congestion control mechanism and its ACK management. Experimental results are given in Section 4, aimed to compare TPA and TCP in realistic small-scale *ad hoc* networks.

These results show that the throughput of TPA is higher than that of TCP and that TPA consumes less energy and enjoys lower congestion than TCP. Then, in Section 5, the paper concentrates on five simulation scenarios in order to investigate the scalability and fairness properties of TPA. Throughout, the paper considers different scenarios, different topologies and both static and mobile configurations.

Supporting the OSGi Service Platform with Mobility and Service Distribution in Ubiquitous Home Environments.
IBRAHIM AND ZHAO

Most ubiquitous applications are supported by the service-oriented paradigms and only allow devices of the same protocol to interoperate. However, the service-oriented OSGi specification enhances residential networking and offers portability and interoperability. Since current implementations of OSGi only provide limited support to the necessary requirements of pervasive computing (spontaneous interoperability, mobility and adaptability), and since current extensions of OSGi remain limited in their abilities to address these requirements, this paper proposes two further extensions aimed at supporting these requirements. These extensions include support for spontaneous interoperability in mobile environments and for adaptability.

The background section of the paper overviews the OSGi middleware and gives an introduction to code mobility, which provides the capability to move code across nodes in a network, together with a detailed overview of some of the literature on code mobility. The authors favour weak mobility where only code is usually transferred (and perhaps also the execution unit's initialization), mainly because supporting strong migration in OSGi may not be possible and furthermore, weak mobility is sufficient. Next, the paper describes a conceptual framework for weak mobility of OSGi services across OSGi nodes where mobility and distribution are key features. After mapping the mobility terminology to OSGi entities and concepts, and after identifying the requirements for the proposed conceptual framework, the paper moves to describe the elements of this framework (in particular connectivity and sharing, controlled visibility and service identification, service distribution and synchronous/asynchronous mobility and invocations). This is followed by the architecture of the proposed framework with the details of its export/import mechanisms and its push/pull mobility styles. The design and implementation of the extension of OSGi, which realizes the proposed conceptual framework are then described. A section is devoted to the evaluation of the proposed framework from a number of angles (interactions, portability and adaptability) and this is followed by a discussion of the related work and a conclusion.

Integrating Wireless Sensors and RFID Tags into Energy-Efficient and Dynamic Context Networks. LOPEZ, KIM, CANEPA AND KOUMADI

Radio frequency identification (RFID) and wireless sensor networks (WSNs) accommodate promising applications in ubiquitous computing. The authors of this paper believe that the meaning of ubiquitous should make WSNs part of the real world objects so that their information can be augmented in the same way as is done in RFID. The authors believe furthermore that merging RFID and sensor networks could result in truly smart mobile objects. With this goal in mind, the paper studies the challenges that arise from merging RFID and WSN.

After introducing the paper in Section 1, the authors discuss related work and compare different approaches in Section 2.

In Section 3, the authors design the WISSE (a wireless sensors and RFID for smart environment) framework which is an integration scenario in which mobile objects and users carrying both RFID tags and WSN receive ubiquitous services. The main components of the architecture of WISSE are described together with the motivation for the work. In Section 4, the context layer association protocols are explained in detail where first the main component 'entity' is presented. This is followed by a description of the grouping of entities and processes, some methods of election of entities and the grouping procedure and its extension. Section 5 defines the energy model and applies it to a lifetime prediction approach. Section 6 describes the simulation tools that implement their protocols and draws the graphical representation of the state. Implementation details are provided in Section 7 followed by the conclusion in Section 8.

Optimal Algorithms for Finding a Trunk on a Tree Network and its Applications. LI, PENG AND CHU

In the literature, numerous optimization problems have been studied with the aim of optimally locating a service facility in a network. It is well known that the criteria for optimization are different from one application to another. This paper concentrates on the so-called trunk optimization path, which optimizes both the cumulative distances (distances from the facility to all its vertices in a network) as well as the weight of the facility. In particular, the authors develop optimal sequential and parallel algorithms for constructing a trunk in a tree network and apply their method to mobile and *ad hoc* networks.

The problem of finding a trunk is reduced to the simpler problem of finding a so-called rooted trunk allowing for an efficient solution to the original problem. After the introduction section, the authors define the trunk of a tree in Section 2 and give the theory of rooted trunks in Section 3, showing that the problem of constructing a trunk for a tree T can be reduced to the problem of constructing a rooted trunk for a rooted version of T. Sections 4 and 5 introduce a sequential, respectively, a parallel algorithm for finding a rooted trunk. Section 6 deals with the applications of the proposed method to mobile *ad hoc* networks and gives concluding remarks.