Session and Network Support for Autonomous Context-Aware Multiparty Communications in Heterogeneous Mobile Systems

Josephina Antoniou, University of Cyprus, Cyprus
Christophoros Christophorou, University of Cyprus, Cyprus
Augusto Neto, Federal University of Goiás (UFG), Brazil
Susana Sargento, University of Aveiro, Portugal
Filipe Cabral Pinto, University of Aveiro, Portugal
Nuno Filipe Carapeto, Portugal Telecom Inovação, Portugal
Telma Mota, Portugal Telecom Inovação, Portugal
Jose Simoes, Technical University of Berlin, Germany
Andreas Pitsillides, University of Cyprus, Cyprus

ABSTRACT

The increase of networking complexity requires the design of new performance optimization schemes for delivering different types of sessions to users under different conditions. In this regard, special attention is given to multi-homed environments, where mobile devices cross areas with overlapping access technologies (Wi-Fi, 3G, WiMax). In such a scenario, efficient multiparty delivery depends upon the grouping operation, which must be done based on several parameters. In this paper, the authors propose context-aware sub-grouping of content-based service groups so that the same service session can be delivered using different codings of the same content, adapting to current network, users, session, and environment context. The context-aware information is used to improve the sub-grouping process. This paper aims to describe these sub-grouping techniques, and in particular how they improve network performance and user experience in the future Internet by focusing on the improved network-level and session-level mechanisms.

Keywords: Context-Awareness, Heterogeneous Mobile Systems, Multiparty Communications, Network Management, Session Management, Telecommunications Technology

DOI: 10.4018/jhcr.2010100101
INTRODUCTION

Increasing demands in group-based multimedia sessions, new technologies and market forces are fueling the design of the future Internet, which is expected to fundamentally change the networking landscape in the upcoming years. In order to preserve profitability while increasing revenues, network/service providers must optimize costs and provide new types of sessions operating in a mixture of access technologies (wired and wireless), which is not trivial and demand complex control. Special attention must be given towards group-based multimedia sessions, since the strong requirements on Quality of Service (QoS) must be fulfilled simultaneously for all users of the same group and be kept during the entire session lifetime.

In terms of group-based sessions, efficiency of session setup requires a correct definition of user groups. Nowadays, most mobile devices are produced with multi-homed capabilities, and it is common to cross areas where there exists overlapping of different network access technologies, such as Wi-Fi, 3G and WiMax. The efficiency of the grouping operation (creation of a set of users to receive a given session) may depend on a few parameters, including the access technology. For instance, 3G networks have lower bandwidth capabilities in comparison to Wi-Fi and WiMax networks, thus, depending on network conditions, for 3G users to be able to join a session, capacities should be carefully considered. Thus, sub-grouping could be performed and the same service session could be delivered with different throughput (e.g., using different codings of the same content) to adapt the throughput to the current network capabilities. In addition to network traffic, other types of context information should also be used to improve sub-grouping, such as noise, terminal location and speed, user’s priority and network preferences, user’s terminal capabilities, quality of signal strength received, environmental conditions etc. Moreover, history context information can also be used for improving sub-grouping. For example, previously received context can be compared with current context for patterns to be located. Using some intelligence, forecasts of undesirable events are possible and sub-groups may be created so that such events are avoided.

The paper, based on work performed in (PT Inovacao, n.d.), proposes such innovative sub-grouping process to enable context-awareness and consequently self-optimization in multiparty, converged mobile environments. These sub-grouping techniques, and in particular how they improve network performance in the future Internet, are described in the scope of cognitive self-managed networks. The session and network-level grouping processes proposed in this paper take as a base support, the description of the base functionalities of each element in the architecture, described in (Antoniou, Christophorou, Neto, Sargento, Pinto, Carapeto, Mota, Simoes, & Pitsillides, 2009), going further on the complete framework for multi-level context-aware sub-grouping. In (Antoniou, Christophorou, Janneteau, Kelil, Sargento, Neto, Pinto, Carapeto, & Simoes, 2009) it was presented a first attempt on the support of context-aware sub-grouping. In this paper, it is provided a thorough description of the sub-grouping mechanism and a full solution for its support, including how session modification and network selection are handled and how they impact sub-grouping. Moreover, we provide information on how such a framework is implemented and evaluated.

Related work is briefly presented next, followed by an overview section discussing a context-aware multicasting architecture and introducing the sub-grouping mechanism. The following two sections diverge into the self-management through sub-grouping as designed at the session and network layers. A presentation of how context is used by the content comes next, and finally the last section offers conclusions and directions for future work.

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