A Testbed for Efficient Multicasting and Seamless Mobility Support

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Abstract—**In modern wireless communications infrastructures, connectivity issues are very important and need to be addressed during the design of new radio network architectures. Therefore, special network components and devices are necessary to ensure the best possible connection for a user. Furthermore, it is important to ensure an efficient use of the available transport medium. To evaluate our proposed concept, we developed an appropriate test bed. In this paper, we introduce our hardware for the testbed and explain the individual parts of our architecture and the according functionality. Additionally, we give an overview about the interaction between the components.**

Mobility Support, Multicast, Handover, Quality of Service, Multiparty Transport Overlay, Context Broker

I. Introduction

Today, the heterogeneity of the radio network landscape requires new concepts for access control. To ensure a mobile terminal always gets the best connection in terms of Quality of Service (QoS), it is essential to develop and evaluate concepts for performing horizontal and vertical handovers. Decisions for performing a handover depend on a list of parameters. These parameters are not restricted to network specific values like Receives Signal Strength Indicator (RSSI), rather, additional sensor information (like e.g. location or speed) will help to predict an upcoming handover.

This paper introduces an architecture for testing and evaluating developed concepts in [1], [2], [3], and [4] to improve QoS results. Figure 1 shows a block diagram of our testbed.

This paper is structured in the following way: Section II presents a brief overview on each part of the testbed. In Section III, we give a system description and present the procedures. In Section IV, a conclusion and an outlook about future work is given.

II. System Architecture

In this section, we briefly describe the major blocks of the architecture.

A. Functional entities

In the first subsection, we describe the functional blocks of our system architecture (cf. Figure 1).

1) Context Broker (CxB)

The Context Broker acts as a centralized register for all context providing entities (NUM, Group Management, SME, Access Points and Mobile Terminals). Its function is comparable to a look-up table.

2) Network Use Management (NUM)

The scope of the Network Use Management (NUM) module is to provide intelligent, context-aware network selection for wired and wireless networks. The overall goal is to achieve an enhanced overall network capacity and performance balancing (i.e. to avoid underutilized or over utilized networks and improve QoS).

3) Multiparty Transport Overlay (MTO)

This module provides multiparty transport overlay services to allow the support of IP unicast and IP multicast connections. Therefore, it is necessary to collect the network parameters from the NUM and transport layer QoS parameters from the IP transport module. The processing of the retrieved data enables the provisioning of functions to allow dynamic interactions between the MTO module and the Group Management.

4) Group Management (GM)

The Group Management provides a dynamic management of multiparty transport groups. All required data can be retrieved from the CxB or the MTO.

5) IP Transport (IPT)

The “IP Transport” (IPT) functional module aims to control the configuration of context-aware network devices in order to deploy an efficient provisioning of network resources suitable for group applications. The main idea consists in using context of network devices, in addition to session, for a dynamical allocation of network resources in terms of bandwidth and IP multicast trees.

6) Flash Server

The flash server provides video streams with respect to the requirements or requests from the MTO and SME respectively.

7) Access Points and Mobile Terminal

The access points are responsible to provide access for the mobile terminals and to send context data like load of the access point or attached number of users to the CxB.

A mobile terminal is a data consumer. It requests a data stream and initiates all necessary processes in terms of network optimization. Additionally, it provides context information, like its position or available networks and sends this data to the CxB.

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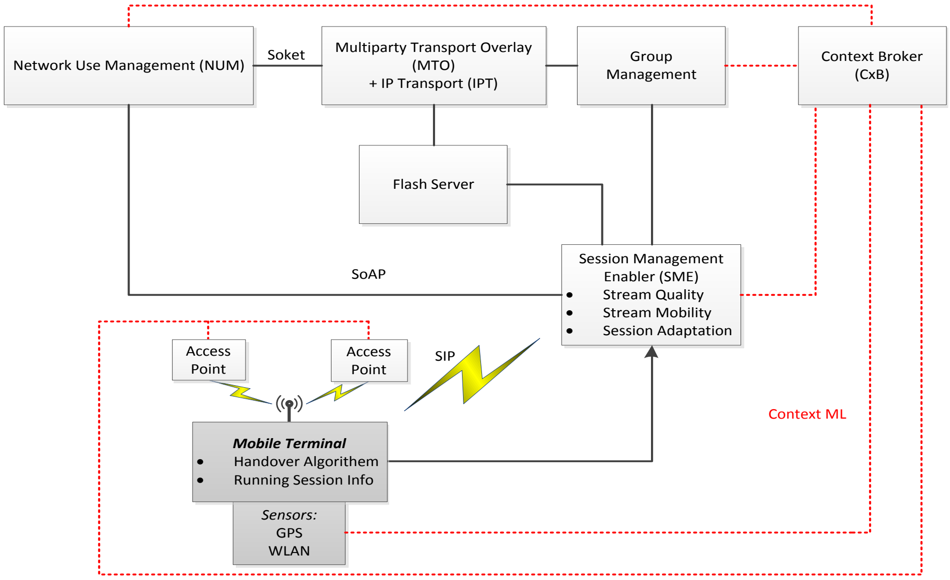

Figure 1: System architecture block diagram

B. Hardware

To ensure a flexible implementation, we decided to use common computer hardware. Our mobile terminals are Dell Latitude E5500 Notebooks with an internal and an additional PCMCIA D-Link DWA-645 Wireless LAN card, and a Garmin GPS receiver. Our Wireless LAN access points are Dell Desktop PCs with additional PCI Wireless LAN Cards. Both card types are equipped with an Atheros chipset.
All remaining components are implemented in Java or C code, i.e. a common PC is sufficient for the deployment.

III. System Description and Procedures

A. Multicasting

In our considered test scenario, several users are co-located in our deployment area. The users start requesting video streams. The SME entity informs the Group Management about the user requests. The GM acquires information such as user profiles that include device capabilities with respect to e.g. screen resolution, supported radio technologies, point of attachment, available radio networks, and network status for group building. In coordination with the SME and MTO, user sessions are initiated and different video streams, originating from the flash server, are triggered. In case the user situation changes, e.g. a change in his point of attachment, the SME is triggered via SIP signaling to adapt the ongoing session.

B. Mobility Support

The proposed concept aims at enabling seamless mobility. In order to ensure an efficient handover (HO) performance, each terminal is equipped with two W-LAN adapters continuously changing their roles, where one card is in charge of establishing a connection to the most suitable AP, while the second card periodically scans for available radio networks. In case a mobile user changes his location and enters the radio coverage of another radio network, the terminal handover algorithm checks whether the HO condition is fulfilled. Only if the signal strength of the (newly) best-rated AP of the scan results list is above a certain threshold plus hysteresis margin for a defined number of successive time intervals, a HO is triggered. If this HO condition is satisfied, the former “scan” card connects to the identified AP and informs the SME about a necessary session adaptation. After session adaptation is completed and traffic redirected, the second W-LAN card becomes the “scan” card.

IV. Conclusions and Future Work

This paper presents a testbed for analyzing multicasting and handover procedures for mobility support. Especially mobility support requires the facility of vertical and horizontal handover procedures. Since our hardware is restricted to W-LAN, we extended each mobile terminal with a second W-LAN card to significantly improve handover performance.

In the future, we will integrate additional radio access technologies like GSM to provide improved options for testing handover procedures.

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