The 4th Workshop of COST Action IC0902
Cognitive Radio and Networking for Cooperative Coexistence of Heterogeneous Wireless Networks
October 9–11, 2013
Rome, Italy

AUTHORS CONSENT TO INCLUDE THIS CONTRIBUTION IN THE OPEN ACCESS ONLINE REPOSITORY OF IC0902: YES

NAME OF AUTHOR GIVING CONSENT: George Agapiou, Ioanna Papafili, Roi Arapoglou, Nancy Alonistioti

---

Contribution to Special Interest Group SIG4>"

A novel cognitive engine towards geo-location based Vertical Handoff decision

George Agapiou, Ioanna Papafili, Roi Arapoglou*, Nancy Alonistioti*
OTE S.A., Athens, Greece
Research Labs
{gagapiou, iopapafi}@oteresearch.gr
** National and Kapodistrian University of Athens, Greece*
Department of Informatics and Telecommunications
{k.arapoglou, nancy}@di.uoa.gr

Insert name of presenter with affiliation here
Ioanna Papafili,
OTE S.A., Research Labs
Athens, Greece
iopapafi@oteresearch.gr
Insert your text from here on (please 2 pages at maximum)

INTRODUCTION

Heterogeneous wireless networks have been very important and constitute the state-of-the-art in 4th Generation (4G) wireless networks. Research towards integration of different radio technologies (e.g. WLAN, WiMAX, LTE) has established several interworking architectures for the technologies to play the role of access and backhauling for satisfying the high bit rates of users. In parallel, efforts towards unified interworking mechanisms have a common purpose, the seamless Vertical Handoff (VHO) by supporting service continuity and QoS.

The most important issue in a Vertical Handoff Decision (VHD) is the selection of the appropriate RAT while also eliminating ping-pong effects. Therefore, a series of algorithms have been developed towards the direction of optimal resource allocation. Among others, received signal strength (RSS), bandwidth and availability are common metrics used in order to define thresholds and detect handover conditions.

A heterogeneous platform is used to demonstrate the Location-Based Vertical Handover (VHO) by executing VHO requests initiated by VHO algorithms which consider position as one of their primary decision metrics. The idea is to demonstrate the potential benefits in preparation/execution of a vertical handover in a heterogeneous environment due to the a priori knowledge of this kind of positioning information and also the benefits in energy efficiency by having a positioning knowledge in beyond 3G-communication where adapters of different Radio Access Technologies (RAT) need to be awake and available in order to transfer (if needed) the call/connection to them. In such a case, positioning information can be used in conjunction with premeasured or pre-calculated coverage maps of the different Radio Access Networks (RAN) to switch ON and OFF the respective adapters and thereafter save to the best possible extent as much energy as possible.

An abstract view of this demonstration architecture is shown **Errore. L'origine riferimento non è stata trovata.**. The test-bed consists of five different or complementary technologies. The testbed consists of base stations and access points that can be either commercial or programmed ones. The commercial ones are more stable but they have characteristics that cannot be programmed easily depending on the standard or the programming language of the firmware. These are WiMAX (802.16d), mobile WiMAX (802.16e), LTE, Cisco based WiFis (802.11n), Soecris based WiFis (802.11b/g) and Femtocells (HSDPA). The VHO process is splitted in two processes. The Communication parameters RSSI and data rate are sent to the database which in return forwards the position data to the platform that instructs the terminal to be connected to the network that can provide the best communication means.
The terminals used in the communication scenarios are conventional laptops/notebooks which employ 2 USB Wireless adapters with; one Wi-Fi and one WiMAX adapter as each of which can connect to either the Wi-Fi Soekris platform or to a WiMAX Base station (802.16d). There will also be advanced 4G smartphones (Android based) and tablets/ipads.
The following picture shows the x, y measurements of the user's terminal that are passed to the WHERE2 database. These are going to be used along with the capacity metrics as a criterion for the handover process. The following figure shows the user's position measurements which can be done either by prediction (fingerprinting process, or by using any other positioning algorithm).
The database, shown in Figure 2, in which the user's position data are kept communicates either straight with a user's terminal which then decides to which network to be handed for the best communication means or to a server which makes the decision and instructs the terminal to take the handover action. Figure 3, shows the handover process action where the positioning data are communicated form the database to a server or straight to the terminal for the handover action.

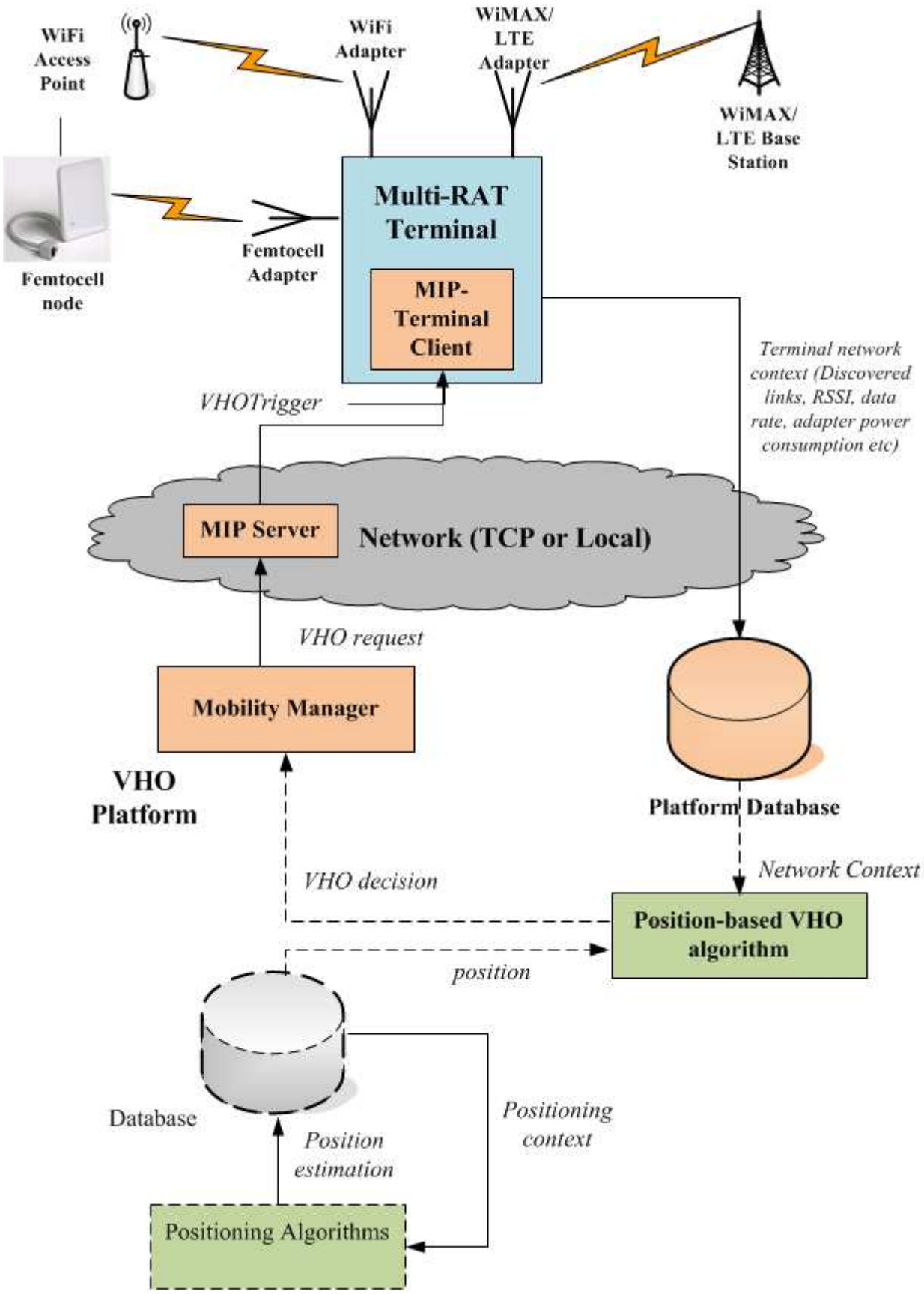

Figure 1. Platform architecture for the VHO process

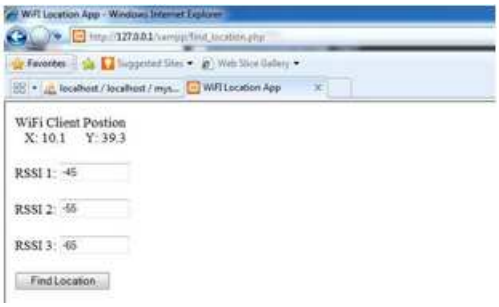

Figure 2: User's terminal position measurements passed to the database

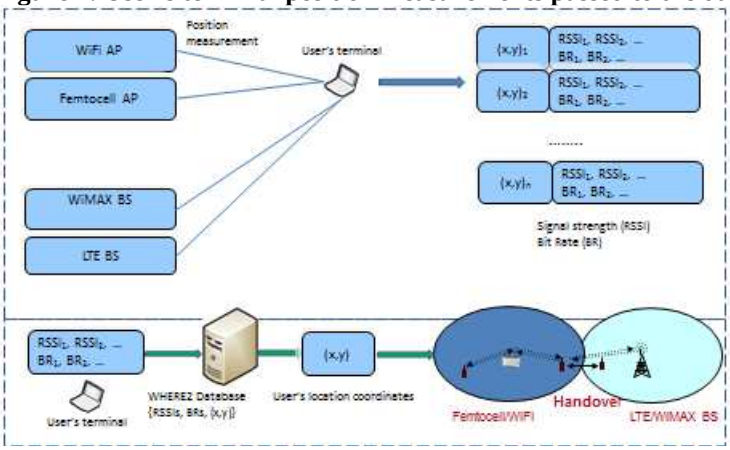

Figure 3: VHO process (Position measurements – Database- Decision- Handover)

with 4G interface in order to show the VHO between the four technologies (802.11g/n, 802.16d/e, femto and LTE).

CONCLUSION

In this paper, an overview of the enhanced cognitive engine of WHERE-2 is provided. This engine is deployed in an heterogeneous network environment and exploits positioning techniques in order to balance the load among available RATs. Future work will focus on the execution of this engine with real network measurements. Towards this direction, an indoor environment is considered where GPS measuring is infeasible. Mobile nodes demand service continuity while associating with different RATs. A video demo will provide the story line as well as the decisions of the cognitive engine. Geo-location based vertical handoff decisions will be enforced and the resulting network resource utilization will be validated. Finally, an assessment of the trade-off between conventional load balancing techniques and the proposed scheme will be extracted.