A Novel Algorithm to improve QoS for Heterogeneous Mobile Devices

A. Haja Alaudeen[1], Dr. E. Kirubakaran[2] and Dr. D. Jeya Mala[3]

[1]Asst.Professor, Dept of Software Engineering,
Periyar Maniammai University, Vallam, Thanjavur, India
[2]AGM, SSTP (Systems), Bharat Heavy Electricals Limited, Tiruchirappalli, India
[3]Associate Professor, Dept of Computer Applications,
Thiagarajar College of Engineeering, Madurai,India

Abstract- The next generation of wireless communication systems will be based on heterogeneous concepts and technologies that are still evolving. Ongoing world-wide adoption of heterogeneous mobile devices has created an unprecedented demand for data access by the user in the field of e-commerce or social media or entertainment applications from anywhere, at any time with enhanced Quality of Services (QoS). Heterogeneous devices used by the divergent users are characterized by different bandwidth, latency and jitter requirements. This divergence characteristic of devices reduces the QoS by the service provider to end users. To overcome this issue, we introduce a novel algorithm to enhance the QoS for heterogeneous mobile devices. Evaluation of our proposed algorithm results in improvement of QoS parameters such as bandwidth, delay, and jitter during data request and retrieval. The increasing importance of such diverse scenarios in which mobile networks concatenated with multiple subnets are connected to a backbone IP has recently been recognized by the Internet Engineering Task Force (IETF), where the working group will study the Network Mobility (NEMO) these and other scenarios.

I. Introduction

The location-based services (LBS) term is a recent concept that denotes applications integrating geographic location (ie, the spatial coordinates) with the general notion of services. With the development of mobile communication, these applications represent a challenge both conceptually and technically novel. Clearly, most of these applications will be part of daily life tomorrow that runs on computers, personal digital assistants (PDAs) [1], phones, and so on. By providing users added value to the mere location information is a complex task. Given the variety of possible applications, the basic requirements of LBS are numerous. Among them we can mention the existence of rules, to computationally efficient, powerful and yet user-friendly human-machine interfaces. This work aims to understand and describe in an accessible manner the different concepts that support mobile LBS. It is written by experts in the relevant subjects. The main issues to consider when it comes to LBS [2]. Location-based services are mainly used in three areas: military and government industries, emergency services, and the commercial sector. As mentioned above, the first location system in use was based on the GPS satellite, which allows precise location of people and objects up to 3 feet or more precision. In this article, Member States are asked to develop national standards for mobile operators to impose the automatic positioning of emergency calls: "Member States shall ensure that undertakings which operator public telephone networks make information call location available of emergency management authorities. “Technical feasibility "in this context means that unlike in the United States, European regulators do not meet the highest levels of precision such as GPS for locating emergency [3]. Though GPS allows a cell phone to be located accurately, European operators have the right to start with precision levels of their mobile networks can offer right now. Given that over 80% of European operators have launched the so-called Cell-ID [CI03] technology for positioning Mobile, very low levels of accuracy can only be offered by now in emergency: 100 meters potentially in urban areas, but only up to 3 -kilometer accuracy in rural areas. In this case, the local content is local to the immediate location of the consumer. Some of these applications couple LBS with notification services, automatically alerting users when they are near a preset destination. LBS Proponents believe that these services will create new markets

 ISBN : 978-81-929742-3-1

and new revenue opportunities for device manufacturers, wireless service providers, and application developers. The main objective of this project is to propose a novel algorithm to improve the QoS for Heterogeneous mobile devices [4] which makes the discovery of available heterogeneous devices around the user and provide qualitative QoS to the users irrespective of their devices. The interconnection of these various wireless technologies for the efficient delivery of services and value-added applications takes several difficult issues. Some of these problems are related to architectures, resource allocations, mobility management, provision of quality of service (QoS) and security.

II. Related Work

The existing work on Location based service is evaluated and the observation made as follows. For the method of measurement without GPS, in DL / UL, AMS receives / transmits signals to / from multiple measurement LBS ABSs. As is known for single carrier operation, most LBS measurement methods (such as TOA and TDOA) should be performed between multiple ABS AMS and at different times. AMS means that only receives / transmits measurement signals to / from an ABS by chance transmits / receives. For example, when it is performing the U-TDOA measurement, serving ABS must negotiate with neighboring ABSs get dedicated ranging resource for location measurement, and sending these measurement parameters to AMS. Then, AMS can use the parameters ranging from information and send as dedicated CDMA codes dedicated to these securities through a single carrier in different moments of meeting. Location based service (LBS) [5] are information services accessible with mobile devices through the mobile network and utilizing the ability to make use of the location of the mobile device. The use of mobile networks is rapidly increasing day by day. There are two aspects in mobile networks and host mobility and network mobility. Protocols used to host mobility handle only a single node to be connected to the Internet. But the protocols used for network mobility care of the entire network to be connected to the Internet with the help of mobile router. The need for the Support Network Mobility (NEMO) is inevitable in mobile platforms such as car, bus, train, etc. The Internet Protocol Mobile 6 (MIPv6) version and NEMO Basic Support Protocol (BSP) are used to support the host mobility and network mobility, respectively.

The management strategy based on a message is sent to a neighbor that is closer to the direction of destination. To send a data message to a destination, a source node draws a circle around the probable target location and makes an application area by drawing two tangents on either side of the circle. In addition, each intermediate node repeats the same process until the data message is delivered to the destination. Upon receipt of the data message, the destination sends an acknowledgment source. If the acknowledgment is not received within stipulated source assumes failure and floods the message route data across the network as recovery routine. If the target location information is outdated, the source floods the message data across the network instead of creating an area of request.

QCI	Resource type	Priority	Packet delay budget	Packet error loss rate	Example services
1	GBR	2	100 ms	10^{-2}	Conversational voice
2		4	150 ms	10^{-3}	Conversational video (live streaming)
3		3	50 ms	10^{-3}	Real time gaming
4		5	300 ms	10^{-6}	Non-conversational video (buffered streaming)
5	Non-GBR	1	100 ms	10^{-3}	IMS signaling
6		6	300 ms	10^{-6}	Video (buffered streaming), TCP-based (e.g., www, e-mail, chat, ftp, p2p file sharing, progressive video, etc.)
7		7	100 ms	10^{-6}	Voice, Video (live streaming), Interactive gaming
8		8	300ms	10^{-3}	Video (buffered streaming), TCP-based (e.g., www, e-mail, chat, ftp, p2p file sharing, progressive video, etc.)
9		9		10^{-6}	

Table 1 QoS Technology over 4G networks

III. Methodology

A. Device Discovery and Service Selection Algorithm

Pseudo code for the device discovery and service selection algorithm is shown in Figure 1and the process flow shown below. We present our approach to the discovery of network nodes and the connectivity between them. Since our approach is mainly based on first major management information base (MIB) [7] objects needed are analyzed to build our algorithm. We then use to build a discovery algorithm, which is basically divided into three different modules, namely, device discovery, device discovery, discovery and connectivity. The user Device section describes the behavior of the client device as it initiates inquiry about the location based services. The Service Device section describes the behavior of the server device as it is discovered. Note that the service device must be in a state of responding to user Device requests in order to assist in the location based services.

Let u be the user device
Let s be the service device
Let LAu be the address of the user device
Let LAs be the address of the service device
Let QRr be the IAS Query Response from the service device
Let DD be a list of discovered devices, where DDn is device n in the list
Let IASIa be the IAS entry for the each device

User Device

Begin
DD = Discover();
if(size(DD) == 0)
return;
Connect(DD_0);
QR_r = IASQuery(DD_0, ":Address");
if(QR_r == null)
return;
BA_s = IRIAS_GetUserString(QR_r);
ServiceConnect(BA_s);
End.

Service Device

Begin
LAu = RetrieveUserAddress();
$IASI_a$ = CreateIASEntry(LA_u);
while(true) {
switch(Event) {
UD_DISCOVER:
DiscoveryResponse();

UD_CONNECT:
ConnectResponse();
UD_IASQUERY:
UDResponse(IAS_{ba});

LBS_CONNECT:
LBSConnectResponse();
}
End

IV Case Study

A. First Review

To recruit the subjects for our study we conducted a survey asking mobile users for their socio-economic status (age, occupation, education level and family status), how long they have used mobile technologies (year started), type of and provider for their current phone, how they think they use their current phones for voice communication and data, which applications they use and with what frequency, general experience with their phone, and whether their expectations (and which ones) were being met, and to which extent. We used the responses to this survey to randomly select 30 subjects for our four-week long study. Android Context Sensing Software (CSS)[8] Application With the rapid development of wireless communication networks are expected to be launched the fourth generation mobile systems in a matter of decades. 4G mobile systems focus on seamlessly integrating the existing wireless technologies including GSM, wireless LAN, and Bluetooth.

V Preliminary Results

By the end of the study, we collected a total of 15 GB of data from all users. The largest sized log files belonged to the accelerometer, magnetometer and orientation CSS modules. The most energy consuming modules were the location log module (including Global Positioning System (GPS) sensor), WLAN sensor, and accelerometer, magnetometer, orientation, illumination and proximity modules [12].

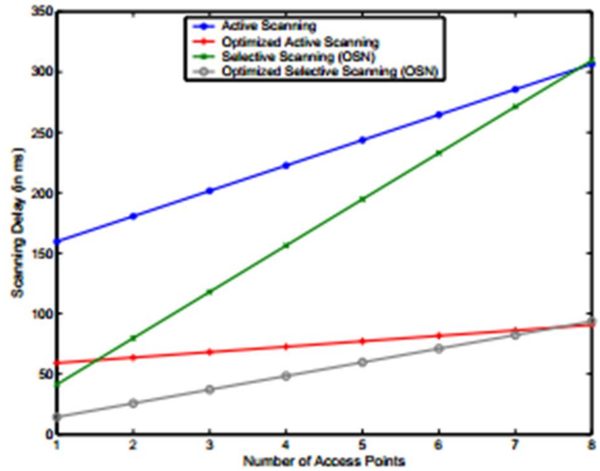


Figure 1. Scanning delay for one user with an increasing number of access points

Our goal is to evaluate the impact of jamming broadcasts in the process of scanning a mobile node. A growing number User randomly placed in the BSS, generate CBR traffic for access 10Mbps point. We can see that the delay introduced in access the medium is still negligible compared to the loss of time to wait Probe responses. Based on these observations, this paper aims to reduce transfer delay in WLANs access architecture using a two-tier consists of a sensor control plane overlay data onto a plane.

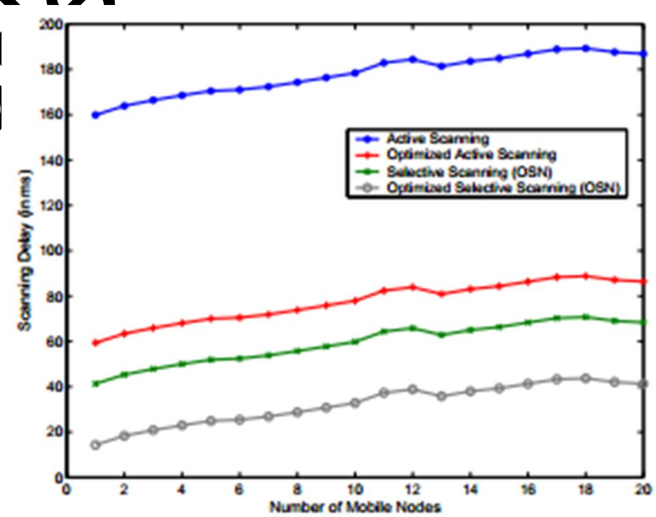


Figure 2. Scanning delay for several users with one access point

A QoE Ratings

In total we have received around 7500 QoE ratings from all users. In the first week we collected around 1300 ratings from our users, in the second 1700, in the third 2500, while in the last week there were 2000 ratings. The high ratings (4 and 5) are much frequent than low ratings (1, 2, 3) for all the users as depicted in Fig. 5. We conclude that in general, people seem to find their QoE to be acceptable in most cases. We expect such results since if the user was not happy with an application, she will likely not continue using it.

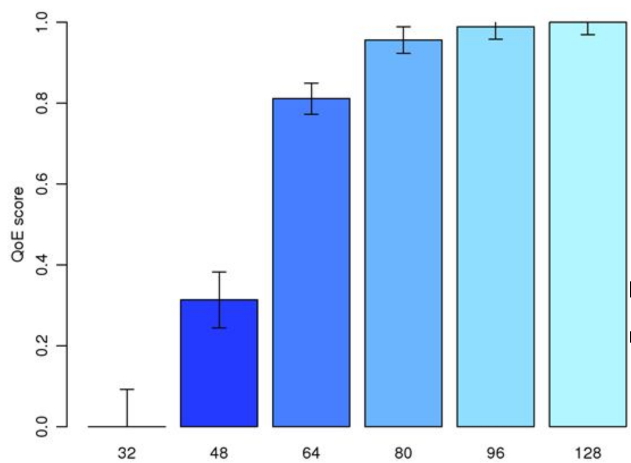


Figure 3 QoE scores ratings from all users

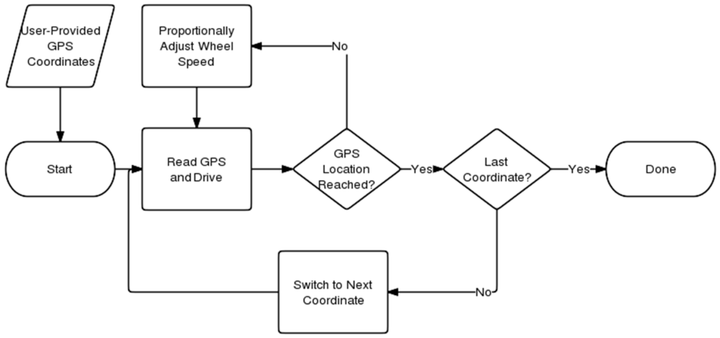
```
if(Debug("Router.SendLSP")) {
   cout << "SendLSP: Node: "<< node << " at:" << Time::Now()<<endl;
 }

 // Sends out LSP Packet
 Router_DB_Entry index;
 Packet p;
 String ListNeighbors;
 String d = ":#:";
 String h = "";

 index = cDB[node];
 if (index.cValid == 0) { // XXX node not valid in cDB
   cout << "FATAL ERROR SendLSP: Node not valid in LSB Database!\n";
   exit(0);
 }
 // Extract LSP information and turn into String
 typedef map<String, int>::const_iterator CI;
 for (CI i=index.cNeighbor_list.begin();i!=index.cNeighbor_list.end();++i) {
   h = h + i->first + d + String::Convert(i->second) + d;
 }

 // Construct LSP Packet
 p["opcode"]       = OP_LSP;
 p["src"]          = cLocalNode;
 p["node"]         = node;
 p["hops"]         = String::Convert(index.cHops+1);
```

```
p["sequence"]     = String::Convert(index.cSequence);
p["age"]          = String::Convert(index.cAge);
p["payload"]      = h;
```



B Role of QoS

Choice of the wireless access technology, i.e., WLAN, 2.5*G*, 3*G* or 4*G*, influences the resulting QoS; therefore we expect that such a choice also influences QoE. We observed that our users either did not use WLAN at all (having unlimited 3*G* unlimited data) or left WLAN always on to connect to predefined networks such as in their home or office.

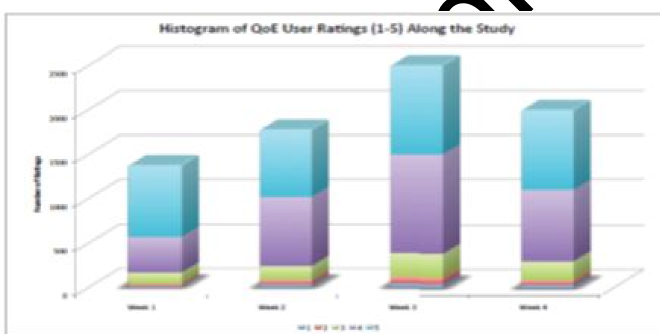


Figure 4. QoE Rating distribution over 4 weeks

In the order WiFi–4G–3G, whilst this changes to 3G – WiFi – 4G for the ones who charge their phone less often. A common feeling among our users was that 4G was as good as WLAN but drained too much battery.

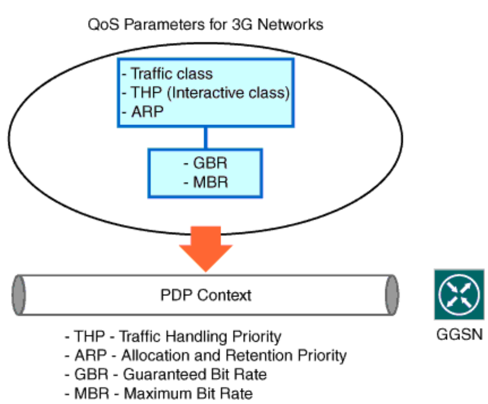


Figure 5. Quality of Service Overview

C. Some Factors Influencing QoE

For most of our users, it was not natural to talk about their QoE experiences; they implicitly assumed that with the study instruments being used, we could measure and understand all the factors influencing itWe observed that user's QoE is influenced by application designs such as web browser page scrolling capabilities, or a specification of the built-in dictionary for messaging. This is one of the biggest problems that we will face in our final data analysis: a user scores an application with a particular QoE value due to any subjective reason, including an interface-related reason. For example, if a person uses an application, in which a slider is too small for her fingers, and she constantly has trouble interacting with it, her subjective experience will be low, despite having an excellent QoS.

VI Conclusion

A lot of research has been done toward finding solutions for the mobile QoS. As Wireless technology matures and wider bandwidth spectrum is allocated to mobile users, wireless data customers will demand accuracy in data services. This paper identifies major problems, challenges and requirements in providing QoS enabled mobile applications and their corresponding candidate solutions. Some existing work is outlined as a survey, while some new ideas and proposals are presented from the research viewpoint. Clearly, the interaction of IP-level QoS signaling protocol with advanced mobility management at the IP level MOWLAM and other scenarios is still an exciting research topic. Furthermore, the problem of minimizing the cost of resources over multiple wireless hops to one QoS requirement of end-to-end as is an area for future research. The implications for design based on these factors are numerous and our future work includes further analysis of the collected data and identification of these implications for design.

References

1. Nair, H., Chintagunta, P., & Dubé, J. P. (2004). Empirical analysis of indirect network effects in the market for personal digital assistants. Quantitative Marketing and Economics, 2(1), 23-58.
2. Filjar R, Busic L, Desic S, Huljenic D. (2008) "LBS Position Estimation by Adaptive Selection of Positioning sensors Based on Requested QoS," Next Generation Teletraffic and Wired/Wireless Advanced Networking: 8th International Conference, Russia, September 3-5, 2008, Proceedings, pp 101-109
3. Silventoinen, M. I., & Rantalainen, T. (1996, February). Mobile station emergency locating in GSM. In Personal Wireless Communications, 1996., IEEE International Conference on (pp. 232-238). IEEE.
4. Wilson, A., Lenaghan, A., & Malyan, R. (2005, September). Optimising wireless access network selection to maintain qos in heterogeneous wireless environments. In Wireless Personal Multimedia Communications (pp. 18-22).
5. U. Leonhardt, Supporting Location-Awareness in Open Distributed Systems Ph.D. Thesis, Department of Computing, Imperial College, London (Imperial College, 1998).
6. Stahl, F., Gaber, M. M., Bramer, M., & Yu, P. S. (2010, October). Pocket data mining: Towards collaborative data mining in mobile computing environments. In Tools with Artificial Intelligence (ICTAI), 2010 22nd IEEE International Conference on (Vol. 2, pp. 323-330). IEEE.
7. Sarkar, S., & Boyer, K. L. (1993). Integration, inference, and management of spatial information using bayesian networks: Perceptual organization. Pattern Analysis and Machine Intelligence, IEEE Transactions on, 15(3), 256-274.
8. Burns, M. N., Begale, M., Duffecy, J., Gergle, D., Karr, C. J., Giangrande, E., & Mohr, D. C. (2011). Harnessing context sensing to develop a mobile intervention for depression. Journal of medical Internet research, 13(3).
9. Farhan Siddiqui, Sherali Zeadally, "An efficient wireless network discovery scheme for heterogeneous access environments", International Journal of Pervasive Computing and Communications, Year: 2008, Volume: 4 Issue: 1 pp: 50 – 60, DOI: 10.1108/17427370810873101.

10. Consolvo, S., & Walker, M. (2003). Using the experience sampling method to evaluate ubicomp applications. IEEE Pervasive Computing, 2(2), 24-31.
11. Kim, H. J., Lee, D. H., Lee, J. M., Lee, K. H., Lyu, W., & Choi, S. G. (2008, September). The QoE evaluation method through the QoS-QoE correlation model. In Networked Computing and Advanced Information Management, 2008. NCM'08. Fourth International Conference on (Vol. 2, pp. 719-725). IEEE.
12. Savarese, C., Rabaey, J. M., & Beutel, J. (2001). Location in distributed ad-hoc wireless sensor networks. In Acoustics, Speech, and Signal Processing, 2001. Proceedings.(ICASSP'01). 2001 IEEE International Conference on (Vol. 4, pp. 2037-2040). IEEE.
13. Borkowski J.M. (2003) "Performance of Cell ID + RTT Hybrid Positioning Method for UMTS". Master of Science Thesis. Department of Information Technology, Tampere University of Technology. Pp 94 – 122
14. N. Davies, The impact of mobility on distributed systems platforms Proceedings of the IFIP/IEEE Int'l Conf. on Distributed Platforms, Dresden,Chapman & Hall, 1996, pp. 18–25.
15. Zhuang, W., Gan, Y. S., Loh, K. J., & Chua, K. C. (2003). Policy-based QoS-management architecture in an integrated UMTS and WLAN environment. Communications Magazine, IEEE, 41(11), 118-125.
16. Zimmerman, T. G. (1999). Wireless networked digital devices: A new paradigm for computing and communication. IBM Systems Journal, 38(4), 566-574.