A survey on Efficient Paging Scheme for Terminal Mobility in Interworked Fixed and Mobile Networks

[1] C.Bala Swami [2] D.Jamuna

[1]Assistant Professor, Department of MCA, Nalanda Institue of P.G.Studies,
Guntur, Andhra Pradesh,
[2] Professor and Head, Department of CSE, Jaya prakash Narayan College of Engineering,
Mahabubnagar, Andhra Pradesh

Abstract:

In this paper, we study, Interworked fixed and mobile networks, both terminal mobility (TM) and personal mobility (PM) should be supported and interworked to provide seamless universal mobility to mobile users. TM supports movement between different locations with the same mobile terminal (MT). In TM management, an MT updates its location when it changes location area (LA) and an incoming call is delivered to the MT by paging all cells within a registered LA. PM supports user mobility between different terminals by using personal identifier (PID). PM registration information of users is managed at registrar and an incoming call is delivered to the registered terminal based on registration information at registrar. Since location management in TM generates a lot of signaling messages over radio interface and consumes scarce radio resources, it is essential to reduce the number of location registration and paging signaling messages, i.e., signaling load. In this paper, we propose an efficient paging scheme for TM in interworked fixed and mobile networks, by using registration information for PM management. In the proposed paging scheme, paging is firstly performed only to the cells containing terminals with which a user is registered for PM, instead of all cells within a registered LA. If the called user is not found in the first paging step, remaining cells within the registered LA are paged. Performance comparison results show that the proposed scheme can achieve significant signaling load reduction at radio interface, and save scarce radio resources.

***Keywords*:** mobility management; personal mobility; terminal mobility, Networked Fixed and Mobile Network.

1. INTRODUCTION:

Mobility management is one of the key technologies to support communication services to mobile users in mobile communication networks. Mobility is classified as terminal mobility (TM), network mobility, session mobility, and personal mobility (PM) and they are implemented in physical/link layer, network layer, transport layer, and application layer, respectively. By TM, a mobile user can be reachable while it is moving around the network with a mobile terminal (MT). Network mobility provides a collective mobility to an entire network of MTs riding on a transportation system. Session mobility allows a session to be maintained while a user changes a fixed terminal or an MT for the same service session. PM enables a user to use any fixed terminal or MT with personal identifier (PID), rather than terminal ID, based on registration information at either a fixed terminal or an MT. TM management consists of location management and handoff management.

Location management consists of location registration and paging, where a mobile user updates its location periodically and an incoming call is delivered to a mobile user by paging all cells within a registered location area (LA). Since location management generates a lot of signaling messages over the radio interface and consumes scarce radio resources, it is essential to reduce the number of location registration and paging signaling messages, i.e., signaling load. Handoff enables a mobile user to change its point of attachment when it moves across the cell boundaries. In handoff, minimizing delay to handover an ongoing call to a new base station is one of the most important requirements. Although TM covers mobility within mobile network, it does not cover mobility between fixed network and mobile network, and mobility between these networks is supported by PM. PM is realized by using unique PID and registration and deregistration at a terminal are needed by using PID.

Incoming call is delivered to an appropriate registered fixed or mobile terminal based on the registration information. PM can be classified as single registration and multiple registrations, depending on the number of terminals that can be registered at registrar simultaneously.

In single registration, only one terminal can be registered at registrar and high registration signaling load is generated. On the other hand, multiple terminals can be registered at registrar simultaneously in multiple registrations and high searching signaling load is generated to find the called user. In most previous works on PM, manual registration and deregistration are usually performed, and misrouted calls may occur if users forget to deregister when they move out from the area of the registered terminal. Recently, radio frequency identification (RFID) technology has been used to register users at terminals with RFID readers automatically by detecting the movement of users with RFID tags. In these works, RFID reader is installed at terminals and users move with RFID tags. Thus, if a user with RFID tag moves between different areas of terminals with RFID readers, the movement is detected automatically and registration can be performed at registrar. Both TM and PM are essential for providing seamless universal mobility services to mobile users but they have been developed independently in most previous works, although our previous work proposes an networking between TM and PM in mobile networks. In the authors propose an efficient pipelined search scheme for supporting PM in Session Initiation Protocol (SIP)-based voice over IP (VoIP) services in order to overcome the shortcomings of both sequential and parallel search schemes. In RFID technology is used to register users automatically when they are moving into a new area and reduce the probability of call-miss. In the authors propose a seamless mobility support mechanism between two access networks with RFID readers for users moving with RFID tags. In the works mentioned above, however, only PM was emphasized and there was little networking between TM and PM, from the aspect of performance improvement, to the best of our knowledge.

However, information registered for PM management can be used efficiently in order to support TM to mobile users. Thus, we propose an efficient paging scheme for TM using PM management information in networked fixed and mobile networks in this paper. In the proposed paging scheme, paging is firstly performed only to the cells containing terminals with which users are registered for PM, instead of paging all cells within a registered LA. If the called mobile user is not found in the first paging step, remaining cells within the registered LA are paged and it is guaranteed that the called user is found within this two step paging. The performance of the proposed paging scheme is analyzed and compared with that of conventional scheme. We will show that the proposed scheme can achieve significant signaling load reduction a radio interface, and thus, save scarce radio resources the optimum utilization of the resources.

In proposed system we focus on the causes of mobility. Starting from established research in sociology, we propose SIMPS, a mobility model of human crowds with pedestrian motion. We propose Sociological Interaction Mobility for Population, a mobility model aimed at pedestrian crowd motion that explores recent sociological findings driving human interactions: Each human has specific socialization needs, quantified by a target social interaction level, which corresponds to her personal status. Humans make acquaintances in order to meet their social interaction needs. We show that these two components can be translated into a coherent set of behaviors, called sociostation.

2. Interworked Fixed and Mobile Network:

Fig below shows Interfixed and wireless network architecture: This paper consists of various fixed and mobile access networks, such as cellular network, Office network, and home network. These networks are interworked based on common IP-based core network. Home location register (HLR), office gateway, and home gateway manage location information of mobile users residing at cellular network, office network, and home network, respectively. SIP registrar manages registration information for PM. It is assumed that terminals in fixed network are equipped with RFID readers and RFID tags are implemented within MTs. For PM, multiple registrations is assumed in this paper and thus, users can register all their terminals, i.e., office phone, home phone, etc., at SIP registrar simultaneously. In this paper hierarchical registration approach for PM management. That is, within home or office network domain, PM registration update is automatically carried out at gateway when mobile users with RFID tags move around different terminals with RFID readers in the same domain. The serving gateway information is managed at SIP registrar. Thus, incoming call or session to a called user for PM is delivered based on a combination of registered information at SIP registrar and gateway. PM registration procedure using RFID, which is based on works .RFID readers are implemented in terminals and RFID tag is implemented in an MT of a mobile user. We assume that mobile users carry their MTs with RFID tags. If mobile users do not carry MTs with RFID tags, it is additionally assumed that RFID tag is attached with a mobile user.

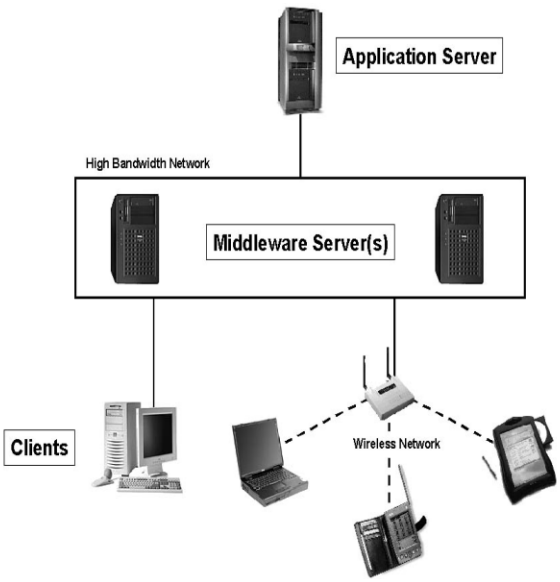

Fig: 2.1.Interfixed and wireless network architecture:

Therefore, mobile user's movement can be detected automatically with RFID reader. When a RFID reader in fixed terminal detects a RFID tag of a mobile user, it sends the RFID tag ID with the IP address of the fixed terminal to its serving gateway. Then, the PM location information of the mobile user is registered at SIP registrar after name server lookup in SIP name server. Finally, incoming call or session to the registered terminal can be delivered based on the combination of registered information at SIP registrar and gateway.

3. Paging Scheme:

In paging scheme, the PM management information registered at SIP registrar is efficiently used and reduces paging signaling load significantly. Since it is highly likely that mobile users reside at cells which contain registered gateways, the natural idea is to page only cells containing gateways managing fixed terminals with which users are registered. If the called user is not found in these cells, remaining cells are paged and it is guaranteed that the called user is found within this two-step paging. If a mobile terminated call or session arrives at cellular network, HLR queries to SIP registrar about the location information of registered fixed terminals. Since the obtained location information of gateways managing fixed terminals is a type of IP address, it should be converted to the geographical location information to find the cells which contain such registered fixed terminals. In this paper, it is assumed that the mapping between IP address and geographical location mapping is available. This converted geographical location information is delivered to visitor location register (VLR) of called MT. Then, the VLR maps the received geographical location information of registered gateways managing fixed terminals to cells within the registered LA which contain these gateways and paging is only performed to the mapped cells. If the called MT is not successfully found at the mapped cells due to stale PM registration information, the remaining cells are paged in the second paging step and it is guaranteed that the called MT can be found finally. By adopting this two-step paging approach based on PM management information at SIP registrar, paging signaling load can be reduced significantly, compared with conventional paging scheme, without increasing location registration signaling load for TM. Since registration signaling load for PM management inherently exists in networked fixed and mobile networks, any significant additional signaling load for PM is not introduced in the proposed paging scheme, except the signaling load for the query at SIP registrar for the location information of registered fixed terminals from HLR. Also, since the signaling load for the query at SIP registrar from HLR only consumes network resources, which has sufficient resources compared to radio interface, it does not introduce any significant burden on the network. We also note that additional delay may be introduced for two staged paging approach, but it is not significant for most applications since paging delay is limited to only two stages.

3.1. Paging Schemes for Location Management:

The performance of a paging scheme can be characterized by different measures, including:

1) Paging delay: the delay calculated from the time a call termination request arrives at the base station (BSC) till the time a reply is received by the BSC from the mobile containing its cell location. Paging delay directly affects the caller's experience and it should be kept as low as possible. If the paging delay is too long, the caller party may hang up

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2) Success rate: the likelihood of paging the precise cell where the mobile recipient of the call is located. If not all cells are paged, a paging message may not be reach the mobile. Clearly, a high success rate is desired.

3) Cost of paging: the total number of cells paged for each established call.

4) Cost of location management: the amount of resources required to perform location management.

Relevant resources include communication bandwidth, data storage, and CPU cycles.

4. Mobility Management for Mobile IP:

Mobility management can be broadly decomposed into two functions: location management and handoff management. Location management is concerned with maintaining approximate locality of the MN. Handoff management is concerned with maintaining connections as the MN moves across the coverage areas of different access points. **.**Standards for terminal mobility over the Internet have been developed by the Internet Engineering Task Force (IETF) and outlined in Requests for Comments (RFCs) within the wire line Internet Protocol (IP), fixed terminals communicate differently depending on their sub network location. Terminals on the same sub network can send packets directly, while terminals belonging to different sub networks must send their packets through IP nodes, or routers, which perform routing functions. The mobility-enabling protocol for the Internet, Mobile ZP, promises to enable terminals to move from one sub network to another without interrupting this process. Variations in Mobile IP include versions 4 (IPv4) and 6 (IPv6). Comparatively, IPv6 can provide more addresses and mobility support than IPv4. Thus, the procedures in this section are based largely on IPv6, except where noted. A mobile node (MN) is a host or router that changes its attachment point from one subnet to another without changing its IP address. The MN accesses the Internet via a home agent (HA) or a foreign agent, FA, in IPv4. The HA is an Internet router on the MN's home network, while the FA is a router on the visited network. The node at the other end of the connection is called the correspondent node. In achieving mobility between sub networks, Mobile IPv6 allows some operations for location and handoff management:

Registration - how an MN registers with it's HA.

Discovery - how an MN finds a new Internet attachment Point when it moves from one subnet to another

Routing and tunneling - how an MN receives datagram's when it is away from home.

4.1 locations Registration:

When visiting any network away from home, each MN must register with it's HA and FA in order to track the MN's new IP address at the visited sub network and to complete the delivery of datagram's to that address. There are two IP addresses associated with each MN, one for locating and the other for identification. The new IP address associated with an MN while it visits a foreign link is called its care-of address (CoA), which is linked to the MN's home address by a *mobility binding.* Each binding has an associated lifetime period, which is negotiated during the MN's registration and is used to determine when the registration is deleted. Depending on its method of attachment, the MN sends location registration messages directly to its HA, or through an FA which forwards the registration to the HA. In either case, the MN exchanges Registration Request and Registration Reply messages based on IPv4 The MN registers with its HA using a Registration Request message (the request may be relayed to the HA by the current FA). The HA creates or modifies a mobility binding for that MN with a new lifetime. The appropriate mobile agent (HA or FA) returns a Registration Reply message. The Reply message contains the necessary codes to inform the mobile node about the status of its Request and to provide the lifetime granted by the HA.

5. System Framework:

Client-server computing or networking is a distributed application architecture that partitions tasks or workloads between service providers (servers) and service requesters, called clients. Often clients and servers operate over a computer network on separate hardware. A server machine is a high-performance host that is running one or more server programs which share its resources with clients. A client also shares any of its resources; Clients therefore initiate communication sessions with servers which await (listen to) incoming requests. SIMPS are composed of two parts: social motion influence and motion execution unit. The social motion influence updates an individual's current behavior to either socialize or isolate. The motion execution unit is responsible for translating the behavior adopted by an individual into motion. We will translate this sociostation into the domain of pedestrian mobility. Although many other influences are at play in any individual's mobility, such as collision avoidance, activity planning and constraints, we wish here to gauge the effect of this process alone, aside from any other influence

SIMPS rely on social graphs from which motion influence behaviors are derived. Social graphs do not represent physical proximity, but only relationships among individuals. Nevertheless, the former influences the latter, since close acquaintances tend to get physically closer. The originality in SIMPS resides in its twin behavior (socialize and isolate) and their interplay. In its expression, SIMPS combines gravitational attraction and preferential attachment.

5.1. Spatial and Time Characteristics:

This describes the space in which individuals move. The boundary conditions can be of three types:

infinite, finite, and periodic. If finite, the topology can be a square, a disc, or any kind of bounded geometric space. If periodic, the topology can be a square. In the remainder of this paper, we investigate the properties exhibited by SIMPS alone. Time characteristics concern the total duration for which motion is considered, and the time quantization step used for motion rendering. These two values, although more related to implementation than to model definition, are of prime concern since their choice can directly influence the outcome of the synthesized motion

5.2. Interaction Based Mobility:

SIMPS also break the barrier between individual and group mobility: collective motion emerges in this model, without the help of explicit grouping. The influence of time on SIMPS outcomes appears in two ways: time quantization step and total simulation time. The first aspect is related to the very common problem of sampling on measurements. Individuals present different mobility characteristics depending on the space they evolve in. We have two parameters defining motion space. The first one, namely space type, defines if individual evolve in finite, infinite, or periodic space.

6. Related work:

The paging scheme determines how and where to search for a mobile user given the latest location update information from that user. In the extreme case when the mobile updates its location every time it enters a new cell, there would be no need for paging since the network would know exact which cell to direct calls connections to in order to reach that mobile device or user. In practice, however, updating location at every cell boundary is too costly. More generally, there is a fundamental trade-of between location update and paging. As the frequency of location update increases, the uncertainty around the exact location of the mobile decreases and therefore the cost of paging the mobile decreases. Conversely, as the frequency of location update decreases, the uncertainty around the location of the mobile increases, and so does the paging cost. It is critical for cellular operators to implement paging schemes which locate mobile devices quickly (so as to keep delay low) and at low cost (because paging consumes valuable spectrum and signaling resources and because the paging channel is a low bandwidth channel). Typically, the approach taken is to minimize paging cost, and in particular to reduce network signaling, in exchange for an increase in paging delay.

Location management refers to the set of techniques used to locate users efficiently. The key characteristic of a location management scheme involves the trade-o_ between the search or paging cost and the update cost (how much work is involved in the system keeping track of moving users). The paging cost is a function of the number of cells broadcasting a search message, also referred to as the size of the paging area. The update cost is the cost for mobiles to update their location registry in the network through the access channel. It is typically measured by the average number of registrations per user per unit of time.

There is a growing number of mobility models used in the design and analysis of communication systems Mobility modeling refers in general Random Way Point (RWP), which is the de-facto standard for both theoretical analysis and simulation results.RWP belongs to the same class as Brownian motion, also called Random Walk. This technique has many advantages; however, the simplicity provided by the RWP fails in capturing realistic behaviors observed in the human mobility, as shown in the recent literatures. To avoid this problem, network and communication technicians deploy various other techniques. Vehicular based mobility models have been developed first as a first set of models based on expectations how the mobility is performed in the particular situations. Dynamic source routing for adhoc networks is taken as one of the key technique to develop the SIMPS methodology. Trace based mobility models have been proposed both indoors and outdoors and the various results are obtained. Various other analyses show that both contact and inner-contact distributions, as well as location popularity distribution are developed.They also allowed revisiting the realness of existing models. For example, they also reveal that the RWP model s unable to realistically model the human mobility. In the valuable work done by the researchers another beneficial aspects have been proposed to develop the realness model of human mobility. But, there remain two question unanswered. They are Lack of explanation of the process governing the mobility and Retained mobility methodology. Hence, taking these issues in account, the new methodology SIMPS have been developed for the enhanced system. A far deeper investigation of the roots governing the mobility is necessary toward realistic mobility modeling. This technique proposes to rely on well established theories that tackle the nature process which govern mobility at its roots. The consequence is the lifelike emergence of mobility characteristics found in measurements; this is contrary to current approaches where these characteristics are artificially generated.

SIMPS is a Mobility modeling that aims at describing in the most accurate and simplest way the motion of mobile entities. Its main feature is being simple and analytically tractable. Another important feature is, it explores recent sociological findings driving human interactions. It updates an individual's current behavior to either socialize or isolate. It is responsible for translating the behavior adopted by an individual into motion.

Future scope:

In our future works, a more detailed analysis on signaling load at network and delay will be carried out based on a more detailed mobility and traffic modeling, in order to analyze the increase of network signaling load and delay quantitatively. Also, a more practical and elaborated algorithm for finding cells which contain terminals with which users are registered will be devised. Finally, an efficient handoff scheme in the interworked fixed and mobile networks will be investigated.

7. Conclusion:

In proposed paper we proposed an efficient paging scheme for TM using PM management information at registrar and showed that the proposed scheme can achieve significant signaling load reduction at radio interface. Although signaling load for the query at SIP registrar for the location information of registered fixed terminal from HLR is additionally generated and additional delay may be introduced for two staged paging approach in the proposed paging scheme, they are not considered as significant, compared with the significant signaling load reduction for scarce wireless resources at radio interfacetures of Multicarrier, Multipath system to address the challenges in wireless communications and provide a solution for the optimum utilization of the resources.

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Author's Information

[1] **C.Bala Swami** pursuing M.Tech CSE from jaya prakash Narayana College of Engineering & Technology. MCA from Nalanda institute of Engineering and Technology, Guntur. Currently he is working as Assistant Professor at Nalanda Institue of P.G.Studies Guntur.He has 2 years experience in Teaching. His areas of interest include Mobile networks, Network Security and Sensor Network.

[2]**Prof.D.Jamunna**, Working as Professor & Head of CSE Dept. Jayaprakash Narayan College of Engineering, Mahabubnagar, M.Tech(SE) from School of Information Technology, JNTUH, Hyderabad. BE (CSE) from Vijayanagara Engineering College, Bellary. Experience 17 Years in Teaching Profession. Her areas of Interest are in Wireless Sensor Networks, mobile adhoc networks Data Mining, and Networking and guided M. Tech and B. Tech Students IEEE Projects.