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Integrated Three Layer Mobile Architecture for seamless Roaming and User specific handoff in 4G networks

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Abstract- Seamless roaming and mobility management are the main challenges before heterogeneous 4G wireless networks. The existing methods for seamless roaming need changes in the implementation of TCP. User specific vertical handover is provided by introducing new entities in the existing networks. This paper presents three layer architecture to provide seamless roaming and user specific handoff without altering the current implementations. It also avoids the need for new entities. The first layer is a management agent and the next is information transfer. The final layer behaves as link agent. Management agent controls and shares the messages among different access networks. Information agent handles data streams. Link agent gathers details about the connected links and provides status updates.

Index Terms- seamless roaming, handoff, heterogeneous networks

I. INTRODUCTION

The aim of 4G communication is making the user to freely roam across various networks seamlessly and provide connectivity to any wired or wireless systems. The mobile agent has capable of handling multiple network interfaces like GSM/GPRS, WLAN, Ethernet etc. every network have its own scope and limitations. In 4G user is allowed to choose the network they like. One user wants very high data rate but accepts limited mobility may use Ethernet. The other user who likes wide coverage area with low data rate can opt for GSM/GPRS. Services like Wireless LAN provide moderate data rate and mobility. When the user move from one cell to another, according to the need of the user they might want to continue in the same network or like to connect to different networks. If the user moves to another cell without changing the access network, it is called horizontal handoff. This type of handoff can be provided without disturbing the current implementations of TCP. When the user wants to change the access network, it is known as vertical handoff. The existing methods uses additional entities like proxy or foreign agent to provide Vertical handoff. In this paper a Three Layer Mobile Architecture (TLMA) which does not require any change in current implementations for seamless roaming is proposed. Also user specific handoff mechanism without additional entities is discussed.

II. RELATED WORK

All the available wireless technologies have handover mechanism for horizontal hand off. To provide vertical hand off different solutions are proposed. In TCP/IP protocol suite implementation of MSOCKS or TCP-migrate provides vertical handoff. But these methods require changes in existing TCP. Most of the mobility solutions are mobile IP based. To support seamless mobility IPV4 or IPV6 requires additional entities in the network. Also IP based methods cannot provide users specific handovers.

Mobility from one terminal to the other needs support of higher level layers. Network layer should rely on session layer for resolving these issues. SLM Session layer based mobility management solution provides a architecture to handle vertical hand over. SLM uses user location server (ULS) in the network. It does not have facilities to use the latest mobile independent handover (MIH) mechanism provide by wireless LAN technologies. Session initiation protocol (SIP) is the other method provides mobility based on location updates[24]. But it still has interoperability issues. It also requires proxy servers and registrars.

III. TLMA ARCHITECTURE

Seamless roaming and mobility can be provided by utilizing the intelligence of the network. Giving more intelligence in the network provides a way to ensure seamless roaming. On the other hand the sophisticated end equipments also provide a way to establish these things. The proposed TLMA architecture mainly utilizes the intelligence of end user mobiles for its frame work. This ensures the use of existing TCP implementations without any change. TLMA provides support for user specific handover which is not provided by TCP. It facilitates TCP rather than changing it. The difficulties of location management are reduced. Fig 1 shows the architecture of TLMA

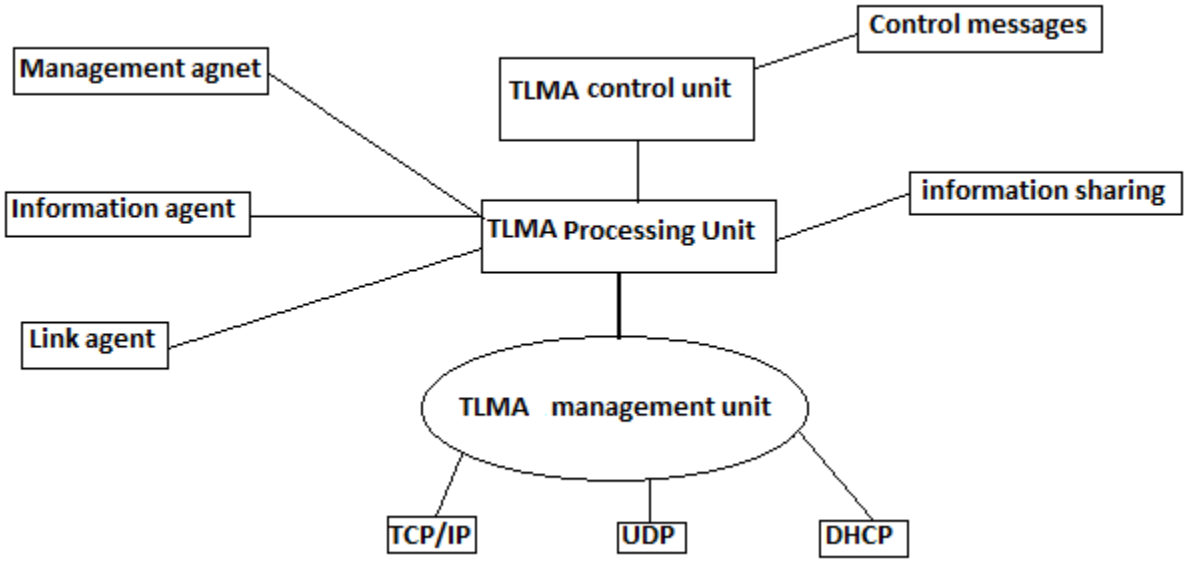

Fig 1: Architecture of TLMA

A. Processing unit

TLMA consists of a processing unit which uses management agent and information agent. TLMA processing unit gathers all the details from information agent, send control information through management agent and establishes a link using link agent.

B. Management unit

Management agent makes association between applications when the end user mobile equipped with the proposed triple layer architecture. The applications using this frame work are aware of the user preferred handoff. Every TLMA has a reference number which is unique. It can handle multiple TCP connections. Whenever the vertical hand off is initiated it affects TCP connections. Then TLMA establishes new connection with TCP. But the unique reference number is not altered for new connection.

When a TLMA compatible end user is looking for a new connection the management agent of the user checks the other end user whether it uses TLMA frame work or not by sending a request to the server. Two type of request can be sent based on the other end user by the management agent , connection establishment request or connection alteration request. These request messages are connection less, uses user datagram protocol (UDP) .

Based on the response of the end user the management agent establishes connection. If the other end user is not using TLMA then TCP connection method is followed. If TLMA compatible user is found then both the users share a common reference number which is initially used for connection establishment. This reference number is a local parameter and it may be encrypted to ensure security. After sharing the common reference connection is established as per user preference. Forming a TCP connection under TLMA makes way for multiple connections.

C.TLMA information agent

Information agent in TLMA provides all the required details to initiate handoff. It gathers information from lower and upper layers and provides that to the TLMA processing unit. It interacts with the processing unit and act as inter layer information provider. At the lower layer information agent communicates with the user agent and using the upper layer it exchanges information with management agent. The information transfer agent makes sure the sequence of data streams unaffected because of new TCP connection created by management agent. It maintains multiple streams for single connection.

Handoff is forced in two situations. First one is regular handoff which is automatically forced when the user moves out of coverage range of a network. When it enters into the coverage area of a new network handoff must be initiated to maintain connection. Lower level layer attributes changes when the terminal enters into a new network. These changes are captured by information agent and sent to processing unit to initiate regular handoff. Second type of handoff provided based on user preferences. In 4G wireless environment the user is free to choose a network based on the application or service. When the parameters of higher level layer changes and expects connection change then user forced handoff is initiated. Here the need of the user is the vital parameter. Here the information agent interacts with the higher level layers and gets the required details to initiate user preferred handover.

D.Data transfer control unit

The data transfer unit of TLMA uses link agent to support user preferred handoff. The link agent interacts with higher level layers such as application layer and gives the details about user preferences network subscriptions. The user preferences are mainly depends on accessibility of a provider, cost considerations and service quality. Based on these factors the

user selects the home network and other preferred roaming networks.

The link agent provides the connection details to the user. The connection details like transit time, data rate, quality of service and all other possible routes for the data transfer are provided. In user preferred handover the destination network can be selected manually by the user or it can be selected automatically. If user preferences are well known then pre-defined the cross over levels can be maintained. If the parameter changes reach the cross over levels then user preferred handoff can be forced immediately. Avoiding the manual selection simplifies the approach. Frequent manual intervention might lead to wastage of resources.

IV. IV. HANDOVER USING TLMA

As mentioned earlier handover can be initiated in two ways. Automatic handover initiation occurs when the user moves away from the excising access network. In the other way the user purposefully can force a handoff according to his preferences. User preferred handoffs are the facility provided by 4G initiatives. TLMA takes care of the handover procedure in both cases effectively.

A. Automatic handover

When the use moves out of the coverage area of the existing network it has to undergo automatic handover. The information agent of TLMA detects the signal strength of the access networks continuously. When the signal strength of the existing reduces it intimates it to the control unit of TLMA and handover is initiated. The methods for automatic handover are clearly defined in all type of networks. The required control information is exchanged between the new network and the user. The user registers itself successfully after the new network authorizes it to get access to the resources.

B. User specific handover

The user can opt for a handover as per his need in a heterogeneous networks environment. This facility is viewed as a very important initiative of 4Gtechnology. To provide user specific handover the user must have access to different networks at the same time. The user should be permitted to switch to any network anytime. This need intervention of higher level layers. If the user decides to force a handover it is given to TLMA through information agent. The control unit receives the request and generates the required control messages. The management agent finds out the availability of the selected target network by sending request to the new network. Simple IP can be utilized for this purpose. The parameter of the new network is loaded into the control unit of TLMA through information agent. Dynamic Host Configuration Protocol (DCHP) is used to get the address information from the new target networks. After exchanging the required control details the link agent of TLMA establishes anew TCP connection with the target can get access to the target networks for the required time duration. It get access as if it belong to network. The user the home network.

V. CONCLUSION

The proposed TLMA architecture can handle vertical handover effectively. The existing network implementation does not require much change. The management unit of TLMA utilizes TCP, UDP and DHCP for its operations and handles the handoff. This avoids any need for modification in the available network. It also avoids the need for any intermediate entities between the user and the new target network thereby avoid delays in vertical user specific handovers. The information agent makes registering and sharing the information with the target network easier.

APPENDIX

Appendixes, if needed, appear before the acknowledgment.

ACKNOWLEDGMENT

The preferred spelling of the word “acknowledgment” in American English is without an “e” after the “g.” Use the singular heading even if you have many acknowledgments.

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