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Vertical Hand off Enhancement by Using Hybrid Scheme in Heterogeneous Wireless Network

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Abstract—**Coming Heterogeneous Wireless Networks (HWN) are contains from diverse wireless techniques such as UMTS & WLAN networks. Vertical Hand off (VHO) is used UMTS & WLAN to get seamless mobility. The Mobile Stream Control Transmission Protocol (mSCTP) has problem in transport layer which offered and fixed by BicastingSCTP (Bi-mSCTP) and Packet Reordering Model (PRM)method. The MobileNode (MN) is get about through HWN in low quickness. In this MN speeds, the difficulties of aforesaid techniques in HWNHduring VHO were very clear. This paper introduced a new approach to solve the problems of both PRM and Bi-mSCTP techniques with high moving MN speeds between HWNs. The suggested method achieved soft VHO through incorporating Bi-mSCTP & PRM techniques, where it is named (BiPH) hybrid method. The performance of suggested method is evaluated through compared it with PRM & Bi-mSCTP techniques. Two parameters are evaluated in this case: PacketLossRate and CWND.** هههههخخخخخخخخ ئئئئ111111خخخخخخ

Keyword-HWN, VHO, mSCTP, Bi-mSCTP, PRM, High velocity

I. INTRODUCTION

The growing needs for applications from classic PCs to mobile devices become a new tendency in PCs [1]. As a results for increasing circulation of wireless technologies in (2G & 3G) cellular, satellite, wireless LANs and Bluetooth the mobile devices were readily entry internet applications anywhere anytime [2]. The costumers gets particular wireless services in different bandwidth and coverage area from aforesaid wireless techniques [3,4]. The HWNs are combining of these varied networks. Outlook of wireless networks are as HWNs, which comprise of the cellular Universal Mobile Telecommunications System (UMTS) & Wireless Local Area Networks (WLAN), please see Fig.1. These techniques get along with them by using VHO to certain universal mobility and continuous service [5-7]. UMTS and WLAN are desired for interwork because them integral features [8–10]. The important features of UMTS are low bandwidth, broad-area connectivity, high changeability in large geographical and expensive communications. Whilst, the user can get so high bandwidth with low mobility and narrow coverage area but the communications cost is cheaper than UMTS costs [11].

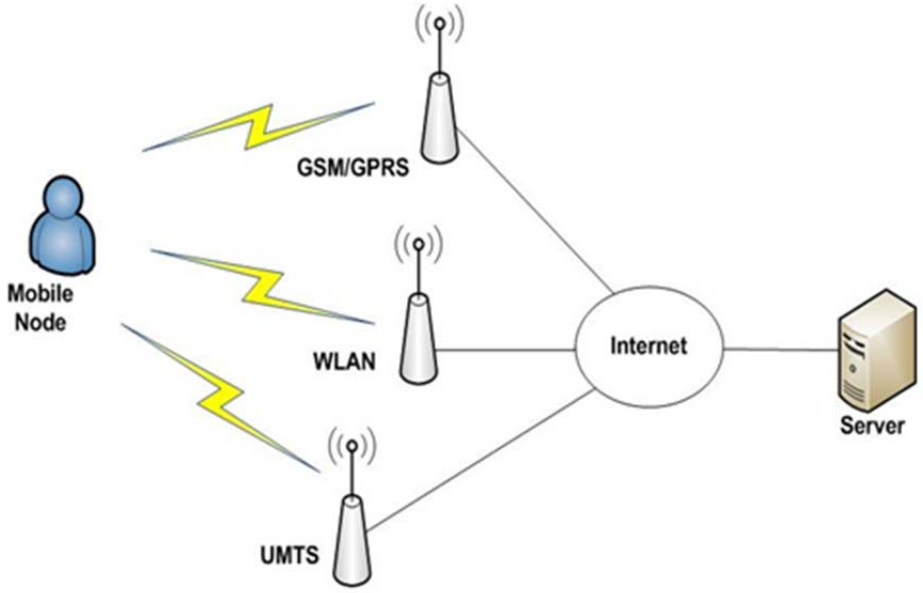

Fig. 1. Heterogeneous Wireless Networks (HWN)

One of the techniques that used to solve VHO problem is mSCPT and PRM techniques. However, in the classic mSCTP a MNs suffer from some problems such as, Selective Acknowledgment(SACK) sending loss, packet resending timing out, and packet reordering. Obviously drawbacks are solved using Bi-mSCTP technique through solve the drawbacks related to the network layer protocol, specially the MobileInternetProtocol (MIP) [11].

The mobility impairment & VHO in Heterogeneous Wireless Networks (HWN)are enhanced using BicastinmSCTP and PRM techniques. The Bi-mSCTP technique applied in network and transport layers while the PRMtechnique in transport layer. Bi-mSCTP and PRM techniques are used to fix the drawbacks of traditional mSCTP [11, 12].

The network layer protocol specially MobileInternetProtocl(MIP) difficulties are resolved in suggested Bi-mSCTP technique. The hybrid directive, registration. delaying, data..session disturbance during VHO, and packet overhead are number of matters in MIP. Obviously issues possible results a triangular directive which happens when the packet of MIP data are transmitted from ForeignAgent(FA) to HomeAgent(HA) by subway through the MobileNode animated to a new network.

The suggested heterogeneous Bi-mSCTP technique depend on the create mSCTP signals to assign new Care-of-Address(COA) to the CorrespondentNode(CN) before the link layer handover when a MobileNode is in the area of VHO. In conjunction, bi-molding flag was inserted inside the AddressConfiguration(ASCONF) control chunk by Bi-mSCTP to tell the CorrespondentNode(CN) starting the transition through WLAN and UMTS routes. Whilst, the introduced PRMtechnique operates as high capacity private buffer that used to receive the TransmissionSequenceNumber(TSNs), after that, it sends the arriving data segments to the MN of WLAN or UMTS after the VHO [12, 13].

However, MobileNode convections at high speeds lead to a loud VHO degradation in HeterogonousWirelessNetworks. Obviously, VHO drawbacks are appear in 6 forms, 3 in MobileInternetProtocl and the other three in mSCTP. Hybrid routing, registration delay and data session clogging are the VHO drawbacks in MobileInternetProtocl, which appeared as a result to transfer data packets from ForeignAgent(FA) to HomeAgent(HA) through MN convection to a new network. This datapackets sending operation required CoAadiscovery and results data session clogging during VHO[14-17].

Whilst, SACK sending loss, bundle resending timeout and bundle reordering are VHO drawbacks take place in mSCTP. SACK sending loss occurs as a results to losing the data bundle through transferring from a CorrespondentNode(CN) to MobileNode in UMTS. This losing takeplace due to path unsteadying before VHO. The second drawback (Packet resending timeout) happens as a result to MobileNode transferring to the new pathway (WLAN-IP2) which lead to losing of data bundle that were sent to the UMTS-IP1 because of signal strength weakness of the old pathway. Final VHO problem is PacketReordering which happens when the data bits that sent by UMTS-IP1 pathway received by MobileNode through the WLAN-IP2 later than the new data bits which were sent after VHO. Fig. 2 shows the obviously drawbacks [12-15].

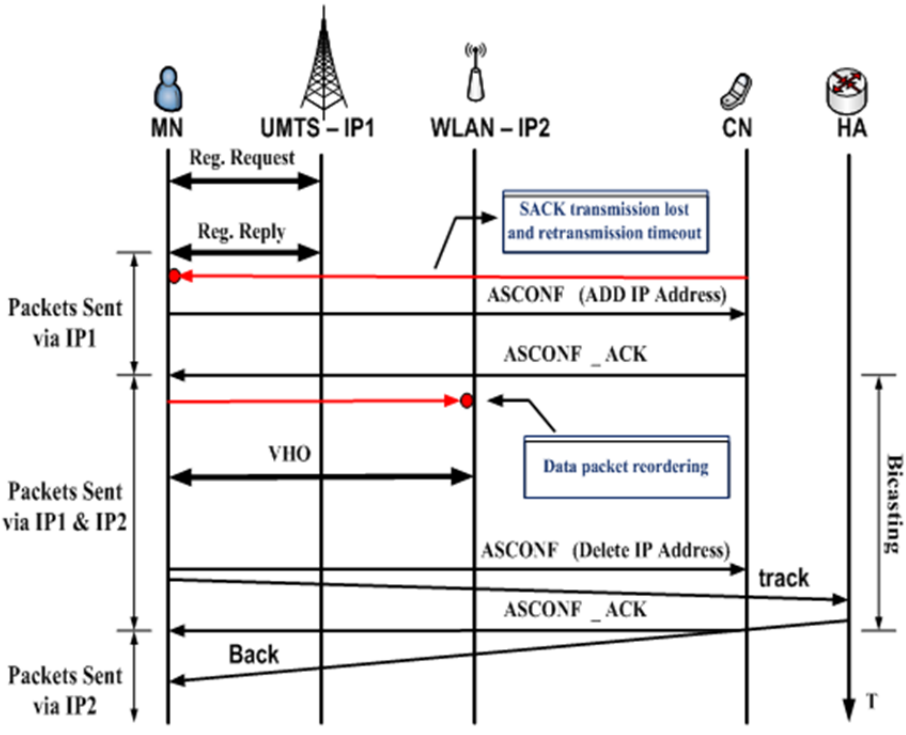

Fig. 2. The Signalising of HybridVHO Technique.

The VHO performing at HeterogonousWirelessNetworks(HWN) degenerates because of the aforementioned 6 problems, especially when the MobilNode(MN) speed increased.

A new method called SBP method based on combining between hybrid Bi-mSCTP and PRM techniques is introduced in this work to solve the problems of mSCTP and MobileInternetProtocol techniques in HeterogonousWirelessNetworks(HWN) through VHO although when the MobileNode transferred fast.

The reminder of this work is arranged as follows: The suggested method viewed in section2. Section 3 views the simulation topology. The results are analysed and discussed in Section 4. The paper conclusions show in section 5.

II. THE PROPOSED SBP SCHEME VHO PROCESS WITH HIGH SPEED

The development of society and modern means of transport with their high speed led the researchers to introduce and investigate new techniques in order to address the issues of VHO when the MobileNode(MN) is transferring speedy [18]. However, the traditional VHO schemes such as mSCTP, MIP, PRM, Bi-mSCTP and SIGMA provide low performance if the MN transfers speedy [7, 19]. So, a new VHO SBP method applied at transport and network layers is introduced in this paper to enhance the performance of VHO with speedy MN moving.

The aim of the suggested SBP method is solving the problems of the traditional mSCTP such as (SACK sending loses, bundle reordering and resending timeout) and MobileInternetProtocol(MIP) such as (mixed routing, registration retard and data session disturbance) in HeterogeneousWirelessNetwork(HWN). The proposed SBP method suggests to combine between mixed Bi-mSCTP and PRM techniques for enhancing the VHO performance at speedy MobileNode(MNs) transferring[20, 21].

At transferring from UMTS to WideLAN with high speed, the MobileNode(MN) start with scan to perform that a WideLAN access within the proximity is exist, please see Fig3. The UMTS/Base Station(BS) The cellular UMTS/Base Station (BS) periodically sends a CoA advertising for the leaving MobileNode(MN) to WideLAN in order to pursue the availability of the UMTS network. The Received Signal Strength (RSS) is making the VHO decision as response of the MobileNode(MN) request when CoA advertising was founded by MN. Henceforward, the SBP suggested approach sends a recording demand to the old UMTSnetwork access router when it distinguish the RSS of the newqlink, please see the Fig. 2.

After that, a recording response message will be transmitted to the MN by the old network accessbrouter. The oldbnetwork that assigned new CoA to the MobileNetwork(MN) will be utilized in the new network, if the obviously message correctly collected [22].

Then, the CN receives an ASCONF piece from MobileNetwork(MN). As a result, the WLAN network new IP (WLAN-IP2) will added by CN after it defines the new assigned CoA using ASCONF control piece that sent by the MobileNetwork(MN) [12]. At this stage, the data pieces will transmitted by CN to the old IP of the UMTSnetwork (UMTS-IP1)& (WLAN-IP2). The PRM activated through inserting new one bit header into the ASCONF-ACK data piece reply message. Finally, all imported data pieces will passed by the PRM to the MobileNetwork(MN)/WLAN through the VHO using First-IN-First-Out(FIFO) manner as shown in Fig. 4.

Well, at speedy MobileNode(MN) transferring, the VerticalHandOver(VHO) behaviour is optimized using the PRM that proposed in SBP approach, Table I shows the optimization steps.

TABLE I.
Suggested SBP Approach Steps at VHO.

Step No.	Step Explaining
St. one	Theoutstanding data pieces informed by the PRM when VerticalHandOff(VHO) happens.
St. two	Is the data pieces reached when expiring resending timer? If yes, goto St.three. Otherwise, goto St. four.
St. three	ThefPRM catch the outstanding data pieces and send them to the MobileNode(MN) to protect the CWND from decreasing if the data pieces become free.
St. four	Two functions are executed by the PRM. First, PRM transmit and acknowledgments to the CN to resent the data pieces, andit also increaseing the CWND. Secondly, repeat the st. three.

The PRM becomes deactivated when the MobileNode(MN) outgoing from overlapping area between UMTSdand WLANe networks. At the end, the MobileNode(MN) sent and ASCONF piece to the CN when it goes out the covering area of the UMTS for removing the oldcIP address(UMTS-IP1), then it delete the previous CoA. Now, the WLAN-IP2 address only will be used by CN&MN for all data pieces resending incoming [11, 23].

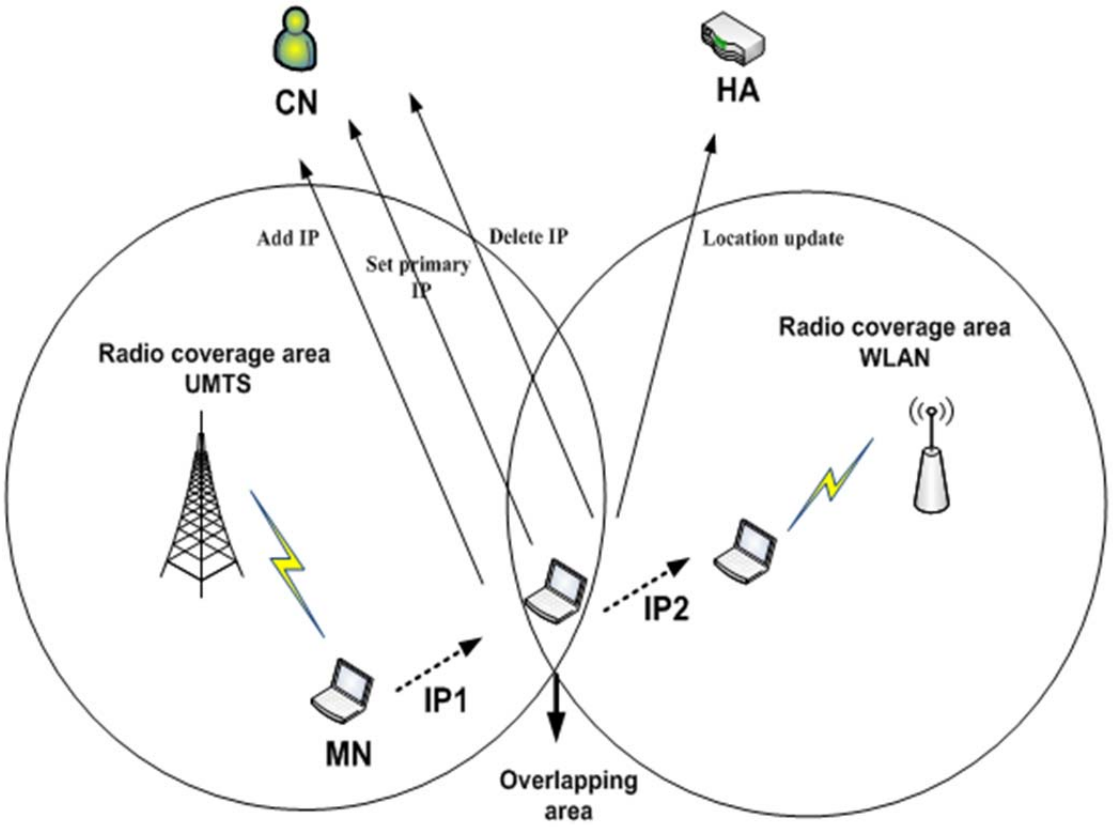

Fig. 3. A diagram of MobileVHO in SBP Method

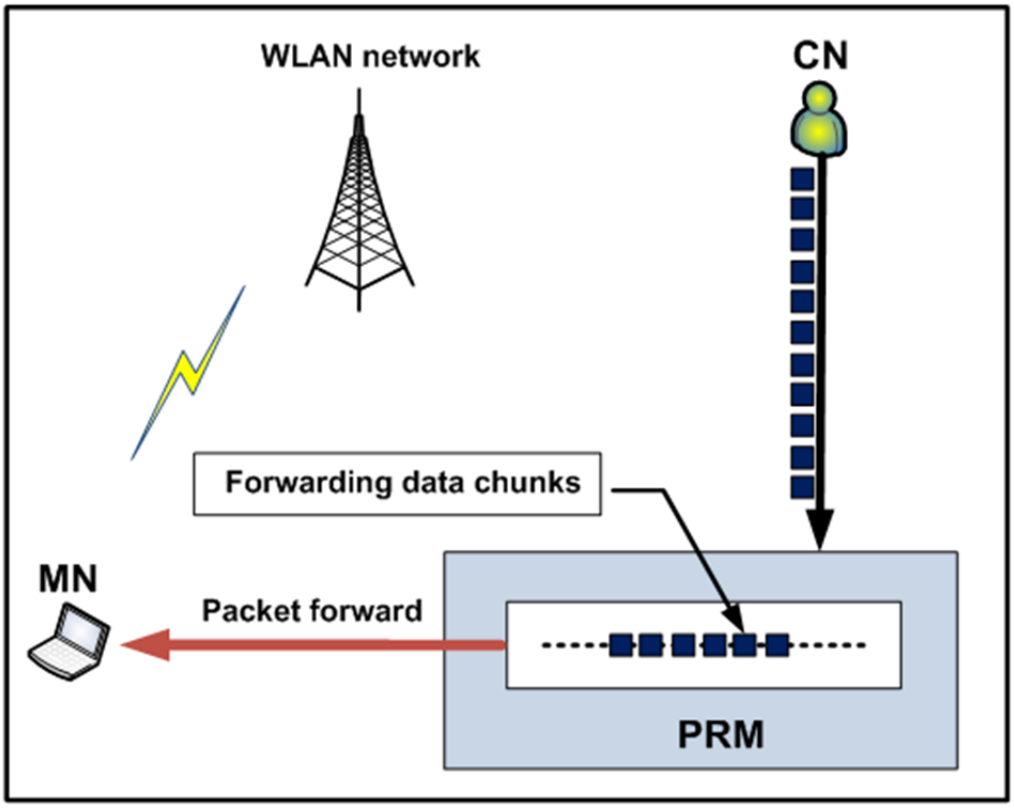

Fig. 4. The Processing Procedures of the PRM Scheme

III. Network Topology Used in the Simulation

In the simulation, a ConstantBitRate(CBR) is used as transit generator to create a constant size payload bits for every constant time. Also, to avoid any simulation problems results from route regarding packets, the base stations and MobileNode(MN) are used NOAd_Hoc(NOAH) operator. The simulation compensates the MAC layer protocol by WLAN802.11 that supplied by NS_2. Any unwanted tardiness that results from clash detection in MAClayer during VHO can prevent through using two various wireles channels for each network. The SCTP module in NS_2 program is used to simulating mSCTP with PRM[24-27]. The CN is used as single homed property whilst the MobileNode(MN) used in multi homed property. In VHO of mobile receiver, the MobileNode(MN) sent at t=10s the ASCONF(SETPRIM) control piece to CN and as response the CN will set the primary destination of data packets to the new MN IPaddress where the VHO at CN in SCTP is initiated using set_primary_destination method. On the other hand, the mSCTP is used directly through VHO operation, where data transmit basic address is varied exchanging the ASCONF control piece which used as acknowledgement between MobileNode(MN) and CN. In suggested simulation, transmitted data in WLAN use WLANIP as source address of data package. The WLANIP address get from setting MobileNodeMN primary address MN itself at t=10s when it gets the acknowledgment to ASCONF [28-29].

The topology suggested in this paper as shown in Fig. 5, where MobileNode(MN) assumed multi homed whilst the CN as single homed. Basically, in the centre of UMTS the MobileNode(MN) is located then transfer it location to WLAN at 5Km/h basic speed and t=15s. After MobileNode(MN) exceed the overlapping area between UMTS & WLAN it come in the WLAN at t=18s. When MobileNode(MN) become at midpoint between the BS of UMTS and access point of WLAN it starts the VerticalHandOff(VHO) at t=20s where data starts moving at t=17s.

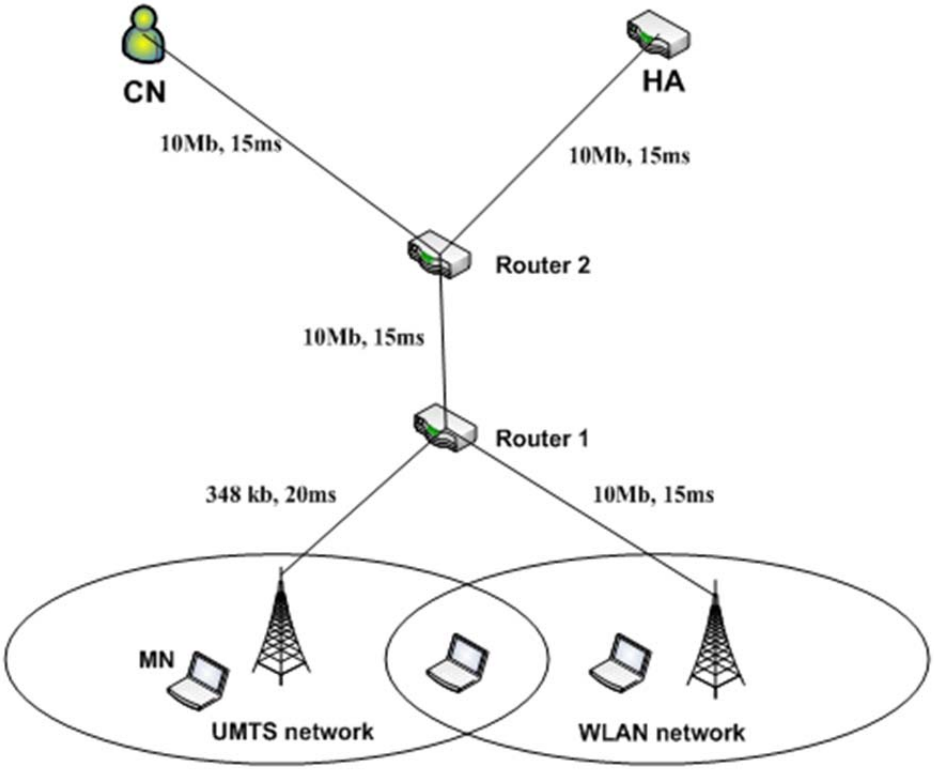

Fig. 5. Suggested Construction of SHP Approach

IV. Experimental Results

All The behaviour of original and proposed simulations works of Bicasting-mSCTP are evenly matched as shown in Fig.6. On the other hand, the Fig.6 show that, the throughput of two cases fluctuate a little. The datasets of original and simulated versions of Bicasting-mSCTP method through VerticalHandOff(VHO) are shown in Table II.

TABLE II
Datasets of BicastingmSCTP

Original Output BicastingmSCTP *10^3	Re-simulation of Bicasting-mSCTP *10^3
1.6539	1.6060
1.5809	1.5701
1.5201	1.5401
1.4715	1.5221
1.4289	1.4981
1.4107	1.4742
1.3864	1.4562
1.3559	1.4442
1.3499	1.4262
1.3499	1.4142
1.3499	1.3939

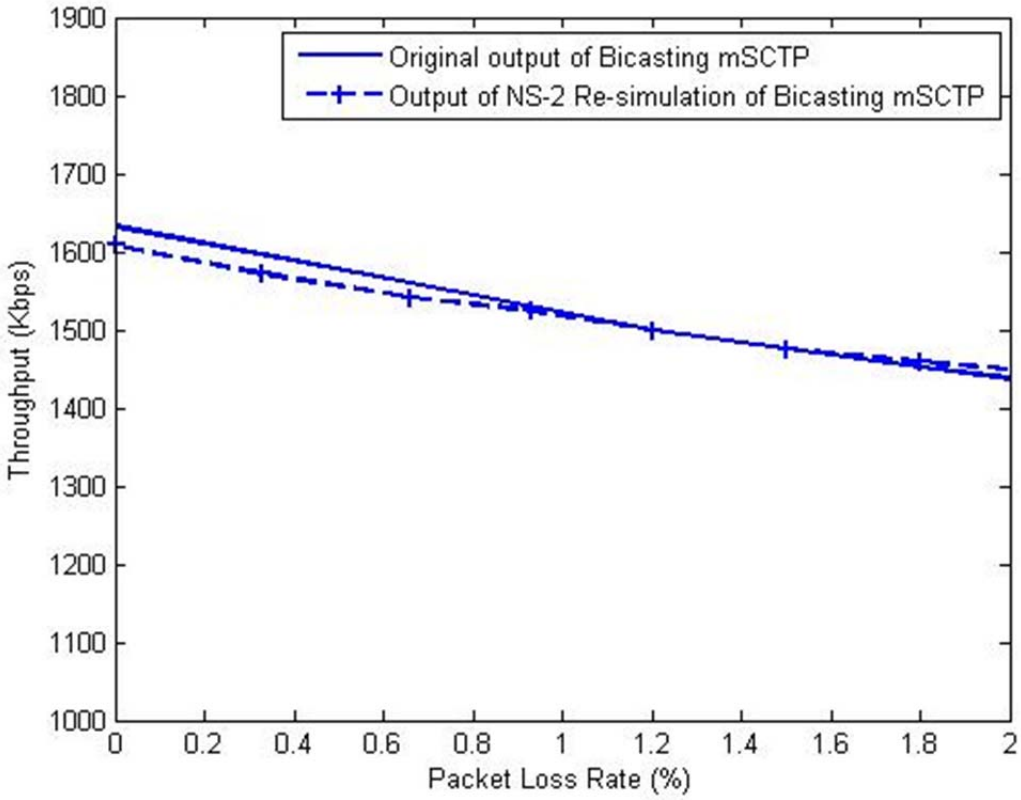

Fig. 6.Comaprsion between original and simulated versions of Bicasting-mSCTP

An important parameter showed to validate the performance of proposed SBP method in comparison with Bicasting-mSCTP and PRM approaches is the PacketLossRange(μ). It is calculated for MobileNode(MN) moving from UMTS to WLAN in different speeds with VerticalHandOff(VHO) processes. The Eq.(1) below used to calculate the PLR(μ): [7]

$$\mu = \frac{\varepsilon}{\beta} \tag{1}$$

where ε is number of the losted packets during VHO and β is the all number of data packets sent by CN.

The effect of transferring speed on the PLR is shown in Fig. 7 for Bicasting-mSCTP, PRM , and suggested SBP approaches. As shown in Fig., the suggested SBP method is the best compared with the other two methods in term of PacketLossRange(PLR) for all tested transferring speeds. The difference between UMTS and WLAN in terms of bandwidth and propagation delay results increasing PLR levels in Bicasting-mSCTP and PRM

approach especially with high speeds 9whan the speed arrive more than 40 km/h. Whilst, in suggested SBP approach the effects of obviously parameters much decreased.

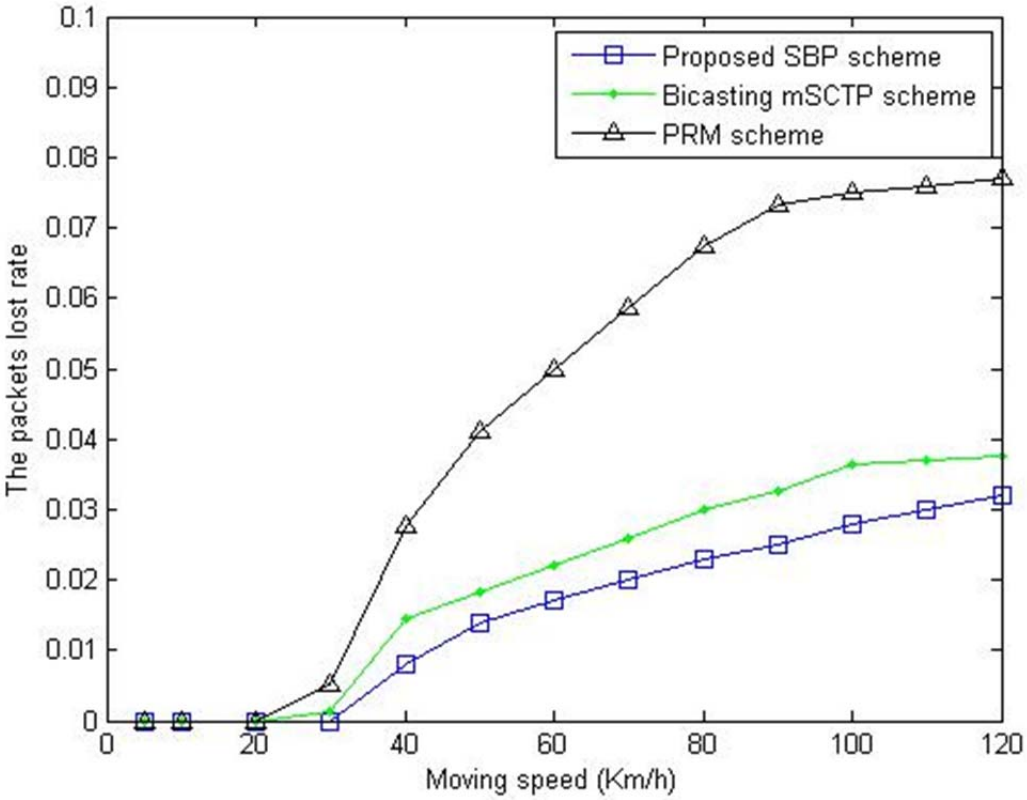

Fig. 7. The relation between transferring speed & PacketsLossRate(PLR).

The congestion windows(CWND) is another factor that used to evaluate the performance of suggested SBP method compared with Bicasting-mSCTP and PRM approaches with MobileNode(MN) transferring speed higher than 54Km/h between the cellular UMTS and WLAN. The behaviour of CWND in bytes with time in seconds are shown in Fig.8 for three methods (Bicasting-mSCTP, PRM, and suggested SBP). Starting can be controlled using CWND in additive to limitation the throughput facing loss. With startup connection, the CWND is doubled for each acknowledgment data, which lead to utilize the bandwidth swift. The proposed SBP method uses the packet rearranging and SACKtransmission lost therefore it can be preventing unwanted retransferring. Obviously property gave the suggested SBP approach possibility increasing the CWND faster than bicasting-mSCTP & PRM approaches in VerticalHandOff(VHO) as shown in Fig.8.

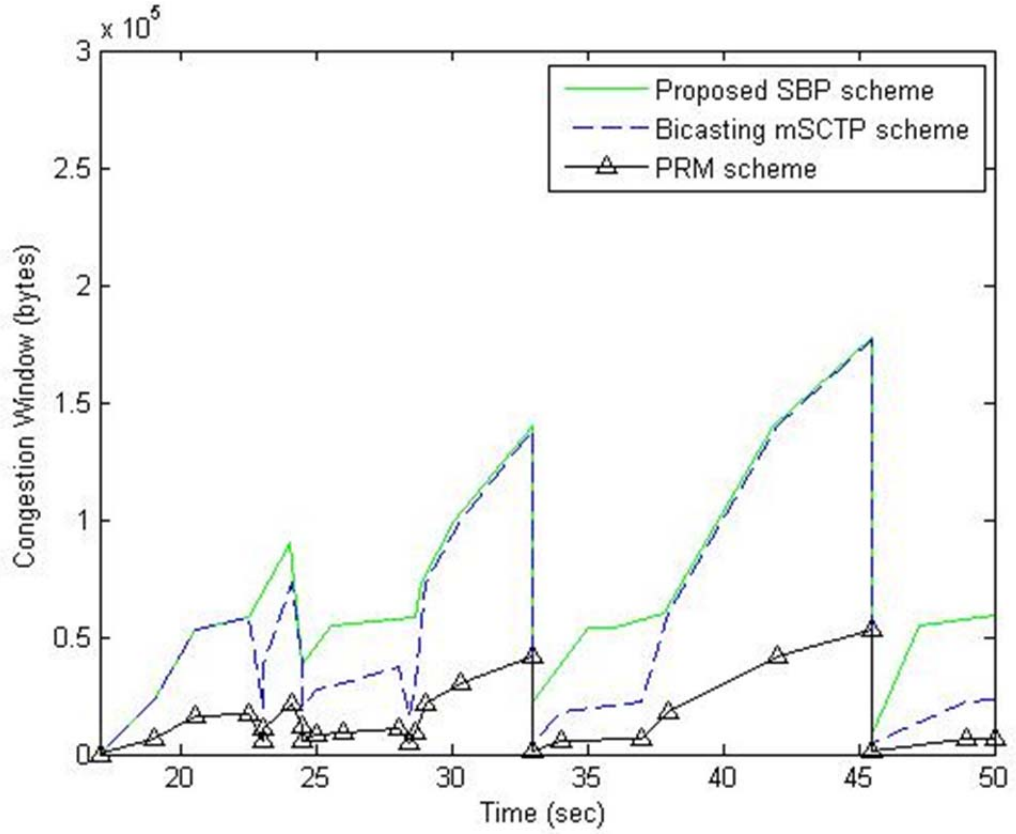

Fig. 8. The comparison between Bicasting-mSCTP, PRM, and suggested SBP approaches interms of congesting windows(CWND).

V. CONCLUSION

The An hybrid method to enhance the VerticalHandOff(VHO) called SBP method was suggested in this paper. The performance of proposed method was validated comparing with high-level VHO method called PRM and Bicasting-mSCTP method using PacketLossRate(PLR) and the CWND parameters. The VHO was been studied for MobileNode(MN) transferred from UMTS to WLAN with high speed. The triple routing drawbacks, the channel bandwidth, and the inequality in sending delay are three problems facing PRM and Bicasting-mSCTP approaches in the HWN especially with high speed MobileNode(MN) transferring. The experimental results proved that the suggested SBP approach can introduce a good VerticalHandOff(VHO) and decrease it's delay to a minimum with high speed transferring of MN.

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