Adaptive Transport Layer Protocol for Highly Dynamic Environment

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Abstract- ***Computer and wireless communication require Internet accessibility at any time and anywhere; this includes during a high-speed mobile station like in speedy trains, fast paced cars as vehicle-to-infrastructure communication. However, wireless Quality of Service (QoS) provisioning in such an environment is tougher .This increased the event of varied schemes concerning the need of smooth handover of the mobile nodes.***

Alternately, transport layer (L4 in ISO layers) protocols stream control transmission protocol can support such a seamless handover in high-speed mobility users. This text highlights on the issues of moving users in mobile WiMAX networks. An adaptation of transport layer protocol of the high moving vehicle that supports seamless handover can guarantee and maintain QoS for rapid handover rates. The results show an improvement of L4 protocol in terms of delay time and throughput so on enable efficient and robust mobility aware protocols.

Indexed Terms- ***Cross-layer, Handover delay, Adaptive mobility, High speed***

I. INTRODUCTION

With a lot of users on the move in want of net con- nection from their home to their workplace, conveyance ad-hoc network (VANETs) has more and more become fashionable. However, to own infrastructure of 3G and 4G around VANET expands its usage by attaching the users to the backbone infrastructure for extra support and usage applications. Thus, in VANET there square measure 2 forms of com- munication, that square measure vehicles-to-vehicle (V2V) and vehicle-to-infrastructure (V2I). V2V deals with communi- ion between vehicles themselves, whereas V2Itransmits data between vehicles and therefore the mounted infrastructure that square measure put in on the edges of the road. This infra- structure includes gateways or base stations that give services like net access. VANET is extremely almost like mobile ad-hoc network (MANETs). However, the topology in conveyance networks is extremely dynamic and therefore the topology is usually forced by the road structure [1, 2].

Furthermore, V2I is probably going to encounter tons of obstacles like poor channel quality and property due to high moving speeds. Thus, there's an important want for effective protocols that take the specific characteristics of conveyance networks under consideration [3, 4].

Most of the present transport layer techniques projected for quality cannot trot out quality on their own, since they depend upon the network layer quality management needed by handovers. The most purpose is solely to attenuate the degradation of transport layer performance caused by handovers. A number of the freshly rising proto-cols, like stream management transmission protocol (SCTP), counsel the likelihood of freelance management of mobility by the transport layer. The multi-homing options of SCTP give a basis for quality support since it permits a mobile user to feature new scientific discipline address, whereas holding the recent scientific discipline address already appointed to itself [5-9].

When the vehicle moves quickly in V2I from aboard station to another; the present net session can expertise long relinquishment delay. to cut back this delay we have a tendency to projected Associate in Nursing enhancement over existing protocol called seamless scientific discipline diversity-based generalized quality design (SIGMA) as shown in Figure one. Letter uses a location manager (LM) to cut back relinquishment delay caused of diversity within the network as mentioned in Figure one. Conversely, letter experiences a lot of relinquishment delay and packet loss rate once the relinquishment rate is high (high moving speed). A cross- layer style of transport layer (L4) and circutlayer (L2)

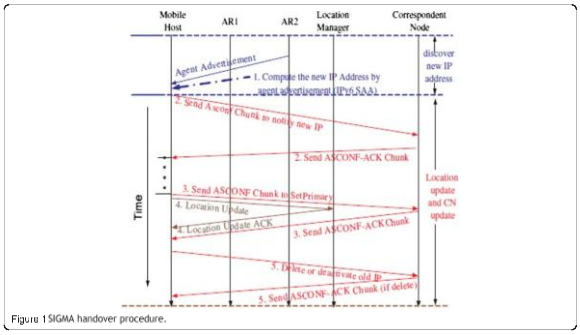

Figure 1 SIGMA handover procedure.

s projected so as to optimize the performance of letter of the alphabet. to take advantage of letter of the alphabet IP diversity and overcome the weakness for prime speeds, a cross-layer style makes L4 aware of the movement of the vehicle victimisation the radio radiation strength indicator (RSSI) of L2.

The rest on the article is organized as follows. The following section presents the extremely dynamic environments literature review, and therefore the connected works. an summary of conveyance network quality management in terms of 5 necessities is careful in "Vehicular network quality management". The cross-layer style of the high speed to beat the matter statement is mentioned in Section "Proposed transport layer adaptation for high-speed vehicle". Section "Simulation topology" describes simulation topology and parameters. Section "Results and discussion" presents results of the protocol style mentioned, and therefore the final section concludes the article.

- Highly dynamic environments
  Mobility management is one in every of the foremost difficult re- search problems for conveyance networks to support a spread of intelligent installation (ITS) applications. Some ancient quality management schemes for web as painter got to meet the necessities of conveyance net- works, and characteristics of conveyance networks (e.g., high mobility). Therefore, quality management solutions devel- oped specifically for conveyance networks would be needed.

- Vehicular network mobility management
  The mobility management in vehicular networks should guarantee the reachability to correspondent nodes (CN) in the Internet as well as the global reachability to mo- bile nodes (MNs). For this reason, the mobility manage- ment has confined requirements such as seamless mobility, fast handover, IPv6 support, high mobility speed, and movement detection [2,6,10]. VANET mobil- ity requirements are summarized in Table 1.

- Related studies
  Mobility support for users and transport networks needs network association as interactive and period of time applications become more and more vital. Therefore, several seamless-mobility approaches are developed to avoid service disruption and minimize the attention of service degradation whereas the mobile device is moving quickly. The study of [1] planned a cross-layer theme known as CEAL to support quality of transport layer protocol mSCTP mistreatment circuit layer primitives. The performance analysis shows less relinquishing delay in wireless local area network environments. In [11, 13, and 14], varied approaches that support seamless and lossless relinquishing within the high-speed transportation system were delineated. The study of [11] exploits prediction technique to boost and optimize the performance in high-speed environments. Thus, there would be no downside relating to light time in association

- Table one quality management flows
  Seamless quality quality of vehicles ought to be

seamless in spite of vehicle's location and wireless technology [1,11]. Moreover, accessibility and repair continuity ought to be bonded

Fast relinquishment quick handover is required for delay sensitive ITS applications (e.g., safety, net access, etc.). quick relinquishment is additionally an important demand for wireless networks with little coverage space (e.g., wireless local area network network), since the vehicle with high speed spends short amount of your time at every purpose of attachment (e.g., Base station). Consequently high relinquishment rate IPv6 support The international reachability needs a comprehensive reliable routable information science address for every MN. IPv6 with massive address area will support a novel address for all mobile devices within the vehicles. additionally, IPv6 conjointly has higher support of security and quality of service (QoS) that area unit the mandatory needs of ITS applications

High quality speed the web access is predicted to be perpetually connected in spite of the movement speed. it's extremely fascinating to create these contents on the market and reliable in spite of time, place, fixed, or mobile. because the speed of auto will increase, the flourishing likelihood of relinquishment decreases because the relinquishment execution time is exaggerated

Movement noticeion Vehicle must detect the provision of various varieties of access networks (e.g., WiMAX base station) referred to as circuit layer relinquishment (L2), and procure addresses in these networks for communication

Location management Location management theme, that deals with the storage, maintenance, and retrieval of MN location data, is required in VANETs [12] establishment because the speed increase. A study in [14] additionally instructed that 802.21 centrical approaches accustomed exploit a previous data methodology wherever network data is gathered from each mobile terminal ANd network infra-structure to ascertain an earlier reference to the new subnet. so as to scale back the result of service interruption within the high movement speed atmosphere, the study of [13] propose a packet forwarding management theme to pick a standard ahead purpose because the tunnel supply to forward packets. Mistreatment this methodology, packets is sent through a shorter delivery path throughout relinquishment. The authors of [3] planned network quality protocol for VANETs NEMO protocol for VANET in route. Since each automobile is occupancy a set direction with high moving speed, the automobile adopting this protocol will acquire science address from the VANET through the V2V communications. In [4], they conferred a cross-layer relinquishment theme, referred to as conveyance quick hand- over theme, wherever the physical layer data is shared with the mack layer, to scale back the relinquishment delay. Mistreatment lower layer's handovers, the transportation layer won't remember of the relinquishment which can cause packet loss and degradation of the network QoS.

Transport layer-based approach like mobile SCTP (mSCTP) influences the power of SCTP to own multiple science addresses per association. mSCTP utilizes a feature of SCTP, that permits AN MN dynamically switch between offered access networks so touching seamless hand- overs. The authors of [6] give analysis that mSCTP will give lower relinquishment latency than mobile science and provides a lot of smaller relinquishment latency for vertical relinquishment. Hierarchical transport layer quality protocol that could be a new planned possibility that deals with the native and international mobilities to boost throughputs throughout the football play amount. This protocol exploits the dynamic address reconfiguration feature of SCTP ANd introduces an anchor quality uniting order to finish a lot of economical football play procedures. A unique error recovery mechanism related to a hand- over was mentioned in [8] wherever the error recovery time of this mechanism is analyzed and compared to it of the plain SCTP for relinquishing cases. The previous work chiefly focuses on low or medium speeds. However, the wants to keep up a seamless communication within the high-speed things is turning into extremely engaging and difficult issue that has to be tackled [3, 4, and 11].

Proposed transport layer adaptation for high-speed vehicle during this cross-layer style (SCTPcd) info

from multiple protocol layers [data link (L2), network (L3), and transport (L4) layers] of the vehicle will effectively be changed to boost performance of the quality management theme. However, L2 and L4 chiefly exchange messages to adapt the speed of the vehicle (L2) with alphabetic character protocol style (L4). To judge the performance of this style, a network state of affairs of 4 BSs connected to CN via the net victimization 2 access routers (2ARs). This network victimization one SCTP association of alphabetic character as mentioned in [5, 15-19] as seems in Figure two. During this state of affairs, the vehicle moves from serving Bachelor of Science (SBS) to the target Bachelor of Science (TBS) that the current running net communication can switch from SBS to TBS with same technology (WiMAX BSs). Long relinquishing procedure might cause delay in electronic communication that results in service disruption. On different hands, within the movement

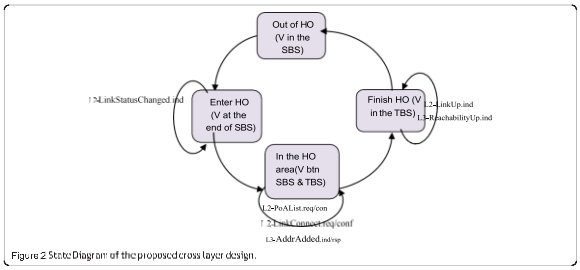

Figure 2 State Diagram of the proposed cross layer design.

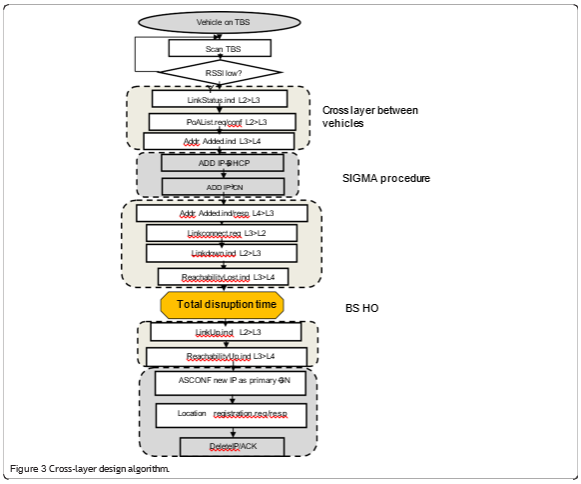

Figure 3 Cross-layer design algorithm.

Layer asking the quantity of BSs, Link Connect. ind to TBS. Last is state four that is that the finishing of relinquishment, L2 receives tie. ind to point signal strength intensifying and L3 message to tell of reaching network. Figure four shows the temporal arrangement diagram of the projected cross-layer to explain the flow of the relinquishment messages between BS and vehicle (L2 handover) and vehicle and CN (L4 hand- over SCTP). On another facet, Figure five mentions the thought of cross-layer relinquishment with the L2 relinquishment message of BS, L4 of SCTP protocol and high-speed vehicle. Handover procedure of SCTPcd

Handover procedure of this cross-layer style is delineated in Figure five. It contains relinquishment delay of 2 protocol layers (L2) relinquishment delay and (L4) relinquishment delay. For data-link layer, the relinquishment delay contains mobile WiMAX BS communication messages to initiate (trigger) and exe- cute the relinquishment. However, most of L4 relinquishment delay of letter of the alphabet protocol victimisation during this style is for SCTP's Set Pri- The Virgin chuck still as delete recent information processing (ASCONF SET- PRIMARY/DEL-IP) messages of relinquishment and trip Time (RTT) of messages between vehicle and CN (about 1–10 ms). Even so, the link delay to update luminous flux unit will

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Total handover delayðT_{HO}Þ¼ L2 þ L4 ðASCONFSET —PRIMARY=DEL — IPÞþ RTT ð1Þ

where L2 data link layer delay, L4: Transport layer delay.

- Simulation topology

To evaluate our plan, a simulation used was OMNET++ hand in glove with MATLAB. As shown in Figure four, the vehicle is multi-homed node moving with speed of 70– a hundred and twenty km/h on road and connected to the web through wireless access purpose (WiMAX BS). The cover- age space of every BS regarding 2000 m, and therefore the overlapping region between 2 BSs is two hundred m. Moreover, from the network facet, every 2 BSs connected to 1 AR, and each of 2 ARs connect one MAP. This MAP directly joins this network to the web as entrance. As shown in Figure a pair of, alternative a part of the network connect the CN as

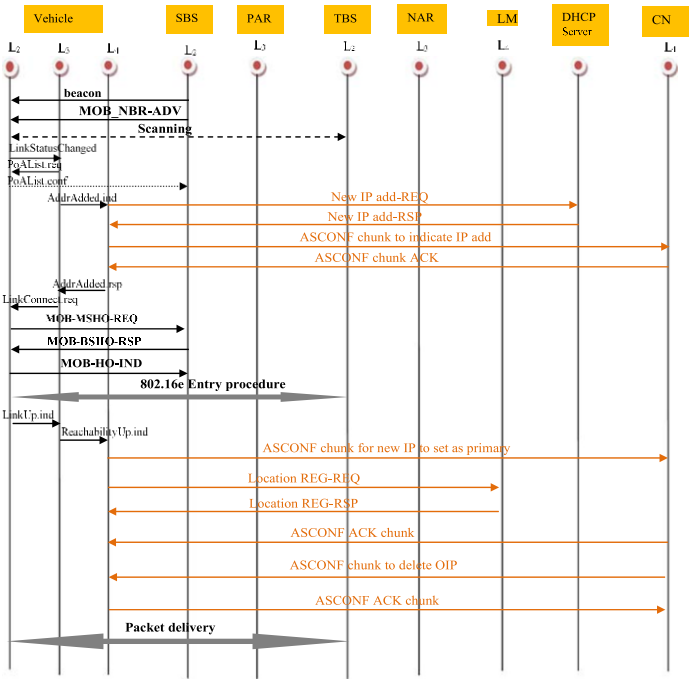

Figure 4 Timing diagram of the proposed cross-layer design.

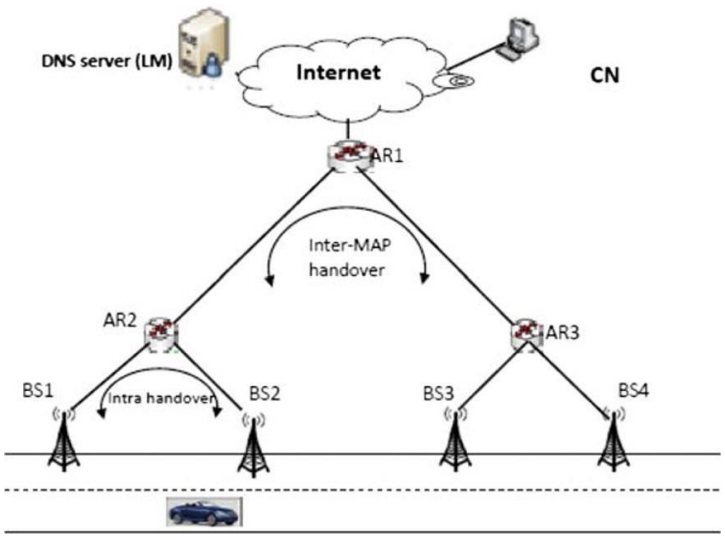

Figure 5 Network scenario.

a single-homed node causation traffic to the vehicle, that corresponds to the services like file downloading or net browsing by mobile users. However, lumen uses by letter as a network management entity.

II. RESULTS AND DISCUSSION

The simulation situation taking accounts the MS speeds between one and forty m/s. forty m/s (equals to a hundred and forty four km/h), that is on top of the a hundred km/h limit delineated in IEEE 802.16e for a seamless relinquishment. once the vehicle is moving to the border of 1 baccalaureate during a bound speed, the signal quality of the SBS begins to degrade. Consequently, either the signal strength becomes low to initiate relinquishment by causing (MOB-MSHO-REQ/RSP) messages. Alterna- tively, once the signal strength is below threshold (WiMAX normal two dB) and therefore the actual method of holmium would be dead as (MOB–HO–IND) sends.

- Handover latency

As mentioned earlier once applies alphabetic character in a very state of affairs seem in Figure a pair of, SIGMA's relinquishment latency of is extremely nasty (15 ms of L2 delay) at a coffee speed of MN [15-17].

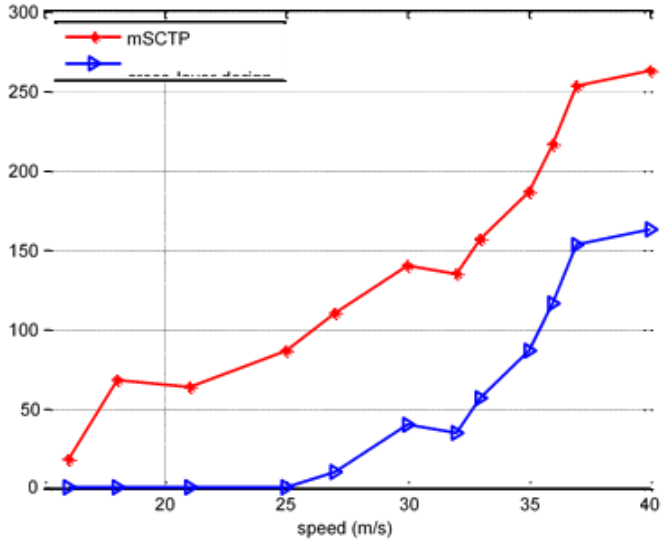

Figure 6 SIGMA & cross-layer handover latency comparison.

Table 2 Comparison of cross-layer and SIGMA throughputs for different speeds (15–40 m/s)

Protocols	Speeds	
	15	40
	Throughput (Mpbs)	
SIGMA	6	0.9
SCTPcd	9	9

On alternative hand, mSCTP experiences additional relinquishment delay in high-speed vehicle case. To eliminate these issues our projected style uses letter of the alphabet protocol hand and glove with mSCTP. However, mistreatment letter of the alphabet during this style is helpful to drop duplication address detection delay mistreatment SIGMA's luminous flux unit while not additional delay once change vehicle location. additionally, mistreatment SIGMA's luminous flux unit remains with no triangle routing downside of the packets' route be- tween CN and vehicle just in case of the high-speed vehicle [13]. That's as a result of the CN continuously sends the packets directly to the vehicle's current information processing address through luminous flux unit. The relinquishment delay for this cross-layer style calculated from vehicle to CN. The disruption time thanks to L2 is regarding ten ms and it's negligible for L3. For L4, it takes regarding zero.045 ms for ASCONF to SET-PRIMARY/DEL-IP, then from Equation (1) the overall disruption time:

T_{HO} ¼ L2 þ L4 ¼ 10 ms þ 0:045 ms þ RTT
¼ 10:045 þ 10 ¼ 20 ms

The handover delay between vehicle and CN depend on RTT between both is about 20 ms. A comparison of these protocols and proposed design handover delays are shown in Figure 6.

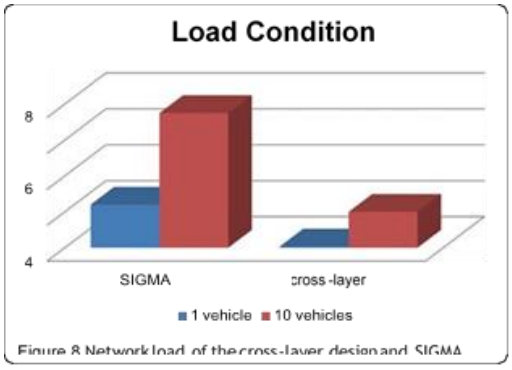

Figure 8 Network load of the cross-layer design and SIGMA

Throughout in this state of affairs, the turnout is considering the vehicle communication to IEEE802.16e. Once the vehicle speed will increase to the upper worth (140 km/h for WiMAX BS), the communication time in one coverage space of BS concerning sixty seven s for SCTPcd and relinquishing latency is concerning twenty five ms. so for high-speed vehicle with a consecutive relinquishing the vehicle cannot receive packets for 0.2 s because of relinquishing, so receives packets for sixty six.8 s. As a result, the turnout of SCTPcd is abundant higher than different SCTP within the setting of extremely dynamic relinquishing. Table a pair of lists the turnout of letter versus cross-layer style in speed of 15–40 m/s.

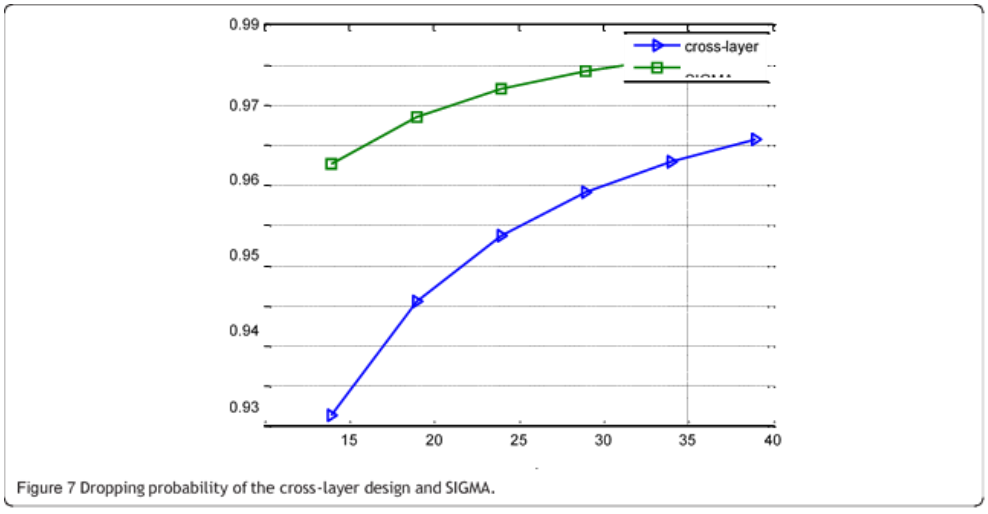

Figure 7 Dropping probability of the cross-layer design and SIGMA.

From Figure 7, the dropping probability is very high in SIGMA design compare with our cross-layer design that is because of the consecutive handover in a short period. Also, Figure 8 depicted the handover delay time when the network load is high. To simplify the comparison, we test the simulation under network load of ten vehicles.

CONCLUSION

Internet accessibility in high-speed vehicles as V2I is more challenging and raise the need of least delay. In this article, an adaptive algorithm was proposed on L2 to support seamless handover in high-speed vehicles that connecting to a CN through the Internet. Moreover, a proposed cross-layer design at L2 has adapted L4 of SIGMA protocol design for global reachability to network. The crosslayer design dynamically updates L4 of handover at the time when network parameters (RSSI, SNR) degrade to unacceptable level. The results show that our design achieves better performance about 90% when speed is higher than SIGMA protocol design.

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