MULTIDIMENSIONAL INFORMATION TRANSMISSION FOR CROSS LAYER MOBILE HAND OFF IN IPV6 NETWORKS

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Abstract: Being digitized the communication system channels are having a severe workload in the current scenario. A number of increases in digital devices require more address variable. The internet and 4G services available in the global world are able to provide good service to both stationary and moving devices. Huge number of devices can be introduced in a specific region of the network. Devices can be operated in any layer of the network. Most of challenges are coming in cross layer hand-off as delay and protocols available different network are different. For the above kind of handoff problems, this paper proposes a technology, which is including a variety of header formats and a suitable protocol for cross layer handoff in IPv6 header format. The work is done on a layer wise hand off and dual communication with two base stations for a certain time, while hand-off occurs. Multiple header format supports reliable, un-interrupted and delay avoidance in the communication system. The security and authentication are enhanced with two control units.

Keywords - IPv6, Header Format, Cross Layer, Hand-Off, Network Region, Signal Strength.

I. INTRODUCTION

Demand of identification of devices, which are connected through global network system leads to the invention of IP-6 address in the network domains. The operation of devices in a variety of regions is highly needed. Devices deployed in different regions are adapted to work some of the specific layers of the network. Although the human interface level of different device may same, they are different network accessing layers. At the time of moving of any device from one network region to another network region have some problem in terms of delay, data requirement varying in layers of the network. Mobile hand-off is a main problem with IP-6 networks. Over the last few years ample new protocols have been developed for multimedia applications in the whole OSI layer’s scale. One of the most visible trends in today’s commercial communication market is the adoption of wireless technology.

In integrated WAN + LAN + 3G cellular systems, data and multimedia communications are carried end to end over the existing Internet infrastructure. A network consists of a number of layers for providing the service of communication. Generally the network consists of a physical layer, data link layer, network layer, transport layer, secession layer, application layer. While the upper layers like section layer, application layer, are subjected to the software application. The parameters present in data link layer, the physical layer, network layer, transport layer are affecting the communication channel. To provide reliable and uninterrupted service a number of protocols are introduced in the network layer and transmission layer. Data is transmitted as a data packet. The data packet is designed in a header format. The data packet is transmitted through a character array. Data always flow from source to destination following a number of protocols. The source and destination are dynamically fixed by the user. Source and destination are identified as IP address format. When digital transmission is started its working in the world, few devices are acting upon it. At this time the data packet is sent through IPv4 header format. Gradually the number of devices increases and requirement of new header format born. Although IPv6 is taking more space in network bandwidth, it is applicable due to the invention of optical fiber cable and high speed processor. The header format is changed as the requirement of the network and new protocols are introduced to provide uninterrupted communication. The parameters present in the IPv6 header are dynamic. Most of the networks present in day to day life are wireless networks. The wireless network consists of mobile devices and mobile service providers. Most of them are using 802.11 level protocols. Communication is taking place from a user to another user through a number of service providers.

Traffic on future wireless networks is expected to be a mix of real-time traffic such as voice, multimedia teleconferencing, and games, and data traffic such as Web browsing, messaging, and file transfers. All of these applications will require widely varying and very diverse quality of service (QoS) guarantees for the different types of offered traffic, and we are now in the early days of this eventual amalgamation. IPv6 header formats are supporting to anytime and anywhere. These header formats can be deployed in 3G and 4G networks. They are able to provide high speed internet and communication system. The future Airborne Network will include a core of loitering/orbiting aircraft which provide inter-
networking over multiple heterogeneous wireless links. Now a day, cross layer hand off is used to operate the mobile devices in a random layer of the network. Due to the unique structure of a mobile ad hoc network it can be deployed anywhere at any time where fixed networks cannot be deployed. Multicast protocol is to minimize the energy dissipation of the network. Wireless technologies provide mobile access to networks and services, eliminating the requirement for fixed cable infrastructures, and thus enabling fast and cost-effective network deployment, re-organization and maintenance.

Next generation wireless networks offer the promise of high speed access as well as IP-based data services to the mobile hosts. Protocols would be required to maintain the same level of performance in the wireless networking environment with frequent handoffs, as in the wire-lined environment. Transmission power controls are important because of the fundamental nature of the wireless network that it is interference limited. Transmission power control has the potential to increase a network's track carrying capacity, reduce energy consumption, and reduce the end-to-end delay. Caution needs to be exercised though, since cross layer design has the potential to destroy the modularity and make the overall system fragile. Another important challenge that has to be taken into account during the design of crosslayered solution for WMNs is the different operating timescales between coding, scheduling and routing algorithms; especially in the case that system performance estimations in different layers have to be performed. Multi-hop wireless networks impose new challenges such as, the varying nature of the signal strength, higher bit-error rates, dynamic variations in channel quality, fading effects, interference problems, mobility, shared and contention based MAC, multihop transmission and path selection at network layer needs some degree of interaction amongst different layers so that to optimized the overall network performance. It is still critical to efficiently utilize radio resources due to the fast growth of the wireless subscriber population, increasing demand for new mobile multimedia services over wireless networks, and more stringent quality of service (QoS) requirements in terms of transmission accuracy, delay, jitter, and throughput. Applications and protocols for wireless and mobile systems have to deal with volatile environmental conditions such as interference, packet loss, and mobility. MULTIMEDIA data transmission experience a number of constraints that result to low Quality of Service (QoS) that is offered to the end user.

Considering the problem of cross layer hand off, which signs in un-reliable network and delay in IPv6 header format, this paper's purpose “Multidimensional information transmission through IPv6 header format for cross layer mobile hand-off in IP-6 networks”. This method includes some slight change is in header formats at different phases of data transmission. This paper is also providing a suitable protocol for the reliable, continuous and delay avoided procedure for hand off in IPv6 network. This paper first gives a suitable introduction of the research material. The knowledge sharable papers are described briefly in the literature part, which is present in section-2. The section three is giving a suitable solution for the described errors present in the network. A valuable procedure, a conclusion follows to the proposal part.

II. LITERATURE REVIEW

The Yuh-Shyan Chen et al. have proposed a cross-layer partner-based fast hand-off mechanism based on HMIPv6, called as PHMIPv6 protocol. Their PHMIPv6 protocol is a cross-layer. With the aid of the partner node, CoA can be preacquired and DAD operation can be pre-executed by the partner node before the mobile node initializes the hand-off request. PHMIPv6 protocol can significantly reduce the handoff delay time and packet losses. The experimental results also illustrate that PHMIPv6 protocol actually achieves the performance improvements in the handoff delay time, the packet loss rate, and the hand-off delay jitter.

Guangquan Chen et al. have described a new crosslayer design considering coordinated scheduling for the performance improvement of delay-sensitive applications over heterogeneous wireless networks was described. Their proposed design utilizes information about the physical and data link layers and decides on the connections transmission power, encoding mode or coordinated scheduling execution. According to extensive simulation results, the design achieves improved performance in terms of packet loss rate, average delay and throughput, when compared to existing systems. A.Maheswara Rao et al. have developed a Cross-Layer Based QoS Routing (CLBQR) Protocol for 802.16WiMAX Networks. In this protocol, the cross layer routing was based on the routing metrics, which include power, link quality and end-to-end delay. In order to realize QoS provisioning with efficient resource allocation an optimal power allocation is required. They have used the EETT (Exclusive Expected Transmission Time) metric to estimate the link quality where EETT is a routing metric, which is used to give a better evaluation of a multi-channel path. They use the average queuing delay at each node. The protocol is the derivative of the AODV routing protocol, which is the variant of classical distance vector routing algorithm. It achieves a higher packet delivery ratio with reduced energy consumption and delay.

The cross-layer design proposed by Jhunu Debbarma et al. was aimed to provide a solution for unidirectional link failure management, reliable route discovery, and power conservation. The link quality can be predicted by the received signal strength from the physical layer. The links having low signal...
strength can be discarded from the route selection. From the MAC layer, the minimum power required can be estimated by performing RTS/CTS packet exchange.

Based on this, the application layer can readjust the transmission rate, to avoid collision. Their ross-layer design makes the AODV routing protocol to survive with heterogeneously powered ad-hoc networks by identifying and rejecting the asymmetric links at the RREQ broadcast stage itself.

Vertical hand-off was defined in as a process which transfers a user connecting from one technology to another. Vehicles and other mobile applications will expect seamless vertical handoff between heterogeneous access networks, via multiple interfaces. This is achieved by exchanging information across multiple layers of the same entity and by sharing information between nodes in the network. Therefore if a link event is not propagated quickly enough across the protocol stack service disruption could occur due to latent handovers. The proposed frameworks introduce 3SE and its capabilities namely multi-homing, multi-streaming, address reconfiguration and able to distinguish between losses due to congestion and radio channel failures.

Among the main novelties introduced by 3SE, there are the diversified bandwidth estimation and the efficient use of multi-homing by the redefinition of primary and secondary path. In addition, they provide a complete solution to use 3SE as an efficient transport solution for MIH. The solution combines a path selection algorithm and the use of MIH services to optimize 3SEs behavior.

III. PROPOSED SOLUTION

3.1 Problem Definition
Demand of identification of devices, which are connected through global network system leads to the invention of IP-6 address in the network domains. The operation of devices in a variety of regions is highly needed. Devices deployed in different regions are adapted to work some of the specific layers of the network. Although the human interface level of different device may same, they are different network accessing layers. At the time of moving of any device from one network region to another network region have some problem in terms of delay, data requirement varying in layers of the network. Mobile handoff is a main problem with IPv6 networks.

The previous papers are considering about the data transmission through only single data packet. These are leading extra time for calculation. Some time network delay is causing failure in network connection. Multilevel requestresponse system given in makes the system too busy. It is also un-reliable and time consuming hand-off in the wireless area network. This method is also not considering all the cases of the network layer. The author has tried on only delay parameters to solve the solution. But the delay is working only in a single layer. Scanning is one of the technologies described by some authors. But still it requires extra work load on the devices working on the network. Routing described in is one the methods which are enhancing the handoff technology. Still it is difficult to predict it when one network area is coming under the region of another network area. Although the method given in the paper is in able to create good hand off, it is not reliable at unpredictable cases. The method given in is working on path solution. The described method in is method having more delay and causing more workload on finding a path. The method given in is modifying only one layer protocol. But it can be enhanced by doing some more modification in other layers. The paper is showing a solution in delay in transmission layer. But networks should be aware of more layers because they have different applications in different layers. The method is not flexible towards the requirement adapting and changing network condition.

3.2 Proposed Methodology
This paper describes procedure which can be applied in any type of wireless network. The wireless network consists of several stationary and several mobile devices. The 4G and WI-LAN networks communicate with each other through IP address. These networks are having huge data transmission capabilities. This procedure is applicable for WI-LAN and 4G networks.

This method tries to modify the header format in terms of its design and arrangement of a suitable protocol. This design leads to the network to be flexible in different access scenario. This proposal considers network layer, transport layer, MAC layer (data link layer) and physical layer. The author has given the requirements and description of the network according to the network layer. Here below this paper is showing where the design can work. It can work in two conditions first where one network domain is coming under another network domain. The second one is where two different network domains are interacting with each other in a common intersect area. Here the mobile node is communicating another mobile node through base station or directly with the base station network provider.

Figure 1a showing one network area is coming under another area and figure 1b showing interception two different areas.

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Before doing any handoff, the handoff area is determined. Here this method proposes dynamic decision. Every mobile device is able to detect the signal strength of different networks. This can be done through scanning the network availability at a standard time (ts). The standard time (ts) is manually set at the time of establishment of the network by the experts. Suppose the mobile device is moving from network A’s domain to network B’s domain. In the above figure-2, it is clearly shown the network intersect area of A and B. The mobile node also deciding the network area under which it wants to work. Here, this method proposes three types of header formats for the handoff technology.

The Type-1 header format carries the sender’s address, network provider address, and the useful data as request and all protocols of different layer. The Type-2 header format carries the same information present in the data packet but like senders’ address for the specific mobile device, the protocols in a relative manner. The details about protocols are given in section 3.3.2. Type-3 header format contains the above similar values but with an acknowledgement. This header format is also multidimensional. Each row of the data packet belongs to one layer of the network. These are transmitted as the header of IPv6. IPv6 has six different data field having size of 32 bits. This data packet information is arranged in the header field. The header is used as transmitting object in IPv6 data transmission. So data packet types can be treated as IPv6 header-1, header-2, header-3, header-4.

The network consists of two base stations and a mobile device. The mobile device has the capability of receiving signals from many base stations. The mobile device is capable of taking the decision to which network it wants to be connected. Handoff is only taking place through the base stations according to the request and data presented by the mobile device. Both base stations try to communicate with the mobile device as long as both the base stations having full handoff through all network layers. So the architectural diagram is given below.

3.3.1 Header Format type1-
Here we consider different types of data packets. The data packet is changed into IPv6 header format. The proposed header architecture is given in figure 3. The handoff is taking place from the data link layer to transport layer. Header format 1 is used for the communication of the current base station (BSc) with the mobile device. In the proposed work, it is assumed that the fields present in the upper row, which is determining the version and defining the protocols for different layer should be fragmented while in the previous IPv6 header format it is united.

### Figure-3 type-1 Header format

3.3.2 Header Format type2-
This header format is used at the time of hand off to provide un-interrupted and confusion free hand off. In this header format, both current base station (BSc) and the chosen base station (CB) are communicating with the mobile device.

Here some fields of the protocol row remain blank. This hand off is taking place from physical layer to transport layer. When the mobile device is started communication with the chosen base station, the header format is having only physical layer protocol. The remaining fields of protocol remain blank. At the same time the current base station is also communicating with the mobile device. The header format of current base station is having all the fields in protocol layer filled except the physical layer. Like this way the hand off is taking place from physical layer to transport layer. In the second phase of data transmission, the header format of the current base station (BSc) has filled field in the network layer and the transport layer of protocol row. At this time, the header format from chosen base station is having filled fields in physical layer and data link layer while having empty fields in the network layer and transport layer. In the third phase of hand off, the header format of the current base station is filled with transport layer protocol and the remaining fields are empty. The third phase is the last phase of hand off through cross layer hand off.

### Figure-4 showing header format type-2

3.3.3 Header format type3
Header format three is used for communication phase which includes inter base stations. In the first phase
of inter base station communication, this header format is sent from the current base station to the chosen base station. Here all fields are filled as described in header format except the data field. The data field carries only a request to a base station with the mobile device’s identity. This is the pre phase of handoff. In the second phase of inter base station communication, the new base station is sending the acknowledgement, with the mobile device identification to the previous base station. All the fields are same as given in the header format style one except the data field. This is the post phase of handoff.

3.4 Handoff Conditions
Handoff request is sent by the mobile device. The mobile device is able to detect the signal strength from various base stations. There is fixed maximum signal strength. The mobile device is calculating the signal strength ratio at a standard regular interval of time (ts) from all the base stations. They are termed as signal ratio one (SR1), signal ratio two (SR2)… signal ratio n (SRn) given by the formula

\[ \frac{\text{signal ratio}}{\text{signal strength ratio}} = \frac{\text{signal strength}}{\text{max signal strength}} \]

The mobile device chooses the best signal ratio from the following formula

\[ \text{Connection ratio (CR)} = \sum \text{signal ratio} \]

Sri are the signal ratios from base stations BSi For handoff the mobile device compare the 0.6BSc (base station current) to the 0.4CB.
Then the mobile device sends a request to the base station, under which it is working right now. Suppose it is working under base station one which is the current base station (BSc). The mobile device sends the address field under which it wants to work on it. Suppose it is chosen base station (CB).

Then, the current base station (BSc) is sending the request to choose a base station (CB). The header format is given in section 3.3.3.

Figure-5 showing header type-3

**Figure-6** showing request from the mobile device to base station

Then, the chosen base station (CB) starts communicating with the mobile device. At the same time the current base station (BSc) is also communication with the mobile device. Handoff occurs at this time from one layer to another layer. The data contained in the header format give the information about layer wise transport. The detail of header format is given in section 3.3.2. The mobile device is also giving all the information of cross layer hand off so that all phases of hand off can be taken place.

Figure-7 showing request communication among base stations

Figure-8 showing request communication among base Stations

Figure-9 showing request communication among base Stations

After the hand off taking in all the layers of the network, the chosen base station informs it to the current base station. Then the chosen base station is acting as the current base station for the mobile device.

**Procedure**-

- The mobile device is communicating with the current base station as the header format-1 given in section 3.3.1.
- At standard time (ts) the mobile device is scanning the networks available for it. It gets the signal ratio (Sr) from the networks.
- It compares the signal ratios getting from the different networks. If it is getting the signal ratios in between 0.4 to 0.6 of network A and network B, then it is generating the handoff
message of that particular device to both the networks. The detailed method is given in section 3.4.

- After getting the request, the current base station (BSc) to which the mobile device is connected at the present time, send header format-3 given in section 3.3.3 to the chosen based station.
- After getting the request from the current base station, the chosen base station start communicating with the mobile device.
- At this time both base stations that are current base station and chosen base stations are communicating with the mobile device till the handoff occurs. At this time both the stations are using header format-2 given in section 3.3.2.
- The hand off is taking place on each layer through data packet. The handoff occurs starting from the physical layer to transport layer.
- All the protocols, which are being used by the current base station and mobile device is being slowly updated from the physical layer to transport layer.
- After the whole hand off occurred, the chosen base station becomes the current base station and starts communicating in header format-1 with the mobile device.
- After the full hand off, the chosen hand off sends an acknowledgement to the current base station using header format-3 given in section 3.3.3.

IV. SIMULATION RESULTS

4.1 Simulation Model and Parameters

To simulate the proposed Multi Information Transmission for Cross Layer handoff in Mobile IPv6 Networks (MITCL) scheme, NS-2 [20] is used. In the simulation, clients (SS) and the base station (BS) are deployed in a 1000 meter x 1000 meter region for 50 seconds simulation time. It consists of 4 base stations among which, BS1 and BS2 are based on WLAN and remaining BS3 and BS4 are based on UMTS. Each network contains 5 mobile nodes (refer fig. 2). All nodes have the same transmission range of 250 meters. At 5 seconds, MN1 from BS1 begins to handoff to BS3 of UMTS network. At the same time, MN6 from BS2 of WLAN network begins to handoff to BS4 of UMTS network.

This is illustrated in Figure 11.

The simulation settings for UMTS are presented in Table 1.

Table 1: Simulation settings for UMTS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mac</td>
<td>Hsdpa</td>
</tr>
<tr>
<td>Base stations</td>
<td>2</td>
</tr>
<tr>
<td>Clients per base station</td>
<td>5</td>
</tr>
<tr>
<td>Downlink/UpLink BW</td>
<td>32 kbps</td>
</tr>
<tr>
<td>HS-DSCH Scheduling</td>
<td>Proportional Fair</td>
</tr>
<tr>
<td>RLC_BUFFER_SIZE</td>
<td>10 Mb</td>
</tr>
<tr>
<td>MN speed</td>
<td>10 m/s</td>
</tr>
</tbody>
</table>

Table 3: General Simulation Settings

<table>
<thead>
<tr>
<th>Area Size</th>
<th>500m X 500m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mac</td>
<td>802.11</td>
</tr>
<tr>
<td>Base stations</td>
<td>2</td>
</tr>
<tr>
<td>Clients</td>
<td>5</td>
</tr>
<tr>
<td>Radio Range</td>
<td>250m</td>
</tr>
<tr>
<td>Simulation Time</td>
<td>50 sec</td>
</tr>
<tr>
<td>Traffic Source</td>
<td>CBR and TCP</td>
</tr>
<tr>
<td>No. of CBR Flows</td>
<td>2</td>
</tr>
<tr>
<td>No. of TCP Flows</td>
<td>2</td>
</tr>
<tr>
<td>Packet Size</td>
<td>100 bytes</td>
</tr>
<tr>
<td>Rate</td>
<td>50 to 250 kb</td>
</tr>
</tbody>
</table>

B. Performance Metrics

We compare our proposed MITCL with the standard IPv6 Handoff. We mainly evaluate the performance according to the following metrics:

Throughput: It is the amount of traffic (real time or non-real time) that is received in the destination, represented in Megabits / second.

Delay: It is the average end to end delay occurred at the destination for all flows.
Packet Delivery Ratio: It is given by the ratio of packets successfully received to the total number of packet sent.

A. Based on Rate
In our first experiment we vary the rate as 50,100,150,200 and 250 kb.

A. Based on Packet Size
In our first experiment we vary the packet size from 100 to 500 bytes.
CONCLUSION
Networks and devices can be flexible using the above described method. At the network hand-off time is detected dynamically, the mobile devices having their incodings to choose their authorized network. Here it has been taken three types of connection; first one is a network provider to network provider, which is two way connections, and the other one is the network providers to mobile device. This is reducing the pressure on single device present in the network. Handoff is taking is taking place from one layer of network layer of the first network to second network, while remaining the other part network layer is acting in the domain of the previous network. So there is a less probability of disturbed service. If some network base station is failing at the time hand-off, it is also not affecting the connection of the mobile device to world through networks. The above described procedure can be installed in any type network domain.
Multidimensional data packet based transport able handoff among two different networking on different layers. Here the network provider devices may be both stationary and standstill. The future work is to apply this solution to WiMAX networks. The automatic routing table can be enhanced to IPv6. Handoff decision making is another area we plan to work.

REFERENCES
[3] VIKAS KAWADIA,” PROTOCOLS AND ARCHITECTURE FOR WIRELESS AD HOC NETWORKS,2005


