Fast Handoff in Wireless Communication Technology

Ranbeer Tyagi¹, Hye-jin Kim²

Abstract

The primary contribution of this work is a detail analysis of the mobile IP fast handoff using sap-reg method. We have seen fast handoff with sap-reg method require very less time delay approximately $3.1 \times 10^{-3}$ make the connection with best link to new BSs. We also analyze the TCP with FTP traffics andUDP with CBR traffics on various scenarios with different parameter like Throughput, Goodput, and Packet loss rate. Due to this simulation scenario we find that TCP with FTP has better performance (Goodput) for less number of mobile nodes.

Keywords:- HO, QoS, Throughput, Goodput, PLR, Wireless Communication.

1. INTRODUCTION

Wireless system categorization is just a substantial job in next creation wireless systems. Wireless engineering has got the excellent value to permit customers flexibility. It’s become the absolute most current region in telecom and networking. The rapid-growth of cellular phone use, numerous satellite providers, and today the wireless Web are generating great adjustments in telecom and networking [1]. Individuals understand the need to become usually linked even if shifting or travelling as increasingly more immediate. They need top quality of service (QoS), high-data rate, and quick connection etc during conversation. But when cellular person shifting, some interruption happen during connection in one access point to another access point in various coverage areas [2-4]. This disruption may cause the real time software like speech, video, along with other real-time services (VoIP). That triggers delay so-called the handoff.

1.1. Description of Handoff

Flexibility may be the most significant function of the wireless mobile communication
program. Often, constant support is attained by encouraging handoff (or handover) in one mobile to a different [5].

Handoff is managed in various methods in various systems and entails numerous factors. Handoff may be the procedure for altering the channel (frequency, time-slot, distributing signal, or mixture of them) linked to the current link while a cell is progress [6][7]. It's frequently started possibly by bridging a cell boundary or by collapse in quality of the signal in the present channel.

Handoff is split into two broad groups: hard and soft handoffs. They're additionally seen as a “break before make” and “make before break”, respectively.

Hard handoff: It is one where the channel within the source cell is launched and just then the channel within the goal cell is involved. Hence the connection towards the source is damaged before the connection towards the goal is created; as a result of this such handoffs will also be named break-before-make.

Soft handoff: It is one in which the channel within the source cell is maintained and employed for some time in parallel using the channel within the target cell. In this instance, link with the target is set up before the connection towards the source is damaged, thus this handoff can also be named make-before-break.

2. Problem statement

The development of WLANs especially 802.11 has natural advantages of wireless engineering for further development of WLANs, there's a need of accessibility, below availability. It means providing connection to person with high performance having cellular facility in same or various networks [8]. To keep the connection with flexibility is a much difficult phrase in wireless. One main term is handover latency, is the time between the final second where the mobile node may obtain and deliver packet through the aged router and also the first motion where it can obtain and send packet through the brand new access modem. Which means this is just a period where the mobile node can neither received, nor deliver IP traffic. That point is used to state the handoff performance.

2.1. The drawback of the present NS2 component for cellular IP

NS2 includes both aforementioned methods, as can be observed by diving in to the component called mlp-reg, [9][10]. Consequently, every time the MH doesn't get a planned
beacon from the FA, the mention of that FA is removed in the checklist. On the other hand, every time the MH hears an announcement from an agent that’s not within the checklist, the MH reflects that it’s moved; consequently it introduces the address new agent in its list and associates with it. Additionally, when the present care-of-address ends, the MH affiliates using the FA that promoted lately [11][12]. This formula works nicely in simulations utilizing instant stereo versions where all packets are effectively sent inside the perfect group addressing the fixed conversation selection of a BS (i.e., the free-space model and also the two-ray ground representation design). About the other-hand, these versions are extremely remote in the actual regulations within the real life and are therefore not suitable to do significant critiques [13][14].

To evaluate agents, the cellular sponsor will have to be familiar with its present link power, or reduction, with recognized agents. For this, we suggest to store a little additional information about each FA within the MH’s checklist and also to possess the MH maintaining a working average of effectively obtained advertisement. To determine this working average, we must first determine a constant $\alpha$ along and a binary variable Beacon-Detected [15]. The worthiness for $\alpha$ is understood to be several from 0 to at least one and it is used to weight the agent’s background against its present every beacon interval. Once the MH inspections whether it’s discovered an advertisement from a agents in its checklist, it sees Beacon-Detected to one if it’s, 0 normally. By using this, it figures the new operating average for that agent is understood to be:

$$\text{New Avg} = \alpha \times \text{OldAvg} + (1 - \alpha) \times \text{Beacon Detected}$$

Actually, our goal would be to show the way the present NS-2’s module for Cellular IP doesn’t make use of a practical wireless transmission model and also to lead having a correctly functioning component.

2.2. Recommended sap-reg mobile IP technique

Because of our altered sap-reg module, this really is really effective and concerning Cellular IP. Furthermore, by evaluating the new module using the older one, it gets easier to understand how sap-reg can be more altered to incorporate substitute handoff systems.

Before move the channel from weak signal strength to powerful signal power, we first determine the word mistake (error), obtained signal strength in addition to quality indicator and evaluate this current signal to old sign. Word Error Indicator (WEI) is just a full that signifies if the present rush was demodulated precisely within the MS [16]. Which means if

Obtained information bytes is roughly or almost equal to the pre-determined information bytes
subsequently we assume sign is good-and remain at same channel no need to the following channel [17]. However the obtained received information bytes aren’t almost equal to the pre-determined bytes. Subsequently procedure would go to the RSSI check; Received Signal Strength Indication (RSSI) is just a way of measuring acquired signal-strength. The RSSI full includes a big helpful dynamic-range, usually between 80 to 100 dB. If RSSI is adequate between 80 to 100 dB and current channel is enough to carry on the phone call. But when signal-strength degree below the pre-defined value. Subsequently procedure moves for next check that’s quality indicator. Quality Indicator (QI) pertains to the signal-to-interference and noise (S/I), such as the effects of dispersion.

[Fig. 1] Sap-reg technique
Qi includes a narrow-range (assisted with the number of S/I from 5 dB to possibly 25 dB), if signal-to-interference and noise (S/I) ratio between subsequently no need move the channel. But when S/I below the particular thresholds then the link move go to the next accessible channel and proceeds the entire dimension procedure the till it get one best channel evaluate to the present accessible channel [18]. To help make the handoff choice precisely and rapidly, it's appealing to make use of both WDT and RSSI. The entire formula can be easily-understood with this design plan shown in fig.1.

3. Simulation Topology

This really is wired-cum-wireless situation with cellular IP process. That execute the handoff procedure between HA and FA in instant site.

3.1. Simulator technique:

We utilized network simulation NS-2.34. The network we simulated includes various situations, that have various quantity of nodes arbitrarily positioned on 300m×300m topological grid. The positioning of Home Agent (HA) is 100, 200 meter and Foreign Agent (FA) is 100, 200-meter in grid, simulator period is 30 seconds. We use flexibility routine that's centered on arbitrary waypoint design [19]. The speed of nodes is evenly dispersed between 30m/s to 110m/s. we utilized various link capability contain 1Mb, 2Mb, 5Mb, 11Mb and 30Mb. Every link convenience of both TCP and UDP is used for numerous cellular nodes speeds, to be able to decide which is much better particularly situation. Within the simulator situation the agent execute the event at subsequent way-in provide below desk:

<table>
<thead>
<tr>
<th>Event Description</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote host start FTP file transfer at</td>
<td>5 second</td>
</tr>
<tr>
<td>Mobile nodes start move away from HA</td>
<td>10 second</td>
</tr>
<tr>
<td>Mobile reach at FA with 33m/s</td>
<td>20 second</td>
</tr>
<tr>
<td>Mobile start move toward HA with 33m/s</td>
<td>25 second</td>
</tr>
<tr>
<td>Simulation stop at</td>
<td>30 second</td>
</tr>
</tbody>
</table>

We imitate the steady-state situation of network with numerous history traffics. UDP packet size is mounted 200 byte with CBR Traffic when compared with TCP with box size1000 byte with FTP traffic. The CBR and FTP traffic Information circulation start at period 5-second. Additionally cellular start transfer toward FA at 5 sec and again toward HA at 25sec. In each simulator situation, we assess throughput, great put and packet-loss rate.
3.2. Simulator situation by NS2

Namespace track result display as soon as of cellular host and traffic-flow in wired domain. Fig.3 is just a screen-shot of the simulation topology applied with NS2 network simulator. Animator
screen has two domain wire and wireless domain. Node (0) and node (1) within the wired
node and node (2), node (3) and node (4) in wireless node. The surface of the screen has play
switch to begin the simulation, and on right of the screen display the simulation period in
addition to speed of simulation. Big group is displaying the number of nodes [20]. While
simulator start packet will deliver from supply to location, below packet between node 3 and
node 4 are delivering and recognize back from node 4 to node 3.

![Diagram showing network nodes and connections]

**[Fig. 3] Screen-shot of simulator situation for TCP/UDP**

4. Goal Of Research

4G is being created to support the QoS and rate needs established by further improvement
of current 3G programs like wireless broadband accessibility, Media Messaging Service (MMS),
video-chat, cellular Television, but additionally new providers like HDTV information, minimum
providers like speech and information, along with other providers that use content. 4G may
permit roaming with wireless local area networks, and may connect to digital-video transmission methods. The 3G/4G operating team require a data-rate at least 100 Mbit/s as the customer actually transfer at high speed in accordance with the stop and 1 Gbit/s while customer and station are fairly fixed-position [20][21]. A smooth handoff should be across heterogeneous community. Additionally, seamless connection and worldwide roaming across multiple systems. Therefore we utilize some regular parameter to obtain the 3G/4G atmosphere like 802.11g, MAC type, distribution/shadowing radio propagation design and DSDV routing protocol [22-24]. This all create the simulator situation really effective regarding packet-loss rate, handover latency additionally end-to-end delay.

4.1. Environmental Parameters for Simulation

802.11g the IEEE 802.11g requirements is design as greater bandwidth 54Mbps and utilizes 2.4 to 2.5 GHz radio wavelengths to deliver and obtain information packages from on-device to a different. Selection of 802.11g about 33 meter or 100-feet, 802.11g has becomes very popular like a WiFi standard in last year due to five main characteristics. They contain High speed, variety, Quality of the signal, Cost and Compatibility. Below the table display the required parameter for the simulator.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Parameter value/ Setup MAC 802.11g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter</td>
<td>Value</td>
</tr>
<tr>
<td>Slot Time</td>
<td>20us</td>
</tr>
<tr>
<td>SIFS</td>
<td>9us</td>
</tr>
<tr>
<td>RTS Threshold</td>
<td>3000 bytes</td>
</tr>
<tr>
<td>Short Retry Limit</td>
<td>7</td>
</tr>
<tr>
<td>Long Retry Limit</td>
<td>4</td>
</tr>
<tr>
<td>Data Rate</td>
<td>54Mb</td>
</tr>
<tr>
<td>Basic Rate</td>
<td>6Mb</td>
</tr>
<tr>
<td>amc</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Parameter value /Configuration Phy 802.11g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter</td>
<td>Value</td>
</tr>
<tr>
<td>Antenna/Omni Antenna set Gt</td>
<td>1</td>
</tr>
<tr>
<td>Antenna/Omni Antenna set Gr</td>
<td>1</td>
</tr>
<tr>
<td>Phy/Wireless Phy set freq</td>
<td>2.472e9 Hz</td>
</tr>
<tr>
<td>Phy/Wireless Phy set L</td>
<td>1.0</td>
</tr>
</tbody>
</table>
5. Parameter of Simulation Evaluation

Within this paper, the next guidelines are accustomed to evaluation the cellular IP fast handoff applying sap-reg technique.

5.1. Throughput

The throughput calculates in kbps. Throughput is the rate where some type of computer or network sends or gets information. It consequently is a great way of measuring the channel capability of the communications link, and contacts towards the web are often ranked when it comes to just how many bits they move per-second (bit/s);

Throughput=[(Whole quantity of bits effectively sent during T)]/T(s)]

5.2. End-to-End-Delay

The end to end calculates in second, it describes the complete time obtained to get a packet
to be transmitted across a network from source to target. It’s an essential parameter to judge the QoS for real-time traffic.

\[
\text{Delay} = \frac{\sum_{i=0}^{N} (\text{Time of packet}[i] \text{received} - \text{Time of packet}[i] \text{sent})}{\text{Total number of packets received}}
\]

5.3. Packet Loss Rate

Packet-loss happens when a number of packages of information travelling across some type of computer network neglect to achieve their location. It’s an essential parameter influencing the efficiency of the network. Packet-loss rate is specific like a percentage of the number of packets dropped towards the complete quantity of packet delivered.

Packet-loss rate = \( \frac{\text{Quantity of fallen data packet } \times 100}{\text{Total no. Of packet data sent}} \)

5.4. Goodput

It is the application point throughput, i.e., the quantity of cooperative bits per-unit of period presented by the network from the meticulous supply address to some meticulous position, removing process expense, and eliminating retransmitted data packages.

Goodput = \( \frac{\text{Delivered packet } \times 100}{\text{Transmitted packet}} \)

5.5. Jitter

Jitter is the variation within the time taken between packets coming, brought on by network obstruction, time float, or route modifications. A jitter buffer can used to deal with jitter.

Jitter = receive packet time-delivered packet time

5.6. Bandwidth

It is typically utilized similar to a word for data-transfer rate - the amounts of information
that can be conveyed in one indicate a different in established period of time. This kind of bandwidth is generally indicated in bits (of information) per-second (bps). Periodically, it is indicated as bytes per-second (Bps). A link having a high-bandwidth is that may be able to transport enough info to maintain the sequence of pictures in a video demonstration [25-27].

6. Performance Analysis of Outcomes

We evaluate performance of UDP and TCP based on situation.

6.1. Bandwidth Results

We utilize FTP for TCP and CBR for UDP traffics. One Remote Host communicates with one cellular Sponsor. Throughout the conversation cellular sponsor transfer from HA to PA. All through this selected 30-second period of simulator, We assess the situation about the foundation of link capability (bandwidth) 1Mb, 2Mb, 3Mb, 11Mb and 30Mb. And mobile node speed set at 30 m/s. The next charts provide logical assessment of TCP and UDP at length. We assess throughput, Goodput and packet-loss rate.

![Bandwidth vs Packet Loss Rate Chart](image-url)

Fig 4.a: Evaluation of TCP and UDP w.r.t connection Capability and Packet-Loss rate having just mobile host.
6.2. Number Of Mobile Nodes

Within this simulator outcome we assess the Goodput of cellular nodes utilizing TCP and UDP. We evaluate that by growing the amount of nodes goodput of both TCP and UDP degrades. We set the hyperlinik capability at 20Mb in addition to speed at 33m/s.
7. Assessment of present NS2 component and recommended sap-reg technique

In this scenario we compare two fast handoff methods one is current ns-2 modules and other is our proposed sap-reg method. When mobile host calculate the link quality, the time taken by current ns-2 module is varies from 0ms to 4ms is greater than the time taken by the proposed sap-reg method is varies from 0ms to 3.5ms. As long as we increased the number of base station then delay does not vary rapidly but most of the time the delay remain constant nearly at 0.2ms. Finally the sap-reg method is faster than the older method.

8. Simulation Time Results

Bandwidth: This graph evaluates the bandwidth requirement for TCP and UDP. So the bandwidth requirement for TCP is much greater than the UDP. When the packet size of TCP is 1500 bytes and for UDP is 200 bytes.
Jitter vs. Simulation Time: Fig.7. (b) & (c) display the jitter variation for every packet for both TCP and UDP. Period obtained by the packet when it directs from source to destination named jitter. Within this chart jitter constantly different with increase the simulation period in case of TCP. However in situation of UDP jitter stay continuous throughout simulation interval. Therefore typical time obtained by the UDP packet is less when compared to TCP.

9. Discussion of Test Result

We evaluate numerous assessments of TCP and UDP performance in excess of wired cum wireless LAN utilizing cellular IP and recommended sip-reg technique. Various situations are described and simulated by NS2 utilizing cell nodes and base station.

Because of growing the cellular nodes the performance is degraded for both TCP and UDP since in case of TCP every MN has quantity of signalling message to accomplish the registration for communication. Hence layer2, layer3 and ACK message affects the performance of TCP. TCP has capacity for retransmission dropped packet are retransmitted as a result of this Goodput for TCP is encouraging even quantity of MNs increases and link capability change.
In case of UDP having no signaling message and reduced payload but primary element degrading the performance of Goodput isn't any retransmission of missing packet.

With only single cellular host create stimulating throughput and Goodput inform of TCP with FTP application. The performance of UDP with CBR traffic is tiny bit reduced than TCP but growing the number of mobile node can be reason for growing the throughput but reduces Goodput (packet-lose).

By growing the link capability, the performance of UDP is increase since more number of packets delivered and reduces the packet-lose. But TCP degrades performance examine to UDP. Because of growing the packet period, therefore UDP with CBR traffic provides better outcome compared to TCP with FTP traffic, when just solitary mobile node shifting. If speed of mobile node increase, subsequently packet-lose rate of each TCP and UDP increase and throughput in addition to Goodput degrade, actually then UDP execute much better than TCP.

10. Conclusion

Within this document situation we discover that TCP with FTP has better performance (Goodput) for less quantity of mobile nodes. However in situation of UDP with CBR provides better outcome (throughput) for many nodes. TCP also create stimulating leads to situation of information include file-transfer, loading of audio, webpages, etc. on internet. However it doesn’t provide stimulating performance voiceover, IP while in case of UDP, it’s discovered better in VoIP as well as growing of cellular nodes create better throughput while maximum packet-lose occur, in result the Goodput to be significantly influences if we can tolerate loss of little data in word of file transfer that UDP can also be best choice for fast delivery of data. Link capability and speed additionally influences the efficiency of both TCP and UDP.

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