Data Article

Data of vertical and horizontal handover on video transmission in Proxy Mobile IPv6

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ABSTRACT

The Internet Engineering Task Force provides a network-based mobility management solution to execute handover in heterogeneous networks on network-side called Proxy Mobile IPv6 (PMIPv6). In this data article, data are presented during the horizontal and vertical handover on video communication in PMIPv6 mobility protocols. The handover data are gathered using several measurement factors, which are latency, jitter, cumulative measured, and peak signal noise ratio under network simulation software, for both horizontal and vertical handovers [8].

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1. Data

Wireless networks and multimedia technologies have experienced significant growth in the last two decades. The use of handheld devices and obtaining services offered by the Internet has now become essential in our daily lives. Therefore, the availability of wireless networks and network quality of service (QoS) offered have become vital for mobile users. When a mobile host (MH) changes its point...
of attachment (access point, base station) to the same network or a new network, the availability of the wireless network becomes an essential consideration. The changing point of attachments will involve two types of shifting process; these are the horizontal handover and vertical handover [1]. When a MH
shift from one access point (AP) to another, such as Wi-Fi → Wi-Fi or UMTS → UMTS, the shifting process will perform a horizontal handover [1–3]. Vertical handover is performed when a MH moves from one base station (BS) to an AP or another BS technology such as UMTS → Wi-Fi, LTE → Wi-Fi [1–3]. During the process of handover, the wireless connection will be lost if a MH takes a longer time to attach the new attachment point. As a result, the performance of multimedia streaming such as video transmission, voice over IP, or file downloads will degrade [2–4,6].

This data article presents the video transmission data on horizontal and vertical handover in Proxy Mobile IPv6 (PMIPv6) [2–6]. The data are measured using average performance metrics, which are the packet latency, frame latency, cumulative jitter, cumulative measured, and peak signal noise ratio (PSNR) [7]. The data are provided with two types of handover scenarios, one involving just one MH and the other involving three MHs.

1.1. Horizontal handover data

Average performance analysis of the horizontal handover data on video transmission along the three mobility protocols of the PMIPv6 is presented in Table 1. The three mobility protocols of the PMIPv6 are PMIPv6-Prediction [8], PMIPv6-MIH [9] and IEEE802.21-enabled-PMIPv6 [10]. Fig. 1 depicts the performance metrics of average handover latency, Fig. 2 depicts the cumulative jitter, Fig. 3 depicts the cumulative measured, and Fig. 4 depicts the PSNR of a video frame during the horizontal handover of video transmissions for the three mobility protocols of the PMIPv6.

Average handover delay of the video frame determines the period after an MH sends packets from its present position to a new position. These can be from AP to AP, or from BS to AP, or from one network to another network, as long as the updated frame allows access to the respective networks.

1.2. Vertical handover data

Table 2 represents the average performance data for the vertical handover of video transmission with the three PMIPv6 mobility protocols. Fig. 5, Fig. 6, Fig. 7, and Fig. 8 show the performance metrics

| Table 1 |
| --- |
| Average data of performance metrics during horizontal handover in PMIPv6. |
| Average Performance Metrics During Horizontal Handover | Mobility Protocols of Proxy Mobile IPv6 |
| | PMIPv6-Prediction | PMIPv6-MIH | IEEE802.21-enabled-PMIPv6 |
| Frame Handover Latency (ms) | 15.153 | 15.107 | 15.107 |
| | 14.207 | 15.994 | 16.748 |
| | 14.727 | 16.474 | 17.475 |
| | 14.85 | 17.266 | 18.004 |
| | 14.936 | 17.537 | 18.351 |
| Frame Cumulative Jitter (ms) | 120.983 | 129.576 | 129.856 |
| | 272.338 | 558.64 | 558.92 |
| | 6.439 | 1270.08 | 1461.14 |
| | 137.642 | 881.215 | 1536.06 |
| Cumulative Measured (kB/s) | 48.7769 | 48.767 | 48.7689 |
| | 42.1612 | 39.9754 | 41.1685 |
| | 44.3586 | 40.6579 | 31.0779 |
| | 45.595 | 40.3813 | 31.7759 |
| | 46.8263 | 40.7358 | 31.4691 |
| | 48.2176 | 40.7358 | 31.4691 |
| Peak Signal Noise Ratio (dB) | 27.7 | 27.49 | 27.47 |
| | 26.6446 | 19.1522 | 17.0861 |
| | 28.0076 | 13.0146 | 11.0073 |
| | 26.3541 | 19.7674 | 14.2669 |
| | 29.5299 | 16.3445 | 11.4209 |
of average handover latency, cumulative jitter, cumulative measured and PSNR of video frame during vertical handover on video transmission in PMIPv6 mobility protocols. During the vertical handover on video transmission, the mobility protocols of PMIPv6-MIH and IEEE802.21-enabled-PMIPv6 have increased latency and jitter, therefore causing a degradation of video transmission performance. This is because these protocols are not designed to decide on the necessary handover conversion as they lack the essential information in the protocols.

1.3. Vertical handover data with 3 concurrent videos

Fig. 9, Fig. 10, and Fig. 11 illustrate the performance metric of average packet latency of each packet (Packet ID) during the vertical handover on video transmission in PMIPv6 mobility protocols. Table 3 represents the data for the average packet latency during the vertical handover of three video nodes in PMIPv6 mobility protocols.

2. Experimental design, materials, and methods

Experiments are conducted on video transmissions during the handover in PMIPv6 mobility protocols using network simulation software [11]. The data provided here are from two types of mobility simulation scenarios, which are horizontal and vertical handover. The simulation scenarios that resulted in the data are presented in Tables 1–3 and are illustrated in figures published by Hassan et al. [8].

The EvalVid video simulation package is utilized for the video transmission simulation, where the MPEG-coded video stream is defined as a source model for MPEG4 traffic [12,13]. The video size used is Common Intermediate Format (CIF) or H.261 which has a resolution of 352 × 288 [14]. In this simulation, a video clip is converted to the CIF format from the movie “Avengers: Age of Ultron” [8].

Three video nodes are set up with two different videos with two frame sizes, which are 640 × 360 and 512 × 288 [8]. In this simulation, three different video clips are converted to the MPEG4 format which are video node-1, video node-2 and video node-3. The videos are from “The Baby Boss”, “Transformers: Age of Extinction” and “Minions” respectively [8]. Video node-1 (MH1) is set up with 640 × 360 frame size and video node-2 and video node-3 are set up with 512 × 288 frame size. The video packet size is set up for 1024 bytes whereas the distance between consecutive packets is set at 0.001 seconds.

The process of data collection is shown in Fig. 12. The videos data are converted into YUV format to produce the packetized data for the sender. These packetized data are installed in the PMIPv6
Fig. 2. Average frame cumulative jitter during horizontal handover (Avengers-2 video clip).

Fig. 3. Average frame cumulative measured during horizontal handover (Avengers-2 video clip).

Fig. 4. Average peak signal noise ratio during horizontal handover (Avengers-2 video clip).
simulation scenarios to collect packetized data at the receiver side. Upon receiving the packetized data, handover data are collected and converted into YUV format for receiver video output.

Tables 4—6 represent the average total value of performance metrics during horizontal and vertical handovers in PMIPv6 mobility protocols. The handover performances are presented in the total value of the average frame and packet metrics (in millisecond). The metrics are handover latency and cumulative jitter. The quality of performances is presented in the total value of the average frame in kilobytes per second and decibel, for the cumulatively measures and PSNR respectively.
Fig. 6. Average frame cumulative jitter during vertical handover (Avengers-2 video clip).

Fig. 7. Average frame cumulative measured during vertical handover (Avengers-2 video clip).

Fig. 8. Average peak signal noise ratio during vertical handover (Avengers-2 video clip).
Fig. 9. Average video Node-1 packet latency during vertical handover (baby boss video clip).

Fig. 10. Average video Node-2 packet latency during vertical handover (Transformers-4 video clip).

Fig. 11. Average video Node-3 packet latency during vertical handover (minions video clip).
### Table 3
Average data of three video nodes performance metrics during vertical handover in PMIPv6.

| Average Performance Metrics During Vertical Handover | Mobility Protocols of Proxy Mobile IPv6 | PMIPv6-Prediction | PMIPv6-MIH | IEEE802.21-enabled-PMIPv6 |
|-----------------------------------------------------|----------------------------------------|-------------------|------------|--------------------------|
| Packet Handover Latency (ms)                        |                                        | 512.101           | 1012.1     | 1012.1                   |
| Video Node-1                                        |                                        | 551.112           | 1107.11    | 1299.11                  |
| Baby Boss Video Clip                                |                                        | 447.718           | 1130.07    | 1424.19                  |
| Video Size: 640 × 360                               |                                        | 432.528           | 1117.53    | 1363.53                  |
|                                                    |                                        | 322.31            | 1094.59    | 1353                     |
|                                                    |                                        | 252.749           | 1065.34    | 1283.12                  |
| Packet Handover Latency (ms)                        |                                        | 126.123           | 126.123    | 126.123                  |
| Video Node-2                                        |                                        | 404.414           | 504.414    | 504.414                  |
| Transformers-4 Video Clip                          |                                        | 539.984           | 726.949    | 826.949                  |
| Video Size: 512 × 288                               |                                        | 281.932           | 717.923    | 816.923                  |
|                                                    |                                        | 260.544           | 831.578    | 1156.38                  |
|                                                    |                                        | 177.101           | 874.879    | 1405.51                  |
| Packet Handover Latency (ms)                        |                                        | 413.108           | 413.108    | 413.108                  |
| Video Node-3                                        |                                        | 796.869           | 796.869    | 796.869                  |
| Minions Video Clip                                  |                                        | 957.29            | 1057.29    | 1257.29                  |
| Video Size: 510 × 288                               |                                        | 982.36            | 1060.36    | 1260.36                  |
|                                                    |                                        | 1170.03           | 1285.71    | 1416.34                  |
|                                                    |                                        | 476.078           | 1070.69    | 1448.11                  |

![Fig. 12. Handover data collection of simulation scenario of PMIPv6-Prediction, PMIPv6-MIH, IEEE802.21-enabled-PMIPv6.](image)

### Table 4
Average of total performance metrics during horizontal handover in PMIPv6.

| Average of Total Value of Performance Metrics During Horizontal Handover | Mobility Protocols of Proxy Mobile IPv6 | PMIPv6-Prediction | PMIPv6-MIH | IEEE802.21-enabled-PMIPv6 |
|------------------------------------------------------------------------|----------------------------------------|-------------------|------------|--------------------------|
| Frame Handover Latency (ms)                                            |                                        | 14.77             | 16.47      | 17.13                    |
| Frame Cumulative Jitter (ms)                                           |                                        | 108.66            | 751.35     | 1102.57                  |
| Cumulative Measured (kB/s)                                             |                                        | 45.21             | 41.95      | 35.77                    |
| Peak Signal Noise Ratio (dB)                                           |                                        | 27.68             | 19.15      | 16.25                    |
Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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