International Journal of
Smart Technologies for Public Health and Aquatic Systems
Vol. 2 No. 1. June 2026, pp. 19-24

Research Article

Weekday-Holiday Quality of Service Asymmetry in A Government Wlan: A Tiphon-Based Evaluation

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Article Info
Recieved: 10/04/2026
Revised: 18/05/2026
Accepted:20/06/2026
Online: 30/06/2026

Abstract
Government institutions increasingly depend on Wireless Local Area Networks (WLAN) to deliver digital public services, yet network quality is commonly assumed to recover automatically once user traffic declines. This study examines that assumption by evaluating the Quality of Service (QoS) of the WLAN at the Office of Communication and Informatics (Diskominfo) of Palopo City under two contrasting temporal loads, namely weekdays and holidays. Packet captures were collected with Wireshark at two access points served by different providers while users performed video conferencing, video streaming, and cloud file transfer, and four parameters throughput, packet loss, delay, and jitter were computed and indexed against the TIPHON standard. The results reveal a pronounced weekday–holiday asymmetry: packet loss improved to 0% on holidays, whereas throughput collapsed from 3,432 bps to 552.7 bps and from 11,285 bps to 3.43 bps, and delay and jitter remained in the Poor category in both periods. The novelty of this study lies in demonstrating that reduced traffic load does not restore QoS in a government WLAN, indicating that the dominant bottleneck resides in network configuration and infrastructure rather than user congestion. This finding implies that QoS remediation should prioritize traffic-prioritization policies, configuration audits, and continuous monitoring over capacity expansion alone.

Keywords: Quality of Service; TIPHON; Weekday–Holiday Asymmetry; WLAN; Wireshark

INTRODUCTION

The digital transformation of local government places the Wireless Local Area Network (WLAN) at the center of public service delivery. As the institution responsible for implementing e-government in its region, the Office of Communication and Informatics (Diskominfo) of Palopo City relies on WLAN connectivity for inter-division communication, data management, video conferencing, and cloud-based document exchange. In such an environment, the performance of the wireless network is no longer a purely technical concern; it is a direct determinant of the quality of services experienced by civil servants and, ultimately, by the public they serve (Lestari, 2019).

Quality of Service (QoS) provides the established analytical framework for assessing whether a network meets these demands. QoS is conventionally measured through four principal parameters throughput, packet loss, delay, and jitter each of which captures a different dimension of transmission quality, from effective data rate to the temporal stability required by real-time applications (Simargolang & Widarma, 2022; Ardhana & Mulyodiputro, 2023). The TIPHON standard issued by ETSI (1999) translates these parameters into categorical indices, allowing measured values to be classified from Poor to Very Good and thereby enabling objective comparison across networks and observation periods.

A substantial body of Indonesian and international research has applied this framework to institutional WLANs. Saputra et al. (2023) classified the WLAN of a private company as Moderate under TIPHON, Suroso et al. (2023) reported a Good rating for a state utility network, and Utami (2020) compared QoS across two commercial internet service providers, while Zawawi et al. (2023) approached QoS improvement from the perspective of rate adaptation in IEEE 802.11ax. A common thread runs through these studies: network degradation is implicitly or explicitly attributed to traffic load, so that periods of low utilization are expected to yield correspondingly better service quality. Congestion, interference, and user density are indeed well-documented causes of WLAN degradation (Hendrawan & Suryadi, 2021), and this expectation is therefore reasonable as a first approximation.

What remains largely unexamined, however, is whether the expectation actually holds when the same network is measured under deliberately contrasted temporal loads. If QoS recovers when traffic subsides, degradation can safely be ascribed to congestion and remedied by capacity expansion. If, on the contrary, critical parameters remain poor even when the network is lightly loaded, the dominant bottleneck must lie elsewhere in device configuration, queue management, or infrastructure design and additional bandwidth alone will not solve the problem. Distinguishing between these two diagnoses has direct budgetary consequences for government institutions, yet the weekday–holiday comparison needed to make the distinction is rarely the analytical focus of existing QoS studies.

This study addresses that gap by measuring and comparing the QoS of the Diskominfo Palopo WLAN on weekdays and holidays at two access points served by two different providers, using Wireshark-based packet capture and the TIPHON classification. The specific novelty pursued in this article is the identification and interpretation of a weekday–holiday QoS asymmetry: the systematic pattern in which some parameters improve while others stagnate or deteriorate when traffic load falls. By isolating this asymmetry, the study aims to determine whether the observed degradation is load-driven or configuration-driven, and to derive remediation priorities that follow logically from that diagnosis.

RESEARCH METHOD

This research employed a quantitative descriptive approach combined with direct field measurement, following the measurement-and-evaluation cycle commonly used in institutional QoS studies (Saputra et al., 2023; Suroso et al., 2023). The design deliberately contrasts two temporal conditions weekdays, representing full operational load, and holidays, representing minimal load so that the response of each QoS parameter to the change in load can be observed on the same physical network.

Time and Place of Research

The measurements were conducted at the Office of Communication and Informatics of Palopo City, Jalan Andi Baso Rachim No. 02, Palopo, South Sulawesi, Indonesia, between March and April 2025. Data were collected on working days and holidays in two daily sessions: morning (09.00–10.30 and 11.00-12.00 WITA) and afternoon (13.00–14.30 and 15.00–16.00 WITA).

Research Object

The objects of measurement were two operational access points representing the two internet providers serving the office: the Command Center access point (Provider Y, Mikrotik CCR1016-12G router with FiberHome AN5506-04-FS access point) and the E-Government access point (Provider Z, UniFi Dream Machine Pro router with the same access point model). The client terminal was an ASUS M515DA laptop with Wi-Fi 5 (802.11ac) capability. The workload during capture reproduced the office's actual usage profile: video conferencing via Zoom, video streaming via YouTube, and file upload/download via Google Drive (Angelina & Rahadi, 2020; Faiqah et al., 2016; Purnama Sari et al., 2022).

Instruments and Data Collection Techniques

Packet-level data were captured using Wireshark, a network protocol analyzer that records every packet traversing the monitored interface in real time (Kurniawan, 2012). For each session, capture was started before the application workload commenced and stopped after the observation window elapsed; the packet summaries were then exported to CSV for computation. As supporting data, link capacity was measured with the Speedtest application to obtain the nominal bandwidth available at the site.

Data Analysis Technique

Four QoS parameters were computed from the capture statistics. Throughput was obtained as the ratio of total received data to observation time; packet loss as the percentage of transmitted packets that failed to arrive; delay as total delay divided by total packets; and jitter as total delay variation divided by total received packets. Each value was then mapped to the TIPHON categorical index (ETSI, 1999), in which 4 denotes Very Good, 3 Good, 2 Moderate, and 1 Poor, and the per-access-point QoS index was calculated as the arithmetic mean of the four parameter indices. The weekday and holiday indices of the same access point were finally compared to characterize the temporal asymmetry that constitutes the analytical focus of this study.

RESULTS AND DISCUSSION

The TIPHON standard used as the evaluation benchmark is summarized in Table 1. All measured values in the subsequent tables are interpreted against these categories.

Table 1. TIPHON QoS Category and Index (ETSI, 1999)

Category	Percentage (%)	Index
Poor	25 – 49.75	1 – 1.99
Moderate	50 – 74.75	2 – 2.99
Good	75 – 94.75	3 – 3.79
Very Good	95 – 100	3.8 – 4

Table 2 presents the measured QoS values at the Command Center access point (Provider Y) for the two temporal conditions. Throughput on weekdays reached 3,432 bps, classified as Very Good, but fell sharply to 552.7 bps on holidays. Packet loss moved in the opposite direction, improving from 1.39% (14 of 1,004 packets) on weekdays to 0% on holidays. Delay and jitter, by contrast, remained far above the TIPHON thresholds in both periods.

Table 2. QoS Parameter Values at the Command Center Access Point (Provider Y)

Parameter	Weekday	Holiday
Throughput	3,432 bps	552.7 bps
Packet loss	1.39% (14 packets)	0%
Delay	1,284 ms	10,061 ms
Jitter	388.311 ms	10.357 ms

Table 3 presents the corresponding results for the E-Government access point (Provider Z). The same asymmetric pattern appears in a more extreme form: weekday throughput of 11,285 bps the highest value recorded in this study collapsed to 3.43 bps on holidays, while packet loss remained excellent in both periods (0.09% and 0%). Delay and jitter were again persistently poor, with weekday delay of 28,269 ms and jitter of 584.4 ms.

Table 3. QoS Parameter Values at the E-Government Access Point (Provider Z)

Parameter	Weekday	Holiday
Throughput	11,285 bps	3.43 bps
Packet loss	0.09% (1 packet)	0%
Delay	28,269 ms	584.7 ms
Jitter	584.4 ms	6,330 ms

Table 4 aggregates the parameter indices into the composite TIPHON QoS index for each access point and period. The Command Center index rose from 2.25 (Moderate) on weekdays to 3.25 (Good) on holidays, whereas the E-Government index moved in the opposite direction, from 2.5 (Moderate) to 1.75 (Poor). The composite indices thus confirm that lower load does not translate uniformly into better service.

Table 4. Composite QoS Index by Access Point and Period

Parameter	CC Weekday	CC Holiday	E-Gov Weekday	E-Gov Holiday
Throughput	4	4	4	1
Packet loss	3	4	4	4
Delay	1	1	1	1
Jitter	1	4	1	1
Mean index	2.25 (Moderate)	3.25 (Good)	2.5 (Moderate)	1.75 (Poor)

The central empirical finding of this study is the weekday-holiday asymmetry visible across Tables 2–4: when traffic load fell, packet loss recovered completely, throughput deteriorated drastically, and delay and jitter remained in the Poor category throughout. This pattern is analytically decisive because each parameter responds to a different underlying mechanism. Packet loss is the parameter most directly governed by congestion buffer overflow and collisions occur when traffic exceeds capacity so its complete recovery on holidays confirms that congestion was indeed present on weekdays and disappeared with the users (Hendrawan & Suryadi, 2021). Had congestion been the sole cause of degradation, delay and jitter should have recovered in tandem. They did not.

The persistence of Poor delay and jitter under near-idle conditions therefore points to a bottleneck that is independent of load. Delay that remains orders of magnitude above the 450 ms TIPHON threshold, and jitter that stays above 126 ms even when almost no competing traffic exists, are signatures of structural factors: suboptimal queue management and buffer sizing on the routers, the absence of traffic-prioritization mechanisms such as DiffServ, legacy access-point hardware operating below the capability of the client devices, and possible radio-frequency interference in the office environment (Duman, 2022; Zawawi et al., 2023). The Speedtest measurement reinforces this diagnosis: the site's nominal bandwidth of 10.61 Mbps download and 10.68 Mbps upload is far above the actual throughput recorded by Wireshark, demonstrating that raw capacity is available but is not being converted into delivered performance.

The throughput collapse on holidays deserves its own interpretation. Because throughput measures delivered traffic rather than available capacity, part of the decline simply reflects the absence of demand on holidays. However, the magnitude of the drop at the E-Government access point from 11,285 bps to 3.43 bps, pushing the composite index into the Poor category exceeds what demand reduction alone can explain, and suggests that the network fails to sustain even light sessions efficiently outside working hours, possibly due to provider-side policies or unmanaged idle-state behavior of the equipment.

Placed against prior work, this result reframes the conventional reading of institutional QoS studies. Saputra et al. (2023) and Suroso et al. (2023) reported single composite ratings Moderate and Good respectively without isolating the temporal dimension, and Utami (2020) attributed inter-provider differences primarily to capacity. The present study shows that a composite rating measured in one period can mask a diagnosis that only becomes visible when the same network is observed under contrasted loads: here, two access points with similar Moderate weekday ratings diverged sharply on holidays, in opposite directions. The asymmetry, not the rating, carries the diagnostic information.

The novelty of this research, accordingly, is the empirical demonstration that reduced traffic load does not restore QoS in the government WLAN under study, and the use of that asymmetry as a diagnostic instrument to separate load-driven from configuration-driven degradation. The practical implication follows directly: remediation at Diskominfo Palopo should prioritize, in order, (1) implementation and tuning of QoS traffic prioritization (e.g., DiffServ) for latency-sensitive applications; (2) a configuration audit covering buffer sizes and queue management on routers and access points; (3) modernization of legacy access-point hardware; and (4) continuous real-time monitoring so that degradation is detected before it reaches users. Bandwidth expansion, the default remedy implied by congestion-centric readings, is relegated to a supporting role, since the evidence shows that capacity is not the binding constraint.

CONCLUSION

This study evaluated the Quality of Service of the WLAN at the Office of Communication and Informatics of Palopo City under contrasting weekday and holiday loads, using Wireshark-based measurement and the TIPHON standard at two access points served by different providers. The measurements revealed a consistent weekday-holiday asymmetry: packet loss recovered to 0% on holidays, throughput fell from 3,432 bps to 552.7 bps (Provider Y) and from 11,285 bps to 3.43 bps (Provider Z), and delay and jitter remained in the Poor category in both periods, leaving composite indices of 2.25 versus 3.25 at the Command Center and 2.5 versus 1.75 at the E-Government access point. The asymmetry demonstrates that the dominant cause of degradation in this network is not user congestion but configuration- and infrastructure-level deficiencies, since the parameters most sensitive to structural factors failed to improve when the load was removed. Consequently, remediation should prioritize traffic-prioritization policies, configuration audits, hardware modernization, and continuous monitoring rather than capacity expansion alone. Future research is recommended to extend the temporal comparison across longer observation windows, to benchmark the results against additional QoS standards beyond TIPHON, and to employ multiple measurement tools so that the diagnostic value of load-contrast analysis can be validated in other institutional networks.

ACKNOWLEDGMENTS

The authors express their gratitude to the Office of Communication and Informatics of Palopo City for granting research access and field assistance during data collection, and to the Department of Electrical Engineering, Politeknik Negeri Ujung Pandang, for institutional support.

AUTHOR CONTRIBUTIONS

Conceptualization, S.M., U.K, and R.K.A.S.; Methodology, S.M. and R.K.A.S; Investigation, S.M., U.K, and R.K.A.S.; Data Curation, U.K.; Formal Analysis, R.K.A.S.; Writing-Original Draft Preparation, S.M.; Writing Review & Editing, S.M., U.K, and R.K.A.S.; Supervision, S.M. All authors have read and agreed to the published version of the manuscript.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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