
PERFORMANCE ANALYSIS OF DUAL-ISP FAILOVER USING STATIC FLOATING ROUTES BASED ON QoS

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ABSTRACT (10pt, Times New Roman)

The availability of an Internet connection is an important factor in supporting a company's operational activities. Dependence on a single Internet connection can disrupt network connectivity when the primary ISP experiences a failure. This study aims to analyze the performance of the Dual ISP failover mechanism using Static Floating Route on the WAN network of PT Sinergi Halal Indonesia. The methods used in this study include observation, literature review, network design, implementation, and testing. The network is designed using two ISPs, namely ISP 1 as the primary connection and ISP 2 as the backup connection. The failover mechanism is implemented using static routes with different Administrative Distance values, allowing the backup route to be used when the primary connection experiences a failure. Network performance is analyzed based on Quality of Service (QoS) parameters, including throughput, delay, jitter, and packet loss, as well as the route switching time (failover time). The test results are expected to demonstrate the ability of the Static Floating Route mechanism to maintain network connectivity and provide an overview of network service quality before and after the implementation of Dual ISP. The implementation of this mechanism is expected to improve the availability and continuity of Internet connectivity within the company's network.

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INTRODUCTION

Internet connectivity is an operational dependency for organizations that use cloud services, electronic correspondence, data exchange, and web-based administration. A disruption on the active Internet Service Provider (ISP) path can interrupt those activities when no alternative route is available. Dual-ISP designs reduce this single-path dependency by providing a second connection that can carry traffic when the preferred path is no longer usable. The effectiveness of this arrangement depends not only on the presence of two links, but also on route preference, failure detection, and verification that the backup path can reach the intended destination (Alifi & Ichsan,

2026; Darajat & Nurhaida, 2019; Mhrez & Ahmed, 2025).

Static Floating Route is a simple approach to primary-backup routing. A primary static route is installed with a lower Administrative Distance (AD), while a backup static route uses a higher AD and is selected when the preferred route is removed from the routing table. However, AD alone does not detect every upstream outage: if the local interface remains up while a remote destination is unreachable, additional reachability tracking may be needed. Research on dual-WAN routing, fast reroute, and SD-WAN also shows that failover methods vary in their detection

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mechanisms, route-selection logic, and recovery objectives (Alifi & Ichsan, 2026; Barkalov, Lemeshko, Persikov, Yermenko, & Titarenko, 2024; Dudczyk, Sergiel, & Krygier, 2025; Ibrahim, Khider, Edam, & Mukhtar, 2025; Papan, Segec, & Kvet, 2021; Rostami & Goli-Bidgoli, 2024; Wang, Bewong, & Zheng, 2024).

Quality of Service (QoS) is used to evaluate network behavior from the perspective of delay, packet delivery, variation in packet delay, and effective data transfer. Prior studies apply throughput, delay, jitter, and packet loss in different settings, including LTE, WLAN, video conferencing, campuses, enterprise offices, and public networks (Farizi, Karna, & Bisono, 2021; Guntoro, Sadar, & Syafitri, 2020; Hakim, Tjahjmoonisih, & Suryadi, 2021; Kautsar, Laksono, & Apriyanto, 2022; Marza, 2022; Nafea, Aboelezz, & Zaki, 2021; Rosid, Martanto, & Ali, 2023; Saleh, Tjahyaningtijas, Nurhayati, & Rakhmawati, 2022; Sula, Michael, & Rusman, 2021). Recent studies also apply TIPHON-based QoS assessment in WLAN, fiber-internet, education, provider, and public-area contexts (Ardiansyah & Yulian Pamuji, 2025; Hidayat, Oktaviana, & Kuncoro, 2024; Mochammad et al., 2025; Sanjaya, Syamdova, Farhan, & Laksana, 2025; Syafrudin, Rianto, Ujianto, Informasi, & Yogyakarta, 2025; Taufiqurrochman et al., 2025; Ulumuddin et al., 2025; Wahyudi, Mujiono, & Fu'ad, 2024). These studies support using a repeatable measurement procedure, but results from other networks cannot be substituted for measurements on the network evaluated here.

The source thesis identifies PT Sinergi Halal Indonesia as the study context and proposes a Cisco Packet Tracer simulation with ISP 1 as the primary path and ISP 2 as the backup. Network-design studies using simulation and staged development provide a suitable methodological basis for such a proposed topology (Adrian & Cahyana, n.d.; Riki Setiawan, M. Ficky Duskarnaen, & Hamidillah Ajie, 2024). The specific research question is whether the documented Static Floating Route design can provide a verifiable primary-to-backup route transition and whether the available evidence is sufficient to quantify QoS before and after failover.

The contribution of this article is to consolidate the proposed topology, routing rationale, test scenarios, and QoS measurement definitions into a journal-format evaluation framework. A key distinction is maintained between a configured mechanism and a measured performance result. The thesis reports configuration steps and route-switching test procedures; however, its recorded ping output includes "Destination host unreachable," and it does not provide a complete table of numerical QoS measurements or failover/failback times. Accordingly, this article reports the evidence that is present and

explicitly identifies the measurements that remain necessary, rather than asserting unverified improvements.

RESEARCH METHOD

This study uses a descriptive network-design and simulation approach. It combines (1) review of the network problem and related literature, (2) design of a dual-ISP topology, (3) configuration of route preference, (4) testing under normal and failure states, and (5) analysis of connectivity and QoS evidence. The sequence follows a structured network development process used in other simulated network-design studies (Adrian & Cahyana, n.d.; Riki Setiawan et al., 2024).

The study materials consist of the thesis narrative, the proposed Cisco Packet Tracer topology, configuration screenshots and descriptions, and the reported command-line observations. The source describes Cisco routers representing the primary ISP, backup ISP, main router, and simulated Internet endpoint; a switch and two client PCs are placed on the user side. Wireshark and iPerf3 are mentioned in the thesis only as optional tools for a separate host-based or live-network measurement. They are not treated as tools already used to produce the reported values in this article.

The proposed topology contains six logical device roles: R1-UTAMA, R2-ISP1-PRIMARY, R3-ISP2-BACKUP, R4-INTERNET, a switch, and two client PCs. R1-UTAMA is the route-selection point. R2 represents the preferred ISP path; R3 represents the alternate ISP path. R4-INTERNET represents the destination network in the simulation and uses a Loopback test address of 8.8.8.8 in the source configuration.

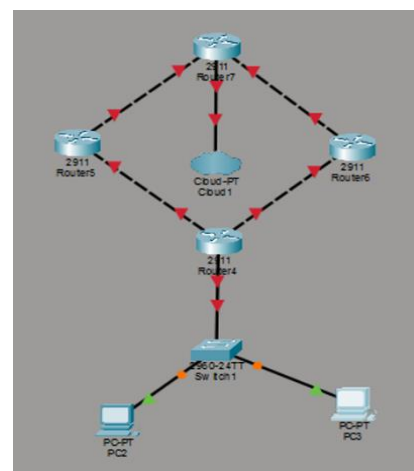


Figure 1. Proposed dual-ISP failover topology in Cisco Packet Tracer

A PT Cloud icon is used as part of the simulated provider/Internet path. The diagram is a proposed simulation, not a claim that the company's private production topology has exactly these devices.

Figure 1 shows the proposed test topology. The route-priority concept uses a lower AD for the primary route and a higher AD for the backup route. The thesis gives the example of AD 1 for ISP 1 and AD 10 for ISP 2. In generic form, the primary default route points to the ISP 1 next hop, while the floating route points to the ISP 2 next hop with a higher AD.

The source thesis describes a baseline test, primary-link failure, failover to ISP 2, and failback to ISP 1 after the primary path returns. The same test sequence is required to compare the network states consistently. Each test should record the timestamp of the induced failure or restoration, the route table, the path observed by traceroute where supported, and a repeated ping result to the same destination. Route changes should be checked with the routing table and track state rather than inferred from a command being entered. The proposed scenarios are listed in Table 1.

Table 1. Test scenarios and evidence to be recorded

Scenario	Action	Evidence to record
S1. Normal	Keep ISP 1 and ISP 2 available.	Successful baseline ping, selected default route, RTT samples, packet count.
S2. Primary failure	Disconnect or shut down the ISP 1 path in the simulation.	Failure time, route-table change, any ping loss, and the time the ISP 2 route becomes active.
S3. Backup active	Keep ISP 1 unavailable and test destination reachability.	Ping success/failure, selected route and path, QoS samples under the backup path.
S4. Primary recovery	Restore the ISP 1 path and wait for route selection to update.	Track state, selected route, time until primary is selected again, and ping continuity.

To produce defensible results, each state should be measured using the same destination, packet size, traffic rate, and test duration. A single ping run can reveal reachability but is not sufficient to characterize jitter or throughput precisely. For repeatability, the experimental record should state the number of packets sent, packet size, interval, simulated interface/link status, and whether the same traffic conditions were used before and after failover.

The parameters selected are throughput, delay, jitter, and packet loss. Failover time and failback time are used as additional route-recovery indicators. The formulas in Table 2 define the calculations to be applied once the raw results are available.

Table 2. QoS and route-recovery metrics

Metric	Calculation	Interpretation
Throughput	Received data (bits) / measurement duration (s)	Effective delivery rate; higher is generally better.
Average delay	Σ packet delay / number of received packets.	Mean packet transit time; lower is generally better..
Jitter	$\Sigma D_i - D_{i-1} / (N - 1)$	Mean absolute difference between consecutive packet delays; lower is generally better.
Packet loss (%)	$(\text{Sent} - \text{received}) / \text{sent} \times 100\%$.	Share of packets that did not arrive; lower is better
Failover time	$t(\text{backup route active}) - t(\text{primary failure})$	Time from induced primary failure to verified backup-path activation.
Failback time	$t(\text{primary route active}) - t(\text{primary restored})$	Time from primary-path restoration to verified primary-route selection

For throughput, the data volume must be observed at the receiver and the measurement interval must be known; a ping-only test does not provide a representative bulk-transfer throughput value. Delay can be summarized from repeated round-trip times when only ICMP testing is available, but that result should be labelled RTT-based latency rather than one-way packet delay. Jitter requires a sequence of packet-delay samples. Packet loss is calculated from the difference between sent and received packets.

RESULTS AND DISCUSSION

A. Documented topology and configuration evidence

The submitted thesis documents a proposed

dual-ISP topology and assigns separate roles to the four routers. Its configuration narrative states that R1-UTAMA is assigned a hostname, the ISP router interfaces are activated, and R4-INTERNET is configured with Loopback0 as 8.8.8.8/32 for reachability testing. The thesis also includes a route-selection stage labelled Static Floating Route and describes the primary route as having lower AD than the backup route. These records are consistent with the intended primary-backup design and establish the configuration sequence used in the simulation.

The thesis further describes a QoS policy-map using a traffic class and a bandwidth percentage. However, this article does not attribute measured QoS changes to that policy-map because the submitted material does not contain a complete before-and-after numerical dataset. The research question here centres on failover using Static Floating Route; QoS is treated as the evaluation framework, rather than assuming that a QoS policy has been proven to improve the selected parameters. This separation is important because route availability and traffic scheduling are different functions: route preference selects the path, whereas a QoS policy may influence treatment of traffic on a congested link.

B. Observed connectivity-test limitation

The strongest explicitly described test output in the thesis is a ping attempt to 8.8.8.8 with 20 requests that returned “Reply from 10.20.20.1: Destination host unreachable.” This output is evidence that the intended destination was not reachable from that test path at the time of the recorded run. It should not be interpreted as zero packet loss or a successful baseline. Before a comparative QoS experiment, the cause must be identified by checking the client default gateway, interface addressing, connected routes, default route next hop, return route, and the status of the simulated ISP path. A successful baseline to the destination is necessary before fault injection so that the failure condition and recovery can be distinguished from a pre-existing routing problem.

The thesis text labels later steps as failover and failback tests and states that traffic switches to ISP 2 and returns to ISP 1. Those descriptions indicate the intended test procedure. Nevertheless, the available narrative does not report a complete sequence of successful ping replies and timestamps linked to each route-table state. Consequently, the procedure can be documented, but the evidence is not enough to calculate failover time, failback time, or the percentage of packets lost during a defined transition window. A reliable conclusion about automatic recovery requires a synchronized timeline showing (1) when ISP 1 is failed or restored, (2) when the active default route changes, and (3) when the destination becomes reachable or reachable again. This is consistent with network-resilience research that evaluates recovery latency and transient packet loss as separate observations rather than inferring them from

configuration alone (Alifi & Ichsan, 2026; Mhrez & Ahmed, 2025; Papan et al., 2021).

C. QoS results that can and cannot be stated

No numerical throughput, mean delay, jitter, packet-loss percentage, failover time, or failback time is reported in the supplied thesis in a form that permits recalculation and comparison. The packet-loss screenshot description reports “Destination host unreachable,” but does not give the complete sent/received summary needed to compute a percentage. The delay figure is described qualitatively, without raw RTT values or an average. Throughput and jitter are discussed as parameters, but no raw samples, duration, or calculated values are provided. Therefore, Table 3 separates source-backed observations from the measurements that remain unreported.

Table 3. Status of evidence available in the submitted thesis

Indicator	Evidence available in source	Result status
Topolog y/configu ration	Four routers, a switch, two client PCs; primary and backup roles are defined.	Documented at design level.
Basic connecti vity	A ping test to 8.8.8.8 is described; output includes “Destination host unreachable.”	Destination reachability was not verified for this recorded test.
Route failover/f ailback	The source describes route-switching commands and the intended sequence.	Procedural description exists; full timestamped route and ping log is not reported.
Through put and jitter	No raw traffic capture or numeric calculation is included in the text available for this article.	Cannot classify or compare.
Delay and packet loss	Delay is discussed qualitatively; the ping failure is mentioned without a complete sent/received summary	Cannot calculate a reliable mean or loss percentage.
Failover/ failback time	No measured time values are stated.	Cannot calculate or compare.

This evidence status does not mean the proposed mechanism cannot work. It means the submitted record is not yet sufficient to demonstrate quantitative performance improvement. QoS studies show the value of publishing raw measurement conditions and metric values, because categorical

ratings depend on the underlying sample and chosen standard (Guntoro et al., 2020; Kautsar et al., 2022; Marza, 2022; Nafea et al., 2021; Rosid et al., 2023; Saleh et al., 2022; Sula et al., 2021) . More recent TIPHON-oriented evaluations likewise report numeric parameter values before assigning a service category (Wahyudi et al., 2024; Syafrudin et al., 2025; Hidayat et al., 2024; Ardiansyah & Pamuji, 2025).

D. Implications for a valid before-and-after comparison

The proposed design can be evaluated without exposing confidential details of the production network. The topology in Figure 2 is a controlled simulation and uses abstract ISP labels; the IP address 8.8.8.8 is used as a simulated test endpoint in the source thesis and should not be interpreted as proof of access to the public Internet from Packet Tracer. In the final test record, the exact simulated addressing, route table, and link-failure action should be preserved as an appendix or table. If Cisco Packet Tracer does not provide the required traffic measurements, it is necessary to use a separate measured environment with a stated capture point and tool, rather than presenting unsupported values as Packet Tracer results.

A valid comparison should use matched test conditions and report raw inputs alongside summaries. For each state, record multiple ping runs or packet samples; calculate throughput, delay, jitter, and packet loss from the applicable raw data; then measure failover/failback intervals from the route-state timeline. The QoS thresholds should be applied after the metrics are calculated and not used to replace raw values. This approach aligns with measurement practice in QoS studies and standards-based evaluation (ETSI, 2003; Demichelis & Chimento, 2002). It also preserves the distinction between the route-recovery mechanism and network-quality metrics used to evaluate its behavior.

CONCLUSION

This article organizes the proposed Dual ISP Failover design for PT Sinergi Halal Indonesia into the Infotech journal structure. The Cisco Packet Tracer topology assigns ISP 1 as the preferred route and ISP 2 as the backup, with route preference determined by different Administrative Distance values. The design and test narrative cover baseline connectivity, primary-path failure, failover, and failback. These elements provide a framework for examining the operation of Static Floating Route in a controlled simulation.

The submitted test evidence is not yet sufficient to conclude that QoS improved after implementation. The recorded ping attempt includes “Destination host unreachable,” while numerical QoS values and measured failover/failback times are absent. The immediate next step is to establish a successful baseline, verify route and reachability tracking, and repeat the tests while recording route state, ping

success, raw QoS samples, and transition timestamps. Once those data exist, the before-and-after comparison can report reproducible calculations and appropriate TIPHON classifications without relying on assumptions.

Future work can compare repeated failover trials under different traffic loads and evaluate whether the backup path remains reachable when only upstream connectivity fails. It may also compare the Static Floating Route design with alternative network-recovery approaches, provided that the device capabilities and test conditions are documented consistently.

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