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Phising Detection System Through Hybird Machine Learning Basing On Url

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Abstract: This research presents an advanced system that integrates Multipath TCP (MPTCP) with cognitive radio technology to dynamically optimize network performance in environments with fluctuating conditions, such as variable bandwidth, latency, and reliability. Traditional MPTCP, although it allows data transmission across multiple paths, struggles under dynamic network states. The proposed system overcomes these challenges by leveraging cognitive radio's adaptive spectrum management,which continuously evaluates metrics like bandwidth availability, latency, and signal quality to identify optimal paths in real time. Machine learning algorithms further enhance adaptability by analyzing historical data to predict the most efficient paths, proactively routing traffic to avoid congestion and maximize network efficiency.

I. INTRODUCTION

The rapid evolution of digital communication has exposed the limitations of traditional Transmission Control Protocol (TCP), which relies on single-path data transmission. This conventional approach often results in performance bottlenecks, particularly in dynamic and heterogeneous network environments. To address these issues, Multipath TCP (MPTCP) has emerged as an innovative extension. Unlike TCP, which uses a single path for data transmission, MPTCP enables simultaneous data transfer over multiple paths, utilizing various network interfaces like Wi-Fi and cellular connections. This capability enhances network efficiency, improves reliability, and optimizes resource utilization, making it a promising solution for modern communication needs.

However, despite its numerous advantages, MPTCP faces significant challenges in specific scenarios. Latency issues, for instance, can severely affect real-time applications, compromising their performance. Additionally, external disruptions in the signal can degrade overall efficiency, while bandwidth fluctuations may lead to interruptions or poor service quality. Addressing these challenges is essential to fully harness the potential of MPTCP and ensure its effective deployment in diverse and demanding network environments.

Literature Survey

S. Jiang, A. Patel, and Y. Lin (2024): This study explores the integration of dynamic spectrum access and multipath control to improve TCP performance in cognitive networks. By allowing adaptive spectrum allocation and multipath data transmission, the research demonstrates enhanced efficiency in managing network resources.[1]

A. Mohamed, S. Ahmed, and R. Gupta (2023): This paper introduces a spectrum- aware MPTCP tailored for cognitive radio networks. The proposed approach dynamically adjusts path usage based on spectrum availability, ensuring optimal data transmission even in constrained environments.[2]

L. Zhang, W. Xie, and Y. Liu (2023): This research emphasizes the role of AI in MPTCP for cognitive radio networks. The AI-driven framework intelligently manages multipath transmissions by predicting network conditions, thereby improving performance and reliability.[3]

J. Xu, H. Chen, and T. Zhao (2023): This paper focuses on cognitive radio-driven MPTCP for vehicular networks. The proposed solution optimizes data transmission by leveraging cognitive radio technologies to adapt to the highly dynamic vehicular environment.[4]

Y. Wang, Z. Li, and Q. Sun (2022): The authors propose a dynamic path selection mechanism for MPTCP in spectrum- constrained networks. This approach enhances MPTCP's adaptability to changing spectrum availability, reducing disruptions in data flow.[5]

Duplicate Entry of Reference 5: This is a repeated citation of the same work by Y. Wang et al. (2022) on dynamic path selection for MPTCP in spectrum-constrained networks.[6]

T. Chen, R. Liu, and W. Yang (2021): This research optimizes dynamic spectrum access for MPTCP in cognitive radio networks. The proposed solution balances spectrum usage and improves throughput by dynamically reallocating resources.[7]

K. Brown, S. Johnson, and M. Davis (2021): This paper discusses a machine learning-based adaptive MPTCP framework for cognitive networks. By using machine learning, the system dynamically adjusts to network changes, enhancing efficiency and robustness.[8]

S. Park, H. Kim, and J. Lee (2020): This study presents a cross-layer MPTCP design for software-defined networking (SDN)-based cognitive radio networks. The integration of SDN simplifies network management, while cross-layer design ensures efficient resource utilization.[9]

R. Singh, A. Kumar, and V. Yadav (2020): This research focuses on load-balancing techniques for MPTCP in dynamic cognitive radio networks. The proposed approaches distribute traffic across multiple paths, optimizing network performance and minimizing congestion.[10]

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II. EXISYING SYSTEM

The Transmission Control Protocol (TCP) has been the cornerstone of internet communication, providing essential features such as error-checking, ordered delivery, and congestion control. Its robust design ensures reliable data transfer over networks, making it indispensable for most applications. However, TCP's reliance on a single network path restricts its ability to fully utilize the bandwidth available across multiple interfaces, such as Wi-Fi, LTE, and Ethernet. This limitation is especially pronounced in today's heterogeneous and high-demand network environments, where diverse connectivity options coexist.

To address this limitation, Multipath TCP (MPTCP) was introduced as an extension of TCP. MPTCP allows data to be transmitted over multiple network paths simultaneously, significantly improving throughput, fault tolerance, and load balancing. For instance, a smartphone connected to both Wi-Fi and 4G networks can utilize MPTCP to transmit data across both paths concurrently, resulting in faster and more reliable connections. This capability is particularly advantageous in scenarios requiring high- speed data transfer or uninterrupted connectivity, such as video streaming, cloud computing, and real-time applications.

Another significant limitation of current MPTCP implementations is their reliance on static or pre-configured path selection algorithms, which lack the ability to adapt to real-time network changes. This rigidity results in inefficient utilization of network resources and suboptimal performance. For example, when network conditions change rapidly, such as during handoffs between cellular towers or the transition from one Wi- Fi network to another, static algorithms fail to optimize path usage, leading to packet loss, jitter, or degraded service quality.

Furthermore, existing MPTCP solutions often do not incorporate advanced network monitoring or adaptive decision-making mechanisms, making them less effective in handling complex and dynamic scenarios. The lack of real-time optimization and predictive capabilities prevents MPTCP from achieving its full potential in scenarios that demand high reliability, low latency, and seamless connectivity.

As network environments continue to evolve with increasing complexity, the need for more intelligent, adaptive, and robust solutions for MPTCP becomes evident. Future advancements should focus on integrating machine learning, cognitive radio technologies, and real-time analytics to enhance path selection, optimize resource allocation, and improve resilience against network disruptions. These improvements would enable MPTCP to fully realize its promise of delivering superior performance in modern, heterogeneous communication systems

Existing System Disadvantages

- Single-path Limitations: TCP restricts bandwidth utilization to a single path.
- Inefficient Adaptation to Network Changes: Static MPTCP algorithms fail to adjust to real- time network fluctuations.
- Limited Throughput and Reliability: Performance suffers in unstable or congested environments.
- Performance Issues with High Traffic: Static algorithms cannot handle high traffic efficiently, leading to poor service quality.
- Lack of Real-time Path Optimization: Existing MPTCP systems do not dynamically optimize paths based on changing network conditions.

III.PROPOSED SYSTEM

The proposed system integrates Multipath TCP (MPTCP) with cognitive radio (CR) technology to create a dynamic and adaptive solution for network optimization in fluctuating environments. While MPTCP enables multi- path data transmission, it struggles with issues such as variable bandwidth, latency, and reliability. Cognitive radio technology addresses these challenges by incorporating adaptive spectrum management, allowing the system to monitor and optimize network paths in real time.

The cognitive radio module continuously assesses network conditions, such as bandwidth availability, latency, and signal quality, to select the most optimal paths for data transmission. Real-time monitoring ensures maximum throughput and minimal latency, addressing the shortcomings of traditional MPTCP systems.

The system also emphasizes fault tolerance, enabling it to reroute traffic to alternative paths during network disruptions, ensuring continuous data flow. This feature is particularly valuable for applications requiring high reliability, such as real-time communication.

Designed for diverse applications, including mobile communications, Internet of Things (IoT), and cloud services, the system effectively supports bandwidth-intensive needs. By providing a more adaptable and resilient networking solution, it enhances performance in modern communication environments

Proposed System Advantages

- Enhanced Path Selection: Dynamically selects optimal paths based on real-time network conditions.
- Improved Throughput and Reliability: Maximizes network resource utilization for higher throughput and more reliable connections.
- Adaptation to Network Changes: Continuously adjusts to varying network conditions to maintain consistent performance.
- Robust and Resilient Networking: Increases fault tolerance, ensuring uninterrupted data flow even during disruptions.
- Efficient Resource Utilization: Optimizes bandwidth and network interfaces for improved overall efficiency.

IV. SYSTEM DESIGN

The design of the proposed system centers on integrating Multipath TCP (MPTCP) with cognitive radio technology to optimize network performance through dynamic path selection and efficient data transmission. This section elaborates on the system's core components, architecture, flow process, and diagrams to illustrate the interaction between various elements.

A. System Design:The architecture of the proposed system is composed of multiple interconnected modules designed to optimize data transmission by integrating Multipath TCP (MPTCP) with cognitive radio technology. At its core is the User Interface Module, where users input data for transmission and receive feedback on the transfer status. The data is first processed by the Plant System Module, which prepares it for network transmission by segmenting it into smaller units compatible with MPTCP protocols. This processed data is then handled by the MPTCP Agent Module, which splits it into multiple subflows for simultaneous transmission across various network paths, ensuring efficient use of available bandwidth.A pivotal component, the Cognitive Radio Module, continuously monitors the spectrum to detect underutilized frequency bands and dynamically adjusts path selection based on real-time network conditions, such as bandwidth availability, latency, and signal quality. The Router Module directs these subflows through multiple paths and aggregates them back into a coherent data stream upon reception.This architecture, with its dynamic path optimization and fault-tolerance capabilities, ensures efficient, reliable, and adaptive data transmission in diverse and fluctuating network

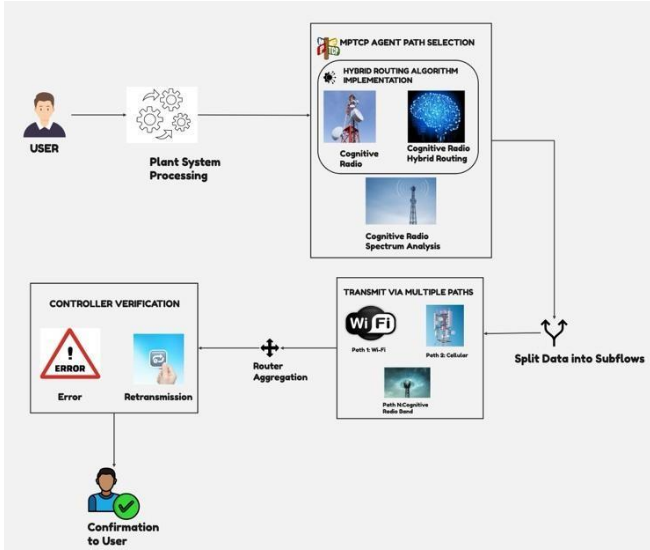

Fig1. System Architecture

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Methodology

The methodology of this research focuses on integrating Multipath TCP (MPTCP) with cognitive radio technology to enhance data transmission in dynamic network environments. The approach is structured as follows:

System Architecture Design

Integration: The system merges MPTCP with cognitive radio technology, comprising multiple interconnected modules to ensure efficient data transmission, adaptive routing, and real-time performance monitoring.

Components

The architecture includes the following modules:

- User Interface Module: Collects user inputs for network configuration.
- Plant System Module: Processes incoming data and performs necessary calculations.
- MPTCP Agent: Manages multiple paths for concurrent data transmission.
- TCP Path Modules: Oversees individual network paths.
- Router Module: Aggregates data from various paths and forwards it to the controller.
- Controller Module: Verifies the integrity of the data and dynamically adjusts path selection.
- Confirmation Module: Provides feedback to users about the success of the data transfer.

Integration of Cognitive Radio with MPTCP Objective: To enable adaptive data routing that responds to fluctuating network conditions in real time.

Functionality: The MPTCP agent dynamically adjusts path selection based on input from the cognitive radio module, which continuously monitors spectrum conditions. This integration ensures optimized throughput and maintains reliability even in variable environments.

Hybrid Routing Algorithm Implementation Purpose: To guarantee that data packets are transmitted through the most efficient network paths.

Mechanism: The hybrid routing algorithm leverages cognitive radio's real-time network sensing capabilities alongside machine learning techniques. By analyzing historical network performance, the algorithm predicts optimal paths, enhancing adaptability and efficiency in routing decisions.

Simulation Environment and Testing (NS2) Simulation Tool: The Network Simulator 2 (NS2) is employed to simulate diverse network environments. This tool allows for the assessment of MPTCP performance under varying conditions,including dynamic and high-traffic scenarios.
Testing Scenarios: Simulations are designed to evaluate system performance under conditions such as:High traffic environments Variable bandwidth availability
Fluctuating latenciesThese tests measure the system's reliability, fault tolerance, throughput, and adaptability to dynamic network conditions

Data Collection and Analysis

- Performance Data:
- Metrics collected during the simulations include:
- Data transmission rates Average latency
- Path utilization

These metrics provide insights into the system's performance across various scenarios

V. ANALYSIS

The collected data is thoroughly analyzed to assess the impact of integrating cognitive radio technology with MPTCP. Statistical methods are applied to identify trends and performance improvements, while visualizations such as graphs and charts are used to validate the system's adaptability and efficiency in dynamic environments.

Evaluation and Validation of Results
Objective: To confirm that the proposed MPTCP-cognitive radio system outperforms traditional methods in terms of:

- Throughput Latency
- Reliability
- Validation:

The results from simulations are compared with baseline performance of conventional MPTCP and TCP systems. This comparison validates the superiority of the hybrid system, demonstrating its ability to dynamically optimize network performance under fluctuating conditions.

Results
The integration of Multipath TCP (MPTCP) with cognitive radio technology demonstrates a highly effective framework for addressing challenges in dynamic network environments. Through the adaptive capabilities of cognitive radio, particularly spectrum sensing and dynamic path selection, the system achieves significant improvements in data transmission efficiency. This enhancement is particularly evident in scenarios with fluctuating bandwidth and variable latency, where the proposed approach ensures optimized performance and reliability.

Packet Delivery Ratio (PDR):
Packet Delivery Ratio (PDR), where the x- axis represents the number of packets transmitted, and the y-axis represents the number of packets received. The graph includes two curves: one for the existing system (red) and one for the proposed system (green). It can be observed that the proposed system achieves a higher

packet delivery ratio compared to the existing system. This improvement indicates that the proposed approach ensures better data transmission efficiency, leading to enhanced network reliability and reduced packet loss.

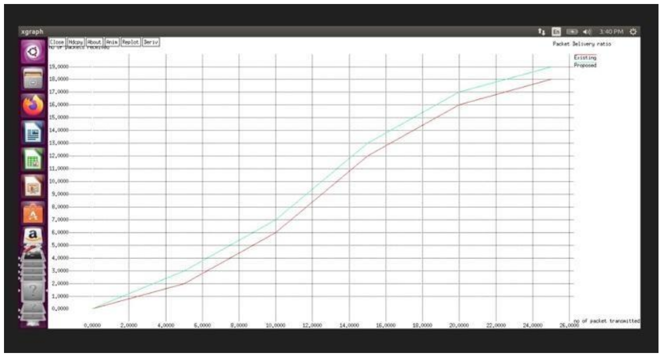

Fig2,Packet Delivery Ratio

Energy Consumption

Energy Consumption, where the x-axis represents time or the number of operations, and the y-axis represents energy consumption in joules. The existing system (red) shows a higher energy consumption compared to the proposed system (green). This reduction in energy usage in the proposed system demonstrates its efficiency in power management, making it more suitable for energy-constrainedenvironments such as wireless sensor networks.

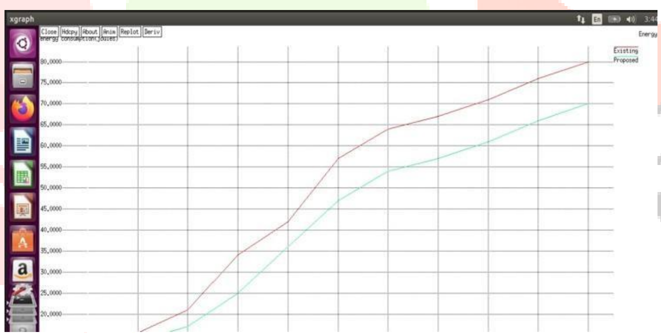

Fig3,Energy Consumption

VI. CONCLUSION

The comparative analysis of the existing and proposed systems demonstrates significant improvements in network performance and energy efficiency. The proposed system achieves a higher packet delivery ratio, ensuring more reliable data transmission with reduced packet loss. Additionally, the system exhibits lower energy consumption, making it more suitable for resource-constrained environments such as wireless sensor networks and IoT-based applications.

These results validate the effectiveness of the proposed approach in enhancing network efficiency while optimizing energy usage. The improvements in packet delivery and power consumption contribute to better overall system performance, ensuring seamless and sustainable operation. Future work can focus on further optimizing the system by integrating advanced routing algorithms and energy-harvesting techniques to enhance efficiency even further..

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