

HTTP Evolution: A Survey of HTTP/1.1, HTTP/2, and HTTP/3 Protocol Design and Performance

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Abstract: *The Hypertext Transfer Protocol (HTTP) is the foundational communication protocol of the World Wide Web, governing how data is transferred between clients and servers. Over the past three decades, HTTP has undergone significant evolution to meet the growing demands of modern web applications. This paper presents a comprehensive survey of the three major versions of HTTP, HTTP/1.1, HTTP/2, and HTTP/3 examining their protocol design, architectural improvements, performance characteristics, and limitations. The study traces the progression from the text-based, connection-limited HTTP/1.1 to the binary-framed, multiplexed HTTP/2, and finally to the UDP-based HTTP/3 built on the QUIC transport protocol. Through analysis of published research literature and performance benchmarks, this paper highlights how each version addressed the shortcomings of its predecessor. Key findings indicate that HTTP/2 significantly improves throughput on stable networks through multiplexing and header compression, while HTTP/3 eliminates transport-level head-of-line blocking and reduces connection latency, particularly in lossy and high-latency network environments. The paper also discusses open challenges in HTTP/3 adoption and future directions in web protocol design.*

Keywords: HTTP/1.1, HTTP/2, HTTP/3, QUIC, Web Protocols, Head-of-Line Blocking, Network Performance, Binary Framing, Multiplexing, Transport Layer

