

Ever since its inception in the 20th century, the Internet has profoundly influenced society and revolutionized our daily lives. From the perspective of an average individual, the Internet is commonly perceived as a remarkable tool that facilitates global connectivity, enabling communication, information retrieval, and content consumption and sharing. On the other hand, most people in the computer science community, whether they are university students or well-known professionals in the field, normally regard the Internet as an overwhelming set of complex protocols, with too many details. However, after reading the paper "**Extracting the Essential Simplicity of the Internet**", written by James McCauley, Scott Shenker and George Varghese, we can view the Internet in a new light, appreciating its "conceptually simple and brilliantly daring design" that has remained virtually unchanged over the years.

The Internet's fundamental simplicity can be attributed to the design decisions made during its development phase. The Internet is a collection of network infrastructures, such as routers and switches, that allow for the transfer of data between different hosts and the processing of that data by applications. This is made possible using the Service Model. Another crucial design choice was the adoption of the Internet as a four-layer architecture, which breaks down the primary objective of two computers communicating into smaller, more specialized tasks. This approach achieves modularity, a fundamental principle in architecture. The four layers consist of the Physical Layer (L1), which manages the physical infrastructure; the Network Layer (L2), which controls traffic and ensures efficient data transmission; the Internetworking Layer (L3), responsible for software addressing; and the Transport Layer (L4), which delivers data packets to specific hosts based on packet metadata. It is also crucial to note three distinct and complex mechanisms that are vital in the implementation of the Internet's architecture - routing, reliability, and resolution:

- Routing is the act of directing packets through the Internet to a specific destination host. This process takes place at the Network and Internetworking layers.
- Reliability pertains to the consistent and dependable transmission of data packets through a transport protocol such as TCP.
- Resolution, also known as Name Resolution, refers to the process of converting hostnames and IP addresses for the purpose of network communications.

In addition to the decisions mentioned above, there are two others that significantly contributed to the success of the Internet. Regarding the Network Layer, there is a specific step in the communication process where a packet must be sent to the correct destination within the local network. By confining this stage to local delivery only, it allows the utilization of non-scalable methods like broadcast and flooding for local communication. The significance of this decision rests on its ability to scale and operate efficiently. Within a local network, broadcast and flooding are straightforward and efficient techniques for distributing packets to all hosts. Nevertheless, on a global level, where the Internet links numerous networks across vast geographical areas, employing these methods on a larger scale becomes infeasible and ineffective. In contrast, the Internet depends on the Internetworking Layer to manage the interconnection of networks. When it comes to Routing Protocols, the choice to utilize algorithms like link-state and distance-vector routing demonstrates the Internet's ability to adjust to various situations, thereby enhancing its resilience and scalability. The paper in question examines two primary categories of routing algorithms - link-state and distance vector. The first approach offers an intricate perspective of the entire network, allowing routers to make well-informed choices by considering a thorough comprehension of the network's structure, whereas the second approach concentrates on the distance or expense required to

reach a specific destination. The adaptability of routing protocols allows for the accommodation of various network environments and specific requirements. Within Autonomous Systems (ASes), distance-vector routing may be appropriate, whereas link-state routing can offer advantages for interdomain routing.

As it is stated, the paper primarily aims to provide an explanation/reason (the “why”) for the various design decisions made by the developers of the Internet. Consequently, we can gain a more profound understanding of the Internet and its functioning. An instance of this can be seen in the depiction of the Layered Architecture. The article explains that the choice to structure the Internet's architecture into distinct layers, each serving a specific purpose, aids in maintaining organization and scalability. It can be likened to a multi-story building, where each floor serves a distinct function. This revelation enabled us to comprehend that by partitioning tasks into distinct layers, such as the Physical layer, Network layer, and others, the Internet becomes more flexible and responsive. Modifying a single layer does not automatically impact the remaining layers. It's possible to alter or enhance a specific component without disassembling the entire framework. Another pertinent example to mention is the presumption of failure as the prevailing circumstance. The article elucidates that as systems expand in size, the probability of component failures escalates. Thus, adopting the perspective of failures as the normal case is a practical strategy that has had an impact on multiple Internet mechanisms. The Internet was designed with the recognition that there may be instances where links or routers fail to function correctly. The existing systems are adept at effectively managing these issues. This cognitive framework elucidates the reason behind the Internet's adeptness in managing its vast magnitude and the inherent nature of unpredictability. This highlights the significance of developing systems that are capable of intelligently addressing issues.

Additionally, it is crucial to mention the title of the article. The motivation behind "Extracting the Essential Simplicity of the Internet" arises from the authors' frustration with their colleagues' lack of interest and inspiration with the Internet. To counteract this, the authors sought to extract the fundamental principles that make the Internet revolutionary and pioneering.

In summary, upon reviewing this paper, it is evident that our Internet design is deficient in several aspects. Upon comparing the design outlined in the article, our own concept lacks the depth and thoroughness of the concepts we presented, resulting in an incomplete and overly general description. Nevertheless, we have identified numerous concepts that closely resemble those described in our idea, such as the use of a layered architecture, data packets and packet forwarding. In addition, there's also many other concepts that we missed in our research, being modesty, failure as normal case and name resolution are important topics that we felt like we needed to discuss and describe even further. Overall, this paper played a significant role in establishing a standard for the level of detail required for an architecture. Furthermore, it serves as a significant point of reference for future projects, emphasizing the necessity for architectural designs to possess not only intricate details but also simplicity and comprehensibility. Finally, as it is stated, our attention should not be solely directed towards the "how", but also towards the "why".