FLATTENING INTERNET TOPOLOGY: MODELING A BETTER INTERNET THROUGH CLASSICAL ANALYSIS

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The Internet has become the essential communication network for exchanging information, performing transactions, and recently catalyzing social interactions between people and businesses across the globe. As such, a disruption or failure in its underlying structure could result in an immense monetary loss for businesses worldwide. The basic infrastructure of the Internet consists of sets of interconnected devices, called routers, which calculate the projected path of transmitted data. This infrastructure has been evolving since its creation, and in modern times maintains a topology, or ordered arrangement, of three tiers, which are ranked network levels. Each of these tiers is represented by an Internet Service Provider (ISP) which adheres to a given class of customer. Such customers as AT&T and Verizon, which are major international corporations, utilize the 'backbone' Tier-1 networks, which are themselves service providers to smaller Tier-2 networks and companies. However, Tier-2 networks aren't simply small companies. These networks represent regional areas, which must provide service to Tier-3 access networks. These Tier-3 networks allow home users to connect to the internet. When a user wishes to connect to a website, they are first connected through these networks in descending order (i.e. Tier-3, Tier-2, Tier-1). Once a proper path has been defined and the necessary Tier-1 connection established, a final connection to the website is made by backtracking through the topology. In recent years, companies like Google, Yahoo, Microsoft and Facebook have been introducing a new topological concept through the deployment of their own wide area networks (i.e., Tier-2 networks). Such networks have enabled these companies to bypass Tier-1 networks, and effectively 'flatten' the topology of the Internet by permitting communication between Tier-2 networks. Through our research, we aim to study this new topology and provide a mathematical model with which we may replicate the results we observe in our data collection. Utilizing traceroute, a tool for analyzing packet routes and transit times, we look for recurring Internet or IP addresses within network routes. Through identifying a common address for each observed route, we identify a source of weakness in the network, effectively finding a point which could block all communication in the network if brought down. Likewise, through analyzing the different distances of routes (i.e. number of routers in a path) and the transit times of traditional networks such as Google, we construct a snapshot of the current topology. From this data, we may provide a preliminary mathematical model of current topology and offer means of improvement through an analysis of it's strengths and weaknesses.

Additional Abstract Information

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