Latency — What is latency and why it is not a problem

Introduction

The ability for satellite technology to provide broadband access over a large geographic area makes it a crucial component of serving rural communities. It becomes an essential technology when it provides higher capacity at a much lower cost than terrestrial alternatives. The often cited high latency of geosynchronous (GEO) satellites and the perceived problems of latency require a closer look. All networks are prone to latency and delays, not only GEO satellite networks.

The Facts

To further examine this, latency is the time it takes for a piece of data to travel to the intended recipient or destination from the sender [1]. Modern day networks contain multiple factors that determine the total latency across the system. These factors include transmission delay, propagation delay, processing delay, and queuing delay [2]. Each factor contributes to the transmission time and overall performance of the network. In reference to GEO satellite networks, there is a general misconception that latency is solely made up by propagation delay. It is important to separate each latency factor and understand that total latency is determined by all factors combined.

Propagation delay is governed by physics and is a constant factor of the speed of light [3]. This factor is derived by the time required for signals to travel from the surface of the earth to a satellite and back. GEO satellites, therefore, have a higher latency as compared to LEO satellites due to their higher altitude orbit. Although LEO satellite networks and terrestrial networks experience much lower propagation delays, all other factors impact these networks and latency may occur due to transmission delay, processing delay, and queuing delay for many reasons.

Latency should not be the only performance indicator on a network. Other indicators such as jitter should be used to judge the performance of all types of networks including LEO and terrestrial networks. Jitter is the variation in the delay of received packets [7]. Network congestion, errors, and poor queuing may cause interruptions within the constant stream of data packets traversing the network. This results in prolonged delays, missed information, and overall poor network performance.

When considering the viability of GEO satellite broadband, the effects of latency must be considered. This being said, a service should not be discounted from the outset for the only reason that there is inherent and unavoidable latency on the network. To start, 82% of internet traffic will be video related by 2021 [4]. Video related traffic is not significantly affected by latency [5]. Email, web access, audio streaming, and other related uses are also not affected by latency and their uses have virtually no impact on the end user. Conversely, interactive online gaming and high-speed trading which require rapid response from users and multipoint video conferencing generally do not work well over highly latent services [6]. Real-time services such as virtual private networks (VPN) may also experience a degradation of performance over highly

latent networks. There are specific VPN products that are designed for high latency links (www.leptonglobal.com). Since the most popular VPNs from Cisco do not work well, there is the false assumption that all VPNs do not work well. Voice and point-to-point video conferencing have been used very effectively over satellite links for over 30 years. Cellular WiFi calling from most service providers works very well over consumer broadband internet terminals from both ViaSat and Hughes. Users may be able to perceive the additional propagation delays of these real-time services over GEO satellite networks, however, these services have been in use and serving these needs.

What is low latency really worth?

Now, looking back at the limits of GEO satellite networks, physical latency is not a major concern. Network latency is a problem for the vast majority of users. Over time the issue of physical latency will be solved through the eventual deployment of fiber, however, GEO satellite technology can solve network latency today. Large bandwidth capability through the use of HTS systems can mitigate network latency. Fiber deployments can be tasked with connecting the small subset of users that demand latent-free broadband in the future. In addition, careful network management has allowed satellite broadband providers to successfully manage queueing delay and over deliver on service performance for the past five years.

With speeds in rural Alaska that are 6 Mbps or less, most consumers are looking for higher speeds and lower prices. Latency is not the primary concern. For those in rural Alaska already using internet supplied by satellite middle mile, customers know how to deal with latency, so speed, capacity, and price are the primary concerns. For example, let's look at cellular service offered in Ketchikan, Alaska, during the summer at peak times. The local provider supplies a cellular broadband service that consists of 50 ms of physical latency, however, the response time of the network is 1.6 seconds. This is caused by network latency and the total available capacity on the network. When someone needs to use this network during peak times, it may be inaccessible. GEO satellite broadband can solve this problem for the user.

Summary

This brings us to what we believe is the best long-term solution for Alaska. In rural Alaska our past experience indicates that low latency middle mile service is very expensive. Expanding that same infrastructure to provide higher speeds and greater capacity is also likely to be very expensive. High throughput satellites (HTS) can provide satellite middle mile with the speed, capacity, and price that can bring Alaska up to the FCC defined 25x3 Mbps broadband threshold. Combined with existing terrestrial middle mile service, consumers can have low latency for those services requiring it as well as high speed and greater capacity. As low earth orbit (LEO) satellite constellations get deployed, those places dependent on satellite only, can benefit from the low latency of LEO and the high capacity of HTS at a cost effective price. The need in rural Alaska is for more broadband solutions, not latency free solutions. While 95% of internet traffic is generally tolerant to latency, satellite offers a solution that can cover a large geographical area relatively quickly. Rural Alaskans will be able to experience broadband services and engage in an online digital economy sooner at a more affordable price.

References

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