

INTRODUCTION

Networks and wireless links have evolved to become much more dynamic. Beam switching, ACM and changing traffic patterns all drive the need for dynamic and adaptive QoS to deliver on SLAs.

XipOS Link Estimation is a new capability within XipLink's SD-WAN feature set, supporting automatic adaptation of the entire Quality of Service framework to dynamic and reconfigurable network topologies.

Link Estimation quickly adapts to bandwidth increases and capacity reductions. Key link metrics such as bandwidth, latency and quality are used to control buffer bloat, thereby delivering enhanced QoE.

KEY BENEFITS

- Automatic, for reduced OPEX
- Saves time, money & resources
- Controls latency for better QoE
- More capacity for faster speed
- Higher network availability

AVAILABILITY

Link Estimation is available for single & bonded links in XipOS 5.13.7 now.

Full support for balanced link sets is added in XipLink's new SD-WAN XipOS 6 release from summer 2020.

Link Estimation is available in all fully featured XA and XV products.

LINK ESTIMATION

AUTOMATICALLY TRACK BANDWIDTH & LINK QUALITY

CAPABILITIES

- ✓ Dynamically adjusts the entire QoS to changing link rates
- ✓ Ensures links are not overdriven to deliver SLA compliance
- ✓ Ideal for Adaptive Coding & Modulation (ACM) for Ku or Ka HTS
- ✓ Automatically learns new link parameters during beam switchover
- ✓ Actively monitors and manages system latency to control buffer bloat

OPTIMIZING SD-WAN LINKS

XipLink's latest Link Estimation feature has been developed to overcome challenges often encountered with link technologies in today's increasingly software defined wide area networks, when the available bandwidth and link characteristics have become highly dynamic and reconfigurable.

Some typical examples of factors that can affect the available bandwidth and link characteristics are:

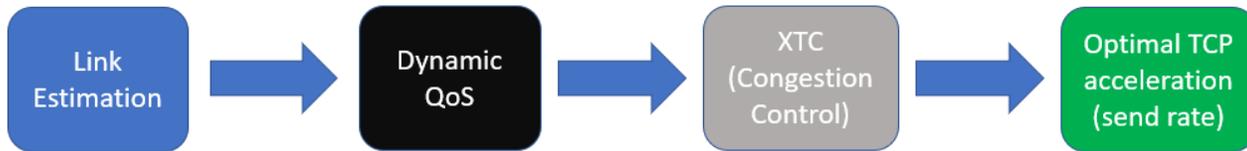
- Beam switching to support mobility, such as maritime applications
- Adaptive Coding and Modulation for higher frequencies
- Shared medium access technologies, like TDMA
- Signal strength, noise and interference
- Load and network congestion causing available capacity to change
- Terminal/modem configuration
- Throttling by network operators

HOW IT WORKS

The Link Estimation feature automatically discovers the available bandwidth and measures the quality of a link. Working in conjunction with XipLink's proven Dynamic QoS and XipLink Transport Control (XTC) schemes, it will ensure optimal network performance and utilization. Link Estimation will not only show benefits for TCP traffic, but also for non-TCP services.

TCP acceleration relies on network metrics for optimal user experience. The most important metric is the available bandwidth for one or more TCP sessions. The available bandwidth is governed by XipLink's QoS mechanism, which can be changed dynamically on any class while carrying traffic. For optimal performance the maximum transmit rate should be set to the current available bandwidth of a link. Otherwise, a TCP session might not utilize all available bandwidth, or it can cause retransmissions due to overdriving of a link, which would degrade the throughput and end user experience.

The introduction of Link Estimation allows XipOS to automatically determine the correct maximum sending rate and adjust the Dynamic QoS accordingly. The selected XTC algorithm then functions within the QoS parameters to manage TCP per-session behavior, as illustrated below.



Non-TCP traffic, such as real-time applications or VoIP, perform optimally when network buffering and overall delays are kept to a minimum. The buffering on a link can be managed by adjusting the Dynamic QoS's Max TX value for a non-TCP class. This occurs automatically to minimize buffering and incurred latency when Link Estimation is enabled. Additionally, to ensure high priority network services are protected, the QoS must be set at or below the available link bandwidth; Link Estimation ensures this relationship is continually enforced.



Even encapsulated TCP, where the network does not see the TCP traffic within other protocols such as IPsec, GRE or GTP, will benefit from Link Estimation managing the rate at which network equipment and modems receive data. This will allow the inner protocols to perform optimally by ensuring they have the required bandwidth and reduced latency.

Link Estimation can leverage user traffic metrics or dedicated probe traffic, if necessary when user traffic is minimal, to determine the available bandwidth and quality of a link. Unidirectional rate, delay and loss metrics provide inputs for the Link Estimation algorithm, serving as proxies for available bandwidth, all-source latency and BER plus PLR respectively.

The Link Estimation algorithm is based on a controller mechanism which adjusts the sending rate (Max Tx) of a parent QoS class to maintain measured metrics within the configured range of one or more setpoints. The setpoints that can be configured are as follows:

Delay setpoint (ms): Allowable incurred buffer delay, over and above base propagation delay. This supports adequate buffer space in network equipment to saturate the available link bandwidth, without causing unnecessary over-buffering, added delays or packet loss.

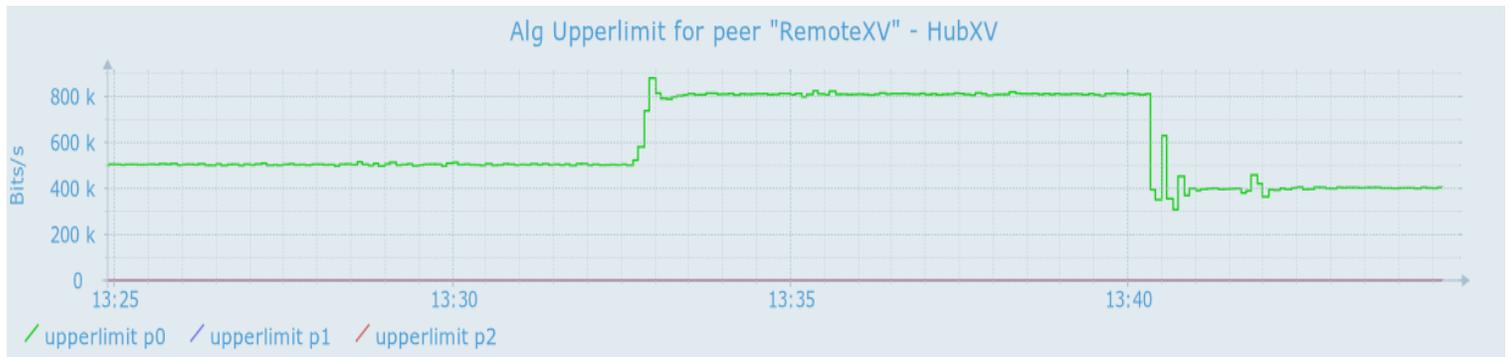
Loss (%): Percentage of acceptable packet loss on the link, which can be due to inadequate buffer space on network equipment or corruption due to a non-negligible bit error rate.

Note that the algorithm will control the uplink and downlink separately using one-way metrics. The above description is for a specific direction, for example remote site to hub site or vice versa.

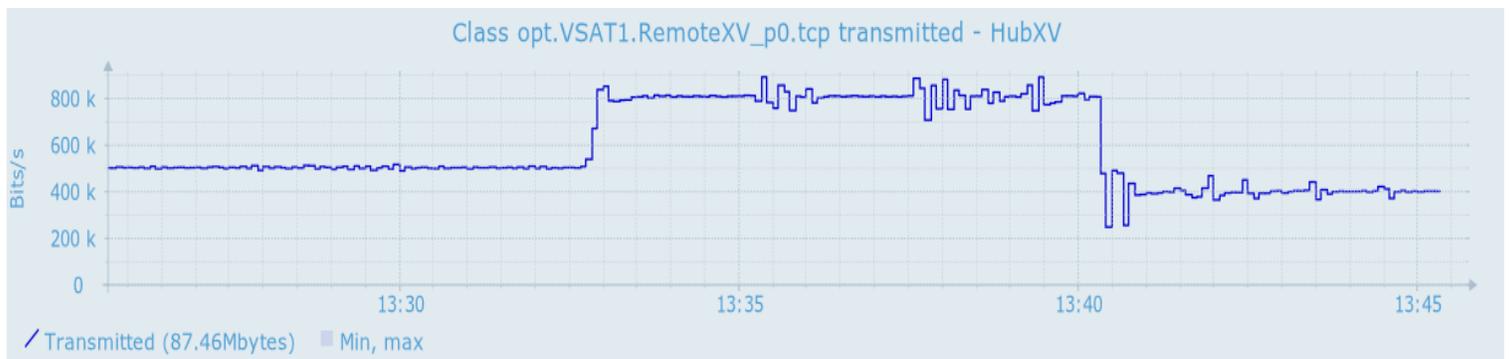
LINK ESTIMATION IN PRACTICE

Below is an example of how the maximum transmission rate is adjusted on a variable bandwidth link.

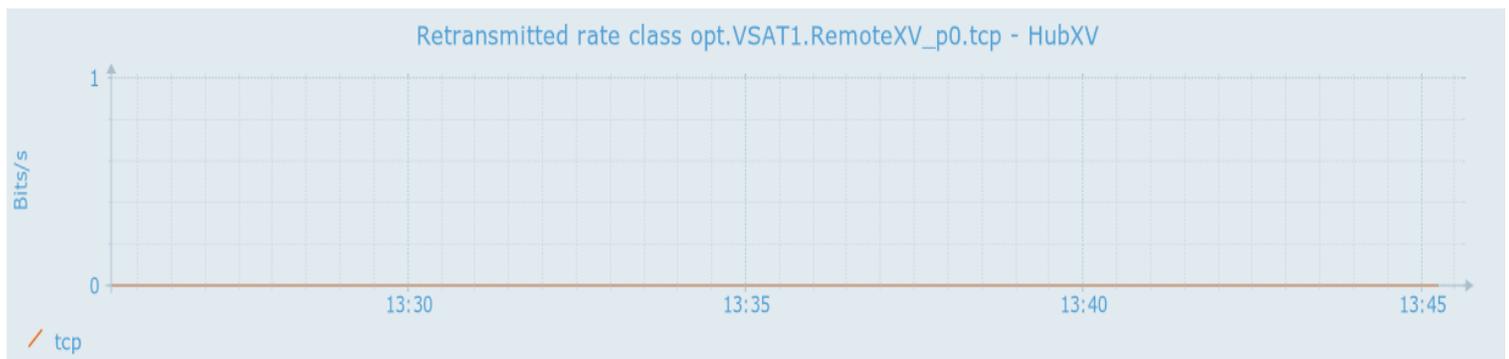
Estimation of available bandwidth: The algorithm discovers a 60% bandwidth increase and makes the capacity available to traffic within 15 seconds, while adapting to a 50% capacity reduction virtually instantaneously.



Traffic transmitted onto the link: Transmitted traffic very closely tracks the estimated capacity of the wireless link.



No retransmissions are observed: When the estimated bandwidth changes there are no retransmissions due to how the well-integrated TCP acceleration is seamlessly adjusted in concert with the overall QoS (as described earlier):



Please note:

- Link Estimation supports both point-to-point links as well as star topologies and relies on Xiplink's Lightweight Tunnel (LWT) technology. Xiplink's LWT is available in all fully featured XA and XV products.
- Modem buffer configurations are important and should be configured according to at least the Bandwidth Delay Product (BDP) of a link for best performance and results.