Microstorm in a teacup: Are you suffering from the long tail effect?

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Is there a storm brewing in your network? Are you getting buffeted by the tail? In well-managed networks packet flow, bandwidth and queuing is constantly monitored to ensure that "long tail" anomalies such as microbursts are minimized and hard won performance maintained.

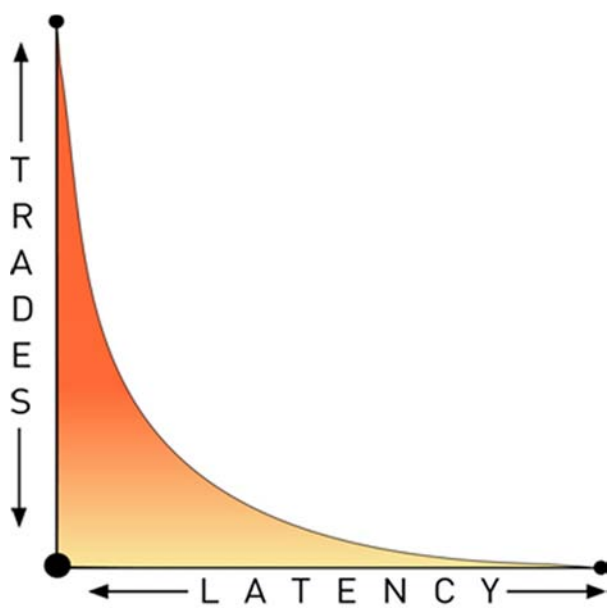
The nature of networks in general and trading systems in particular are characterized by what statisticians call a "Long Tail Distribution" of events.

No matter how well a system is tuned and optimized - there exists a small but significant occurrence of anomalies in the far reach of the "long tail". Microbursts are one such example of a long tail anomaly and can have serious and wide spread consequences for any trading system.

Trading networks are by nature bursty, but beyond average, even 95th percentile bandwidth utilization does occur. Undesirable network saturating microbursts (bursts occurring in the sub-second window), can be caused by software or hardware. They can occur because of something as simple as networks becoming overloaded when trading floors open, due to queues of overnight trades that are then not smoothly switched by routing systems, leading to sudden uneven bursts of traffic. If not dealt with, these sudden spikes, which can last for several milli-seconds, can cause significant service and financial impact to trading networks.

Microbursts impact network segments in many ways:

- **Increased latency**: Automatic re-routing of data by systems to overcome a network outage, can lead to packets being routed over slower network segments.
- **Lost packets**: While a few milli-seconds of lost packets may not be much of an issue for general applications, real time systems such as trading networks cannot tolerate this level of disruption.
- **Orphaned packets**: Lost in the network, orphaned packets continue to traverse the system, taking up bandwidth and resources until they expire.



A long tail distribution in a trading network can represent the distribution of latency experienced by trades. The majority of trades experience very low latency, less than 5 milliseconds, but a small number can experience trade latencies upwards of 900ms. Latency can be symptomatic of a long tail anomaly such as a bandwidth saturating microburst. An example, demonstrated by Cisco, was that on a Gigabit LAN, a 100ms microburst can cause 10,000 transactions to be lost or excessively delayed.

• **Message storms**: Automatic procedures kick in with routing devices attempting to re-establish flow control and in doing so generating lots of control traffic, sometimes creating a micro-storm.

So how do you minimize the effect of long tail anomalies such as microbursts?

The answer is to deploy an intelligent solution that can reliably discover and trace the source of these events versus expected behavior, e.g. microburst or normal traffic burst?

When designing and implementing trading networks, all system designers model the traffic, building for capacity and known characteristics in flow and growth. Modeling is possible due to the wealth of information on how protocols, hardware, software and feeds such as RMDS or OPRA behave.

Through monitoring and categorization of application and traffic behavior, unusual traffic flow in the trading network can be captured and quickly traced to its origin by decoding and reconstructing the transaction. The resolution of the capture and analytics must be extremely granular since too low a capture rate, for example, will lead to network flow looking normal because events such as microburst's can happen so fast that they can be missed.

Another concern for network managers is long tail anomalies in application performance. As with traffic flow, applications perform most transactions in a timely fashion, but in a system where several applications may be interacting, data interchange can stall. There may even be a form of microburst as a flurry of commands are suddenly executed followed by a lock up. In a trading system, there are instances where individual market data quotes or individual orders experience a latency that is far beyond the average as a result of such application interactions. It is not uncommon for a trading system to experience instances of orders that take up to 900 milliseconds to process!

The ability to see the long tail of latency in market data and trade executions is key in determining their cause. Is the latency a symptom of a microburst or software interaction? The only way to answer these questions is by measuring and correlating both the performance of the logical business applications as well as the underlying infrastructure in sufficient granularity.

By capturing, time stamping, and then reconstructing transactions, "event messages" (those making up the transactions) and the original packet stream, long tail anomalies such as microbursts, can be identified and correlated using both the packets and complete semantics of each message on the network.

Reconstructing the full state of the logical transaction at multiple points along the transaction path enables network managers to quickly identify, locate, and eliminate the cause and effect of these debilitating network events.

Performing this kind of behavior analysis is critical to creating a predictable and trusted trade infrastructure for users and ensures that the trading network is running with minimal service degradation and operating costs.

For more information on how you monitor, capture and analyze all aspects of your trading network please visit partners Endace and SeaNet Technologies Inc.

Endace designs, develops, sells, and supports high-speed packet capture technology, built to capture every packet, of any size, on any network interface, up to speeds of 40Gb/s with zero network impact. www.endace.com

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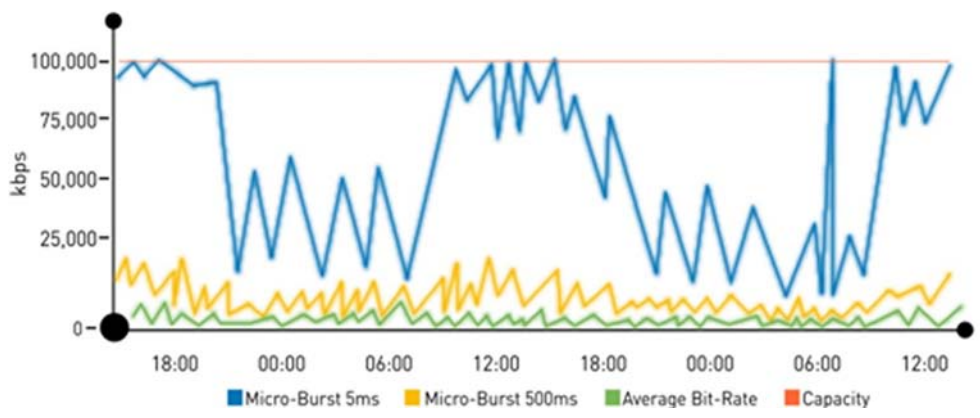

Too low a bitrate capture resolution yields a false view of network segment saturation. Increasing the resolution reveals the extent of saturation at the microburst level.