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Terminology for Implementing Lossless Techniques in Wide Area Networks
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Abstract

This document compiles a glossary of terminology commonly used in discussions about enhancing lossless transmission capabilities and network performance in Wide Area Networks, especially those terms already in related IETF drafts without further explanation. To aid operators and implementers in reading contemporary drafts, this document attempts to provide an overview of terms and definitions for clarifying the current understanding, so as to facilitate the ongoing research.

Status of This Memo

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1. Introduction

With the emerging of big data and intelligent computing, data-intensive applications such as high-performance computing (HPC), genetic sequencing, multimedia content production and distributed training, have growing demand for efficient and reliable network over thousands of kilometers during massive data transfers. Implementing lossless techniques in Wide Area Networks is often associated with these scenarios that require high timeliness and reliability of data transmission, as well as network performance such as high throughput and extremely low packet loss rate.

This document compiles a glossary of terminology commonly used in discussions about enhancing lossless transmission capabilities and network performance in Wide Area Networks, especially those terms already in related IETF drafts without further explanation. The goal of this document is to provide an overview of terms and definitions for clarifying the current understanding, so as to facilitate the ongoing research.

It is likely that the document will be refined in the future as understanding improves through increased insights and changes in practice.

2. Terminology

Lossless WAN: applies to scenarios that require high timeliness and reliability of data transmission across large geographical areas, providing on-demand,efficient and lossless data transmission across for user services.

Lossless Technique: The network technology that guarantees high throughput, extremely low packet loss rate, and low latency of the network through capabilities such as flow control, congestion notification, and flow scheduling, thus realizing lossless bearing of applications.

PFC: Priority-based Flow Control. It allows for selective pausing of traffic according to its class, enabling more granular flow control and preventing data loss due to congestion in data centers and other high-priority network environments [IEEE 802.1Qbb]. It is based on hop-by-hop, port-level feedback, pausing or resuming specific priority queues to prevent congestion.

Fine-grained flow control: An enhanced PFC mechanism that enables precise flow control at flow/tenant or other granular levels, limits flow control to specified paths and slices, and provides intelligent congestion backpressure to prevent network congestion.

ECN: Explicit Congestion Notification. It is a mechanism that allows end nodes to be notified of congestion in the network without packet loss as described in [RFC3168].

Rigid Bandwidth: The allocation of a fixed amount of network resources for specific traffic, ensuring a consistent and guaranteed level of service regardless of network congestion. It can be zero, which means no bandwidth resource is reserved, but a forwarding resource object (eg,SQ/VOQ...) is still allocated to the user for flow control.

Elastic bandwidth: The bandwidth is dynamically adjusted according to the network conditions to improve network bandwidth utilization and network transmission efficiency. When the network is lightly loaded, users can fully utilize the available bandwidth resources to achieve peak traffic rates; when the network load is heavy, the bandwidth of user is limited.

Network congestion: It occurs when the number of packets is too large, the network transmission performance deteriorates due to the limited resources of storage and forwarding nodes. The congestion is usually determined by buffer occupancy at the output interface, which can in data loss, increased latency, decreased throughput, and even congestion collapse.

Buffer: It is used to store and forward packets, including single device buffer and multi-level network buffer. The device buffer is shared and competed use by all ports. When the buffer of single device is insufficient, multi-level network buffer can absorb burst traffic using buffers collectively across multiple network devices along the path.

Packet loss rate: The ratio of the number of lost packets to the number of sent packets. Lossless WAN needs to consider the influence of micro-burst and ensure extremely low or zero packet loss rate in a certain period of time.

Throughput: The amount of data (measured in bits, bytes, packets, etc.) that a network, device, or port can successfully transmit per unit time. The throughput of data transmission is affected by transmission distance, packet loss rate, effective data length and sending window size.

BDP network: Bandwidth-Delay Product network. It refers to a network in which the product of bandwidth and delay is significant,in a high BDP network, a large amount of data that can be in transit at any given time[I-D.liu-rtgwg-mdt-in-high-bdp]. BDP reflects the amount of data that can exist simultaneously on the transmission path in the network, which can help determine appropriate buffer sizes, flow control mechanisms, and congestion avoidance strategies to ensure efficient data transmission.

Elephant flow: In computer networking, an elephant flow is an extremely large (in total bytes) continuous flow set up by a TCP (or other protocol) flow measured over a network link.

3. Security Considerations

This document does not have any specific security considerations.

4. IANA Considerations

This document does not have any IANA considerations.

5. References

5.1. Normative References

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