Cloud-Assisted Reliable User Datagram Protocol

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How is data send between devices through the internet?
How can the cloud accelerate the data transfer rate?
What are the potential applications?

Introduction

- The generally adopted protocols for sending data between devices connected to the internet are the Transmission Control Protocol (TCP) and the User Datagram Protocol (UDP), with each serving different purposes. TCP is used for reliable in order delivery of data packets (such as for sending files) while UDP is used for unreliable out of order delivery of data packets (such as for streaming media contents).
- By building an additional layer on top of the UDP that provides reliability and in order delivery of data packets UDP can be repurposed to send data more efficiently than TCP thus reducing the latency and increasing the transfer rate.
- Virtual Private Networks (VPN) are commonly used to extend a private network across public networks like the Internet. When two devices are separated by a VPN sending data between them is impacted by the added layer of indirection which reduces the transfer rate and increases the latency.
- In this study, a Highly Available Cloud Service serving as a discovery and routing agent is used to accelerate the data transfer rate by establishing a direct communication path between the connected devices
- The RUDP implementation can be used by multiplayer mobile games and file transfer applications among others.

Method

Motivation

- The motivation for the experiment is to find a way to improve speed up the transfer rate between two devices connected to the internet and in particular when the devices are separated by private networks.

Prerequisites

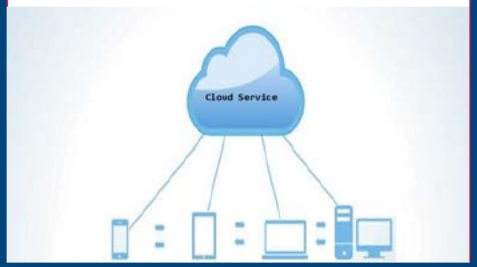
1. Two or more heterogeneous devices running on different Operating Systems with an internet connection
2. A Highly Available Cloud Service hosted by a Cloud Service Provider (AWS)

Procedure

1. Each device connects to the Cloud Service and performs a registration.

2. The Cloud Service then establishes a connection between the devices and provides connection details to both devices. Optionally, the cloud service can also exchange metadata about the type of information that will be transmitted which can reduce the size of frequently used data.

3. After performing the initial registration and the connection has been established the devices are ready to begin communicating.



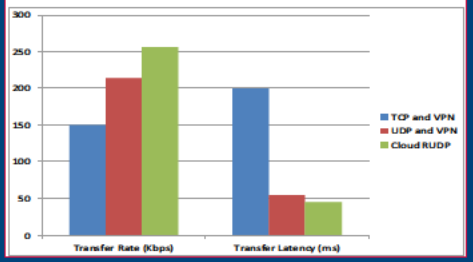
Results

1. The data transfer rate and latency between two computers connected to the internet were measured using a simple sequencing technique. Data packets of fixed size get transmitted from the sender to the receiver and the data is recorded. The following tests are performed:

- Measure the transfer rate and latency when sending data using VPN and TCP;
- Measure the transfer rate and latency when sending data using VPN and UDP;
- Measure the transfer rate and latency using the Cloud Assisted RUDP.

2. The results will vary depending on the physical characteristics of the network but different tests indicate consistently higher transfer rates and lower transfer latencies when devices communicate through the established RUDP connection.

3. The specific test example below measured data transfer rates between two computers in Deerfield Beach and Fort Lauderdale using the indicated methods. It indicates a 70% increase in data transfer rate and a 77% reduction in latency.



Discussion

1. UDP is fast, lightweight and incurs smaller data packet overhead when compared to TCP and for those reasons it has the potential of achieving much higher transfer rates. There could be many applications where achieving optimal data transfer rates or latencies is paramount. One good example is multiplayer mobile games where small bits of information between devices must be send as fast as possible (low latency) in order to achieve the best user experience or between applications for sending large files where time is an important factor.

2. The available Cloud infrastructure makes it possible for devices that are part of private networks with a connection to the internet to establish a direct connection in order to achieve better transfer rates and latencies when compared to connections established through a Virtual Private Network (VPN). This is true because the VPN adds an extra layer of indirection to the communication between the connected devices.

References

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