Identifying and understanding performance bottlenecks with Aspera Transfers

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Performance bottlenecks due to Aspera license or bandwidth settings

**Figure 1**: Aspera configuration and license bottlenecks

**Aspera License Cap**
All Licensed Aspera Clients and Servers have a bandwidth capacity limit. You can check the license cap via the command line or GUI.

**Aspera Target Rate**
Aspera Clients always request a target rate. Aspera servers will either allow the client to transfer at the rate requested, or will throttle the client to a rate which is set by the server.

**Aspera Virtual Link**
Aspera clients and servers are capable of restricting the maximum aggregate transfer rate. This feature is called *Virtual Link*. The client virtual link is set via the Graphical User Interface, in the *Preferences* section.

**Other**: Connect Client

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Most common performance bottlenecks

**Figure 2**: Most common performance bottlenecks
**Physical Bandwidth at Sender or Receiver**
Available physical bandwidth is the most common limitation on transfer performance. The bandwidth at the sender and receiver is often different, as shown in the diagram above.

**I/O Receiver or Sender Disk**
The receiver disk limits transfer speed more often than the sender disk. The I/O limitation is more common with high concurrency or high packet loss. I/O bottlenecks can be hard to detect, if the disk is occasionally accessed by other applications, for example, NFS or CIFS shares.

**CPU Sender or Receiver**
The CPU can be a bottleneck, especially when using encryption for high speed transfers. Currently the `ascp` process is not multithreaded, so if you have multiple concurrent transfers, it is important to have multiple CPU or multi core system, so you can spread the CPU load.

**Performance bottlenecks due to systems and storage**

![Diagram showing file transfer direction](image)

**I/O Sender or receiver NAS / SAN**
Using remote storage can be a bottleneck for high speed transfers. Sometimes this is due to the storage (physical configuration, disks), and sometimes this can be due to the network file system (NFS or CIFS).

**Sender or Receiver CPU or Memory**
The CPU or memory can be a bottleneck, especially when using encryption for high speed transfers. Currently the `ascp` process is not multithreaded, so if you have multiple concurrent transfers, it is important to have multiple CPU or multi core system, so you can spread the CPU load. When doing high speed transfers or highly concurrent transfers it is possible to run into a memory bottleneck.
**Sender or receiver Network Card**
Although unusual, it is possible that a network card has a physical limit, or the network card driver configuration is creating a limit. On a few occasions, we have observed that buggy network card drivers cause transfer performance issues.

**Performance bottlenecks due to networks and network devices**

![Diagram](image)

**Sender or receiver VPN/ Router**
VPN can reduce performance of Aspera FASP transfers. This can happen when the VPN device is fragmenting packets and Aspera is unable to detect that the packets were being fragmented.

**Sender or receiver Firewall / QOS**
Firewalls that implement QOS (Quality of Service) or other bandwidth restrictions can be the cause of performance limitations. Firewalls that perform deep packet inspection (IDS/IPS) can cause transfers to slow down.

**Sender or receiver WAN link**
ISPs may limit UDP throughput or completely block UDP after some fixed period of time.
Appendix A

How to identify the limitation

This section provides information on how to identify and confirm each of the potential transfer bottlenecks. The screenshots show you the various configuration interfaces or commands that can be run to verify the setting or restriction.

Aspera license cap

Check the license cap via the command line. The command ‘ascp -A’ run from any command line will provide you output as shown below. Please note that Aspera Evaluation licenses are unlimited in speed, but normal production licenses will show a specific speed.

```
Eric:-~ eric$ ascp -A
Aspera Enterprise Server version 2.7.3.40446
ascp version 2.7.3.40379
Operating System: MacOSX
FIPS 140-2-validated crypto ready to configure
license max rate=(unlimited), account no.=1, license no.=21991. Expiration date: Thu May 31 16:59:59 2012
```

Figure 1: Output of ascp

Check the license cap via the Graphical User interface. The Aspera Client, Point to Point Client and Enterprise Server all have a menu option for checking and changing the license key. Follow the ‘Tools -> License’ menu option to see or update the license, as show below:

![License Interface](image-url)
Aspera server target rate
Check the Aspera Target rate on the server via the server configuration panel. In the screenshot below, you can see the configuration for the user ‘eric’ where the bandwidth Incoming Target Rate Cap is set to '20,000 Kbps' (20 Mbps).

If you are on a Linux or Unix system, you can always review the configuration in aspera.conf directly. The aspera.conf file contains all settings for Aspera users. In the screenshot below, you can see the user section of aspera.conf where the user *eric* has a target rate set at 20,000 Kbps for inbound and for outbound transfers.
It is also possible to query the configuration file directly using `asuserdata` which is a command utility provided with our products for validating and checking a configuration file. The basic syntax of this utility, for checking the user `eric` is `asuserdata -u eric`. The command can be found in the same location as the `ascp` file. They are both located in the `bin` sub directory of the Aspera install. The screenshot below, shows a portion of the output from the command `asuserdata -u eric`.

**Figure 4: Example section of aspera.conf**
The Aspera Management Console can be used to view and configure the target rate configurations. The screen shots below show the Configuration interface for default system target rate as well as the user target rate setting.

Figure 5: Example output of asuserdata
**Figure 6: Console system default configuration**

**Figure 7: Console Account Bandwidth configuration**

**Aspera client target rate**
The Aspera Client, Point to Point Client and Enterprise Server endpoint configuration allows you to set the default target rate for the endpoint.
The target rate can also be set when initiating a transfer. This dialogue below shows the interface for setting a target rate upon transfer initiation. This setting will override the default end point target rate setting.

The Connect browser plug-in preferences panel has a Maximum allowed connection speed. If this setting is lower than the available bandwidth, or network capacity, it can artificially limit the transfer speed. The default for this setting is 45 Mbps. In the screen shot below you can see the speed is set to 200 Mbps.
Client virtual link setting

The Aspera Client, Point to Point Client and Enterprise Server graphical user interface provides a client configuration via the Preferences configuration dialogue. In the screen shot below, you can see the client has set a maximum allowed aggregate rate of 100 Mbps.
Figure 11: Client preference setting for Global Bandwidth Limit

Server virtual link setting
The Server configuration panel in the Point to Piont and Enterprise Server products allows you to set and view the virtual link policy as a default, per group or per user. The first screen shot below shows a virtual link configured for 100Mbps (100000 Kbps). The second screen shot below shows that the virtual link ID 101 has been applied to theaspera user for incoming transfers.

Figure 12: Server Configuration for Virtual Link
If you are on a unix or Linux system, you may need to view the configuration file (aspera.conf) to see what virtual link policy is applied as a system default, or for groups or users. The first screen shot below shows a default configuration for all users (the `<default>` section applies to all users). The second screen shot shows the Vlink policy applied to the aspera user.

```xml
<default>
  <transfer>
    <out>
      <bandwidth>
        <aggregate>
          <trunk_id>100</trunk_id>
        </aggregate>
      </bandwidth>
    </out>
    <in>
      <bandwidth>
        <aggregate>
          <trunk_id>101</trunk_id>
        </aggregate>
      </bandwidth>
    </in>
    <protocol_options>
      <rtt_autocorrect>true</rtt_autocorrect>
    </protocol_options>
  </transfer>
</default>
```

**Figure 14: Aspera.conf – default Virtual link setting for all users**
If the configuration file is too large and difficult to read, you can also query the configuration file using the utility ‘asuserdata’. This utility will aggregate the configuration file settings for default, group and users and output the specific settings for the specified user.
Figure 16: asuserdata – Virtual link setting for user aspera
Network bandwidth

ISP – rate limiting, or UDP blocking. How long does transfer last? View details of Transfer session.

Senders / Receiver Disk

In higher speed or high concurrent transfers, I/O limitations can become a bottleneck. There are a few methods for determining your storage I/O capabilities. One such method is a set of Aspera transfer options (--no-read --no-write), which allow you to eliminate either the reading from or writing to disk, as part of a transfer. This will show your network capacity, independent of your storage throughput. The Aspera Support portal provides an excellent article on testing I/O performance:

https://support.asperasoft.com/entries/2099488-performance-testing

There are also third party tools. One we recommend is the open source IOzone tool kit which is freely downloadable from the internet. (IOzone.org). Please review the Aspera Knowledgebase for detailed examples on how to test using IOzone.
Senders / Receiver SAN or NAS storage

Generally with SAN devices, if you have I/O performance issues, there is a configuration issue with the SAN. Please work with your storage team or SAN vendor to review the configuration. With NAS devices, performance problems can be more complicated to debug. Please review this Support KB article for more details, or contact Aspera Support:

https://support.asperasoft.com/entries/20151793-improving-nfs-performance-on-the-lan

Other testing options:
Run IOzone against these devices – it will tell you the optimum block size and maximum expected speed.

For CIFS, be sure to use SMB2.
For NFS – use kernel parameters, and also Aspera block size writes / reads.

Firewall

Rate limiting and deep packet inspection can be hard to verify without direct access to the firewall configuration. If your organization has a security team, we would recommend that you contact them to review the firewall configuration. One indicator of rate limiting is a high packet loss rate. The best way to validate this is to run the following test with the full desktop client. You can also use the GUI on our server products to run this test. Start a transfer to the server, using an Aspera client, using a low target rate at FIXED mode (e.g. 5 Mbps). Open up the detail view of this transfer session, and confirm that you have no packet loss. Gradually increase the target rate, and observe both the transfer rate and packet loss. At some speed (usually a fixed amount) the actual transfer rate will not increase any more, but the packet loss will. The first screenshot below show the initial transfer at a low speed without packet loss. The second screenshot shows a higher target rate transfer where the actual rate is less than the target rate, but the packet loss is quite high.
It is possible to have a CPU limitation on the VPN/Router device. The aspera transfer will be slower than the target rate. In most cases, there will be no or minimal packet loss but an increase in delay (RTT). In some cases, this will result in higher loss.

This situation is exacerbated when the VPN devices are configured to defeat path MTU discovery, and the data packets are fragmented by the VPN device. Aspera uses path MTU discovery at the beginning of a transfer session to determine the appropriate packet size. If this process is defeated, then Aspera will send packets at the standard size (1492 bytes). Both Cisco and Juniper VPN devices can be configured to defeat path MTU discovery by clearing the DF bit (do not fragment).