Traffic Shaper

Traffic Shaper

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1 Introduction

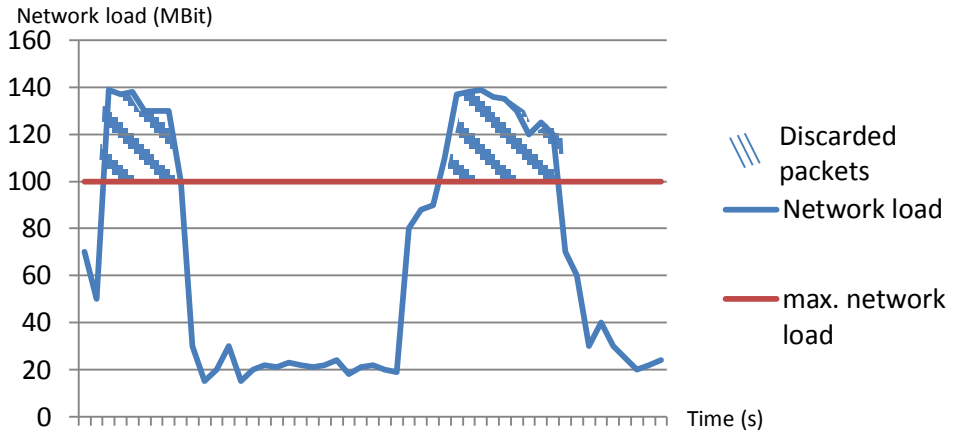
1.1 Overview

General information

In networks, unpredictable load peaks can occur. As a result, data packets can be discarded. Therefore, data packets that are necessary for an application might not arrive at the destination, for example.

The following figure shows the network load with peak loads, which can lead to data loss.

Figure 1-1



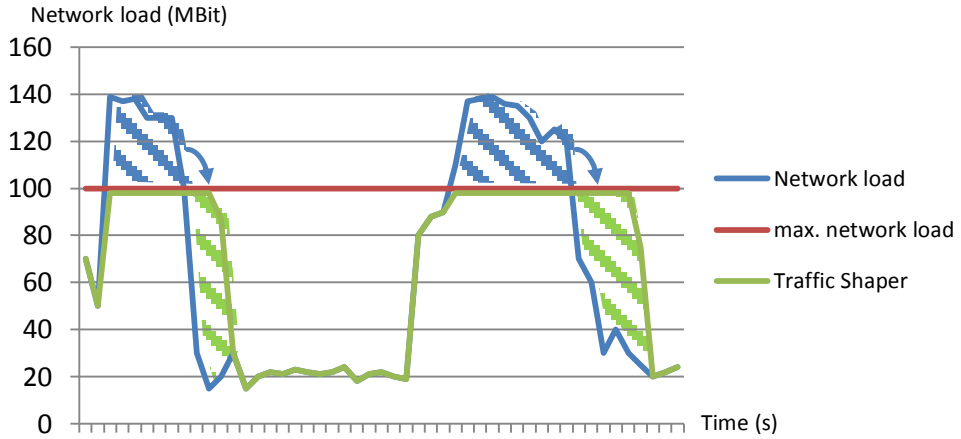
Solution

To prevent peak loads, the Traffic Shaper is a helpful tool. Through the Traffic Shaper, data packets originating from a network card can be limited according to predetermined maximum values.

If the network load is above the specified maximum value, the network load is distributed so that the data packets are sent only in phases of lower network utilization. The Traffic Shaper buffers the data if required by configuration. They are buffered in a queue in the memory until they are sent to the line (see Token-Bucket procedure).

The following figure shows the network load with peak loads and how the network load looks after distribution through the Traffic Shaper.

Figure 1-2



Possible uses for the Traffic Shaper

The Traffic Shaper can be used in various applications.

- Check:
  The Traffic Shaper offers the possibility to limit the maximum data rate of a network card. This allows you to control exactly how much data is put into the network, e.g. for example, by remote operate server.
- Load limitation:
  The traffic shaper limits the data flow passed through a network card into the network during load peaks and high network load. This can prevent the data flow from being disturbed with high priority.

Benefits

The Traffic Shaper offers the following advantages:

- Data packets cannot be lost.
- A high priority data flow cannot be disturbed by a lower priority data flow.

Note The data is buffered in a queue before transmission to the line. This queue is limited to 50 data frames. If the queue is full, the Traffic Shaper discards the data packets. Applications diagnose packet loss as with overloading of the network.

1.2 Mode of operation

Structure of the application example

This application example shows you how to use the Traffic Shaper.

To demonstrate the functionality, a SIMATIC MICROBOX PC and a PG/PC are used. These two devices communicate with each other. In parallel, a camera permanently transmits a live video stream to the PG/PC. The PG/PC displays the video stream in a picture playback application.

Requirement

The requirement is that the live video stream arrives without losses on the PG/PC and is displayed. If there is data loss, then production must be stopped.

The data flow between the camera and image playback on the PG/PC has the highest priority. Therefore, the live video playback should not be disturbed by the communication between MICROBOX PC and PG/PC.

Solution

The Traffic Shaper is used so that the live video playback is not disturbed by the communication between MICROBOX PC and PG/PC.

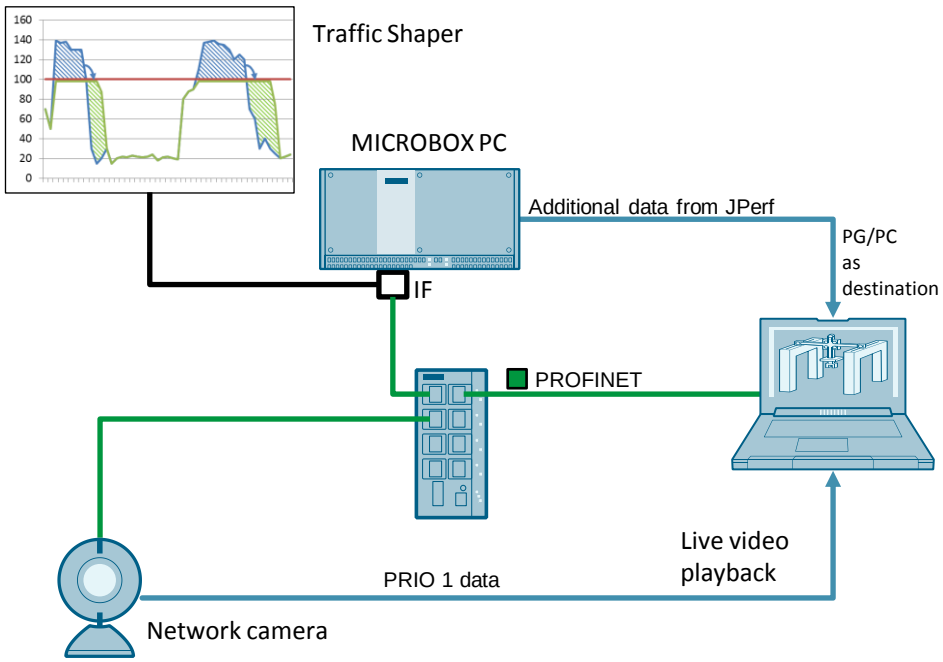
The Traffic Shaper is installed on the MICROBOX PC and controls the interface to the network. This interface routes traffic to the network.

The data flow from the MICROBOX PC is limited under load peaks so that there are no packet losses.

Note The data originating from the MICROBOX PC with the PG/PC as destination is generated by a load generator. In this application example, the tool "JPerf" is used.

The following figure shows the schematic structure of the application example.

Figure 1-3



1.3 Components used

The following hardware and software components were used to create this application example:

Table 1-1

Component	Number	Article number	Note
Windows 7 SP1 (64 Bit)	1		64-bit version is required for the Traffic Shaper.
Traffic Shaper	1	-	
JPerf	1	-	Open source
SIMATIC IPC427C	1	6ES7647-7BL40-0AD10	Alternatively, any other PC with Siemens network cards can be used.
SIMATIC FIELD PG M5	1	6ES7717-.....-0...	Alternatively, any other PG/PC can be used.
Unmanaged switch	1		z. B. SCALANCE XC-100
D-Link DCS-7513	1	-	Alternatively, any other network camera can be used.

This application example consists of the following components:

Table 1-2

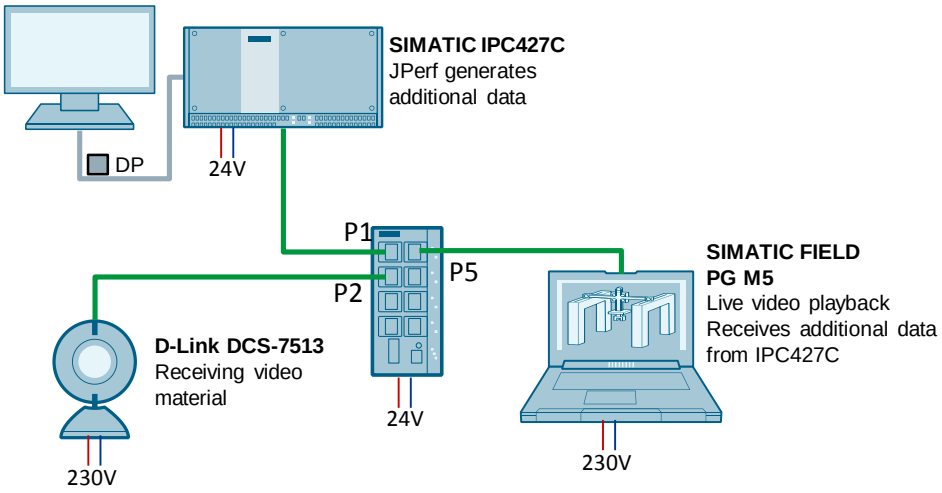
Component	File name	Note
Documentation	109750661_TrafficShaper_DOC_V10_de.pdf	This document
Traffic Shaper	109750661_TrafficShaper.zip	

2 Engineering

2.1 Hardwareconfiguration

The following figure shows the hardware configuration of the application example:

Figure 2-1



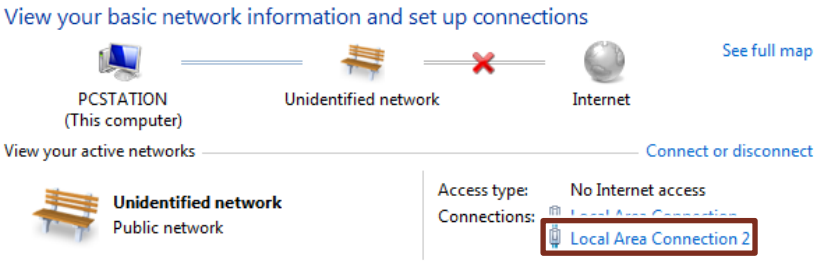
Note All IP addresses of the devices must be in the same subnet.

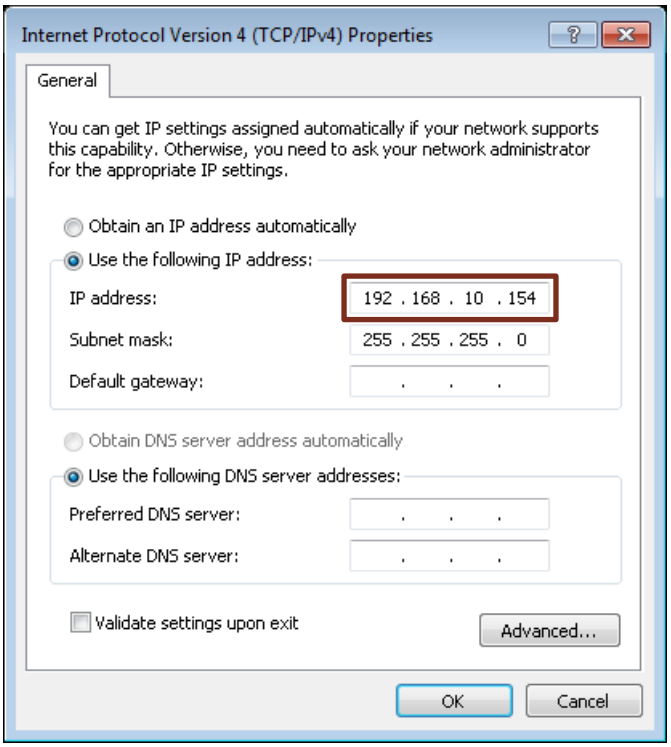
2.2 Configuration of the SIMATIC MICROBOX PC and PG

Assigning an IP address

Assign an IP address from the desired subnet to the interfaces you want to use for the application. Repeat the following steps for the PG/PC and the SIMATIC MICROBOX PC.

Table 2-1

No.	Action
1.	To do this, open the "Network and sharing center".
2.	Click on the desired interface (here "Local area connection 2"). 
3.	Click on the button "Properties" and in the list "This connection uses the following elements:" Double-click the "Internet Protocol Version 4 (TCP / IPv4)" ("Internet Protocol Version 4 (TCP/IPv4)")

No.	Action
4.	Assign an IP address to the interface used here (here "192.168.10.154").  **Note:** The assigned IP addresses must be in the same subnet.
5.	Confirm the two following property windows with the "OK" button and close the status window of the interface with "Close".

2.3 Configuration of the Traffic Shaper

2.3.1 Load calculation in the example network

Before you install the Traffic Shaper and use it to limit the data flow, you must perform a load calculation.

For the load calculation, you must calculate how far you want to limit the data flow.

Preparation

The PG/PC is connected to port 5 (P5) of the SCALANCE and receives the following data via this interface:

- the data of the camera
- the additional data from the MICROBOX PC (generated by the load generator JPerf).

The aim of this application example is to prevent data loss during live video transmission to the PG/PC.

Since both the live video transmission and the data generated by JPerf are routed to the PG/PC via the P5 interface, you must ensure that the low-priority data flow of the load generator does not overload the P5 interface too much.

To calculate the data flow on the Traffic Shaper, you need to know how much bandwidth the P5 interface of the SCALANCE is available and how much data the nodes generate and route to the network.

Note The P5 interface of the SCALANCE provides a maximum bandwidth of 100 Mbit/s.

The following table shows how much data the respective subscribers pass over the interface.

Table 2-2

Device	Data flow	Comment
Camera D-Link DCS-7513	15 Mbit/s	Fixed size that should not be disturbed by the JPerf load generator.
Load generator JPerf	Variable (In this case 0.1-100Mbit/s)	Maximum possible amount of data between client and server. Is limited by Traffic Shaper.

Calculation

The data flow generated by JPerf is limited by a data flow configured in the Traffic Shaper. The data flow generated by JPerf should be limited in such a way that possible further participants can communicate with the PG/PC via interface P5 of the SCALANCE. Therefore, the load generator should send a maximum of 30Mbit/s into the line.

The following calculations show you the calculation of the parameters of the data flow to send a maximum of 30Mbit/s into the line:

- Rate: The rate indicates the average of the data that is routed through the interface at the most. There must be a conversion of 30 Mbit/s into bytes/ms, since the Traffic Shaper expects the transmission rate in bytes/ms:

  $$\frac{30\frac{Mbit}{s}}{1000\frac{ms}{s} * 8\frac{Bit}{Byte}} * 10^6 \frac{Byte}{Mbyte} = 3750\frac{Byte}{ms}$$

  Result: At the rate of data flow, you must specify 3750 bytes/ms.

- Burst: The burst indicates how much data can be sent at most in one go. Therefore, the burst should be close to the rate.

  Result: Enter a value between 5000 and 7000 bytes for the burst.

2.3.2 Installation of the Traffic Shaper

Requirements

To install the Traffic Shaper on your device, the following prerequisites must be met:

- Windows 7 Professional SP1 64-Bit
- Siemens IPC (network interfaces with Siemens MAC address)

Installation

To limit the bandwidth available to an interface, you must install the Traffic Shaper on your MICROBOX PC.

The following table describes how to install the Traffic Shaper.

Table 2-3

No.	Action	Description
1.	Download the Traffic Shaper.	The tool is on the same HTML page as this document.
2.	Unpack the downloaded .zip file.	
3.	Install the Traffic Shaper.	Follow the instructions of the installation wizard.

2.3.3 Configuration of the interfaces with the Traffic Shaper

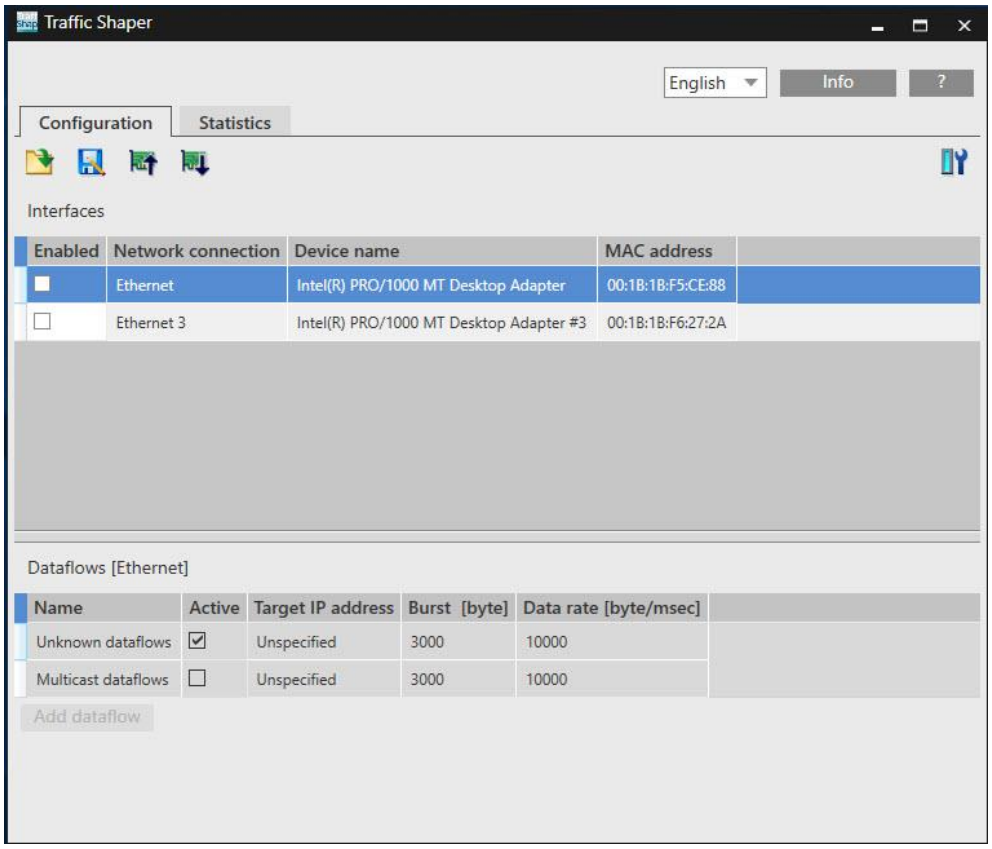
Note Only interfaces of Siemens components can be monitored.

Selection of the interfaces to be monitored

Select the interfaces to be controlled explicitly via the user interface of the Traffic Shaper.

The following illustration shows the user interface of the Traffic Shaper.

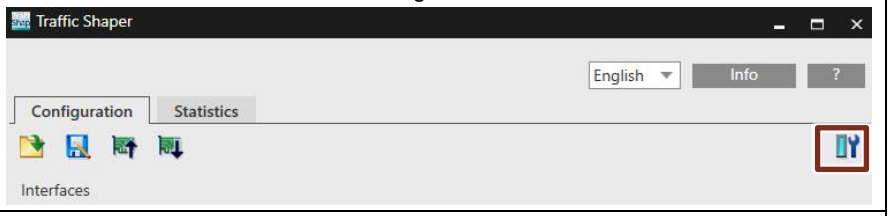
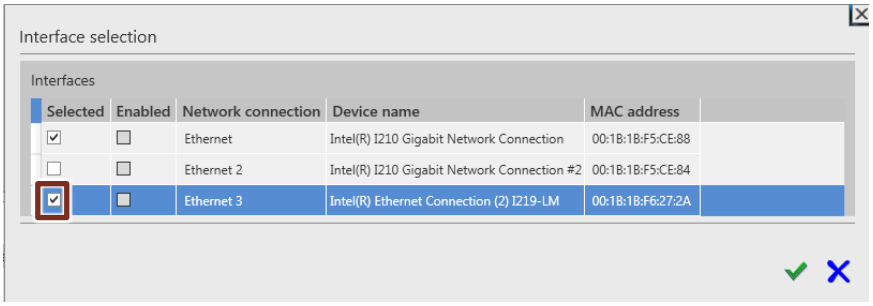
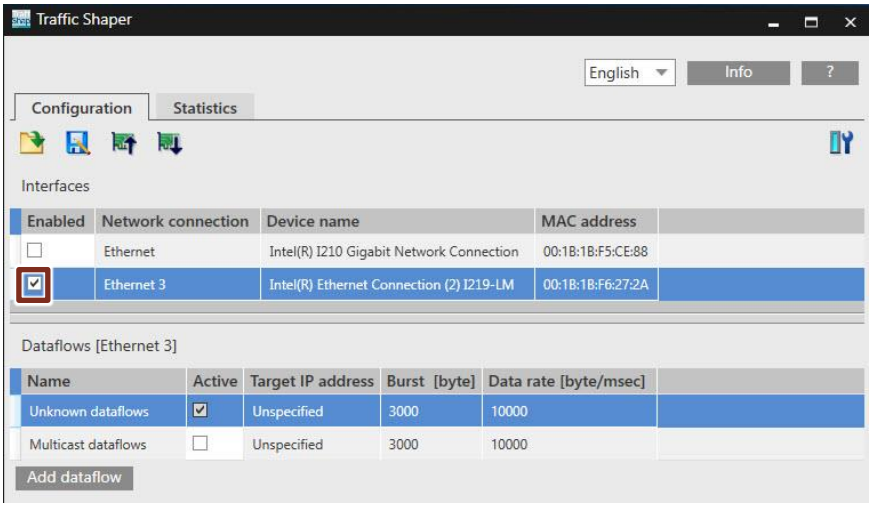
Abbildung 2-2



Note When you first start after installing the Traffic Shaper, the Interface selection window will open (see Figure - in Table 2-3 Step 3). At least one interface must be selected here.

The following table shows how you can select the interface whose data flow is to be controlled with the Traffic Shaper. Follow the instructions in the table.

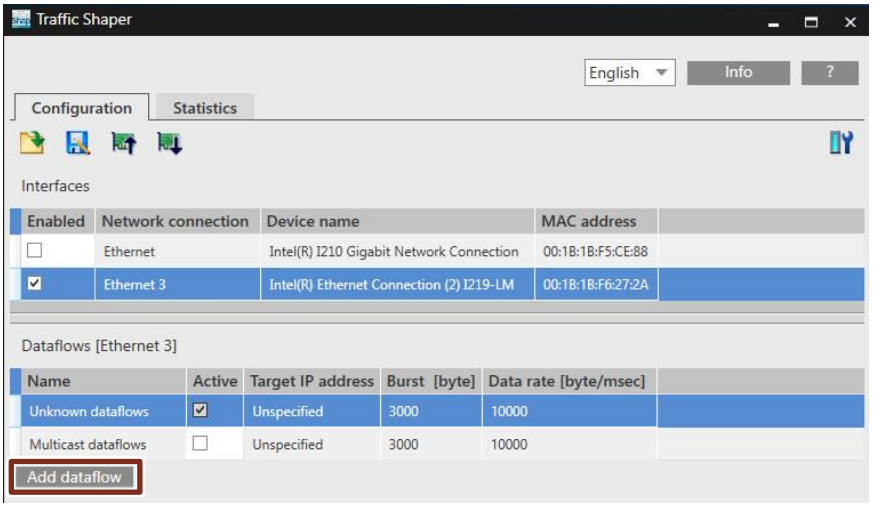
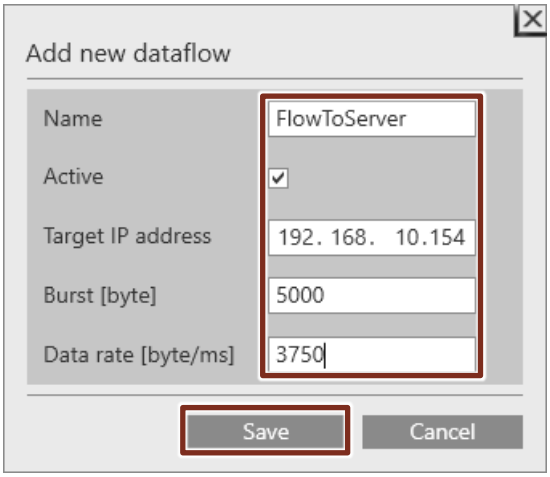
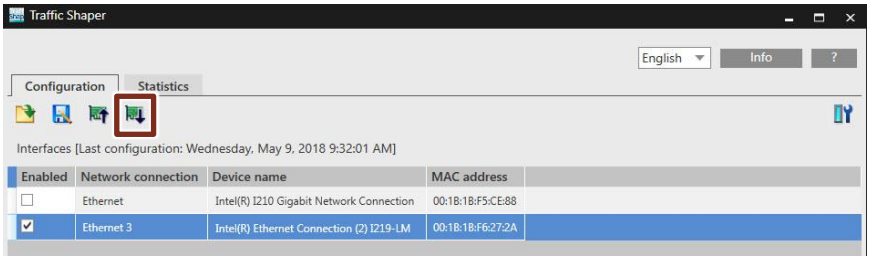
Table 2-4

No.	Action / image
1.	Open the Traffic Shaper. **Note**: When you open the Traffic Shaper for the first time after installation, the "Interface selection" window opens. Continue with Step 3.
2.	Click on the "select interfaces for configuration" button. 
3.	In the following window, select the desired interfaces of your device (here "Ethernet 3"). Check the box in the "Selected" column.  **Note:** Only interfaces of Siemens components can be monitored.
4.	To be able to configure the selected interfaces on the user interface of the Traffic Shaper, click the "Ok" button.
5.	Confirm the opened "Interface Selection" dialog with "Yes". You are back on the user interface of the Traffic Shaper and see the newly selected interfaces.
6.	Activate the Traffic Shaper for the interface you are using (here "Ethernet 3") by ticking the table in the "Enabled" column. 

Configuring the data rate of the interfaces

To control the data rate of the interface, you can add individual data flows and interfaces. The table below shows you the procedure.

Table 2-5

No.	Action / image
1.	Select the interface that you want to limit the outgoing data for.
2.	To add a new data flow, click on the "Add dataflow" button. 
3.	A new dialog opens. Define the name of the data flow and the parameters for controlling the outgoing data. Click the "OK" button to complete the configuration. **Note:** Conversion factor Byte/ms to Mbit/s (x*1000*8)/10^6. 
4.	Load the current configuration of the Traffic Shaper to the interface driver. Click on the " Load configuration to network card" button. 

Statistical evaluation of the monitored interfaces

Under the tab "Statistics" you can see the following information:

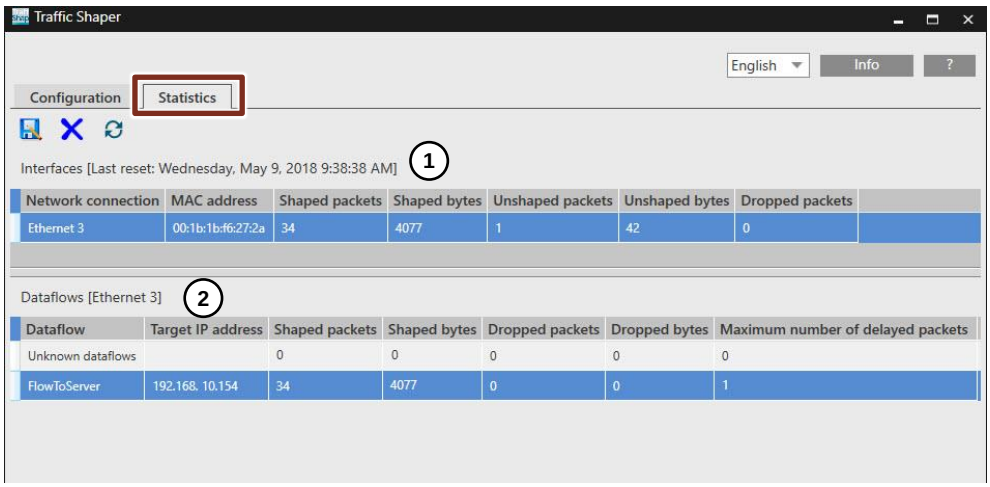
- how much data was limited by the Traffic Shaper
- how much data has passed through a monitored interface.

The "Interfaces" overview shows how many frames and bytes were limited and buffered or passed through the interface without intervention (1).

As soon as you select an interface, you can view the statistics for the individual data flows (2).

The following figure shows the "Statistics" tab.

Abbildung 2-3



Note

The data flow "Unknown dataflows" contains the data flows and destinations that were not limited by the Traffic Shaper and were fed into the network via the interface.

2.4 Configuration of the camera

Note

Only the configuration of the network camera D-Link DCS-7513 used in the application example is described here.

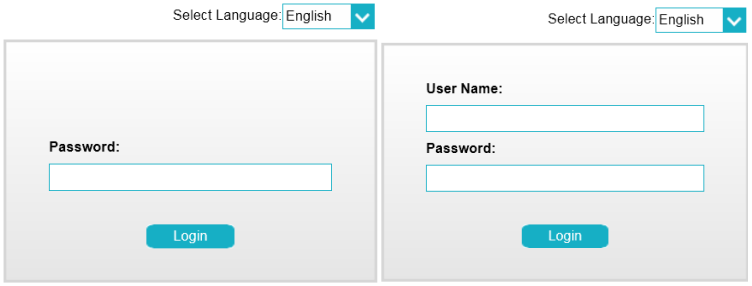
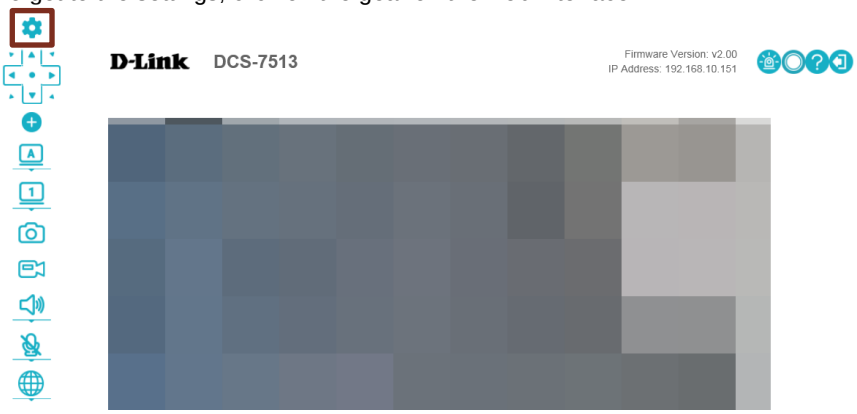
If you use another network camera, follow the instructions in the corresponding manual.

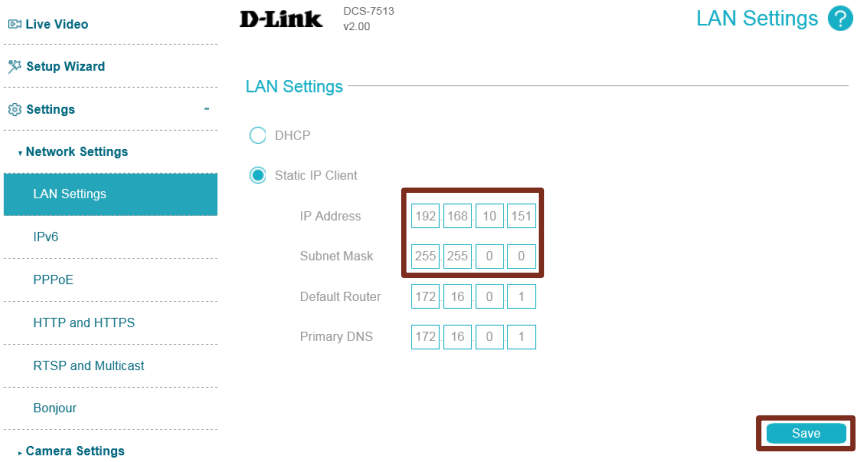
The network camera DCS-7513 symbolizes the data flow with high priority in this application example. The live broadcast of the camera must not be disturbed by data flow with lower priority.

Assign the IP address for the DCS-7513 network camera

The network camera must be in the same subnet as the PG/PC and the MICROBOX PC. Assign the camera an IP address via the web interface. The following section describes how to proceed after initial startup.

Table 2-6

No.	Action / image
1.	Connect to the network camera via a browser by entering the previous IP address of the camera in the address bar.
2.	Log in as an administrator (image left) or other user (image right) with the password you have entered on the web interface of the DCS-7513. 
3.	To get to the settings, click on the gear on the web interface. 
4.	Under "Settings", click the "Network Settings" drop-down menu. The "LAN settings" will open.

No.	Action / image
5.	Enter the required "IP Address" (here 192.168.10.151) and subnet mask (here 255.255.0.0). Make sure that they are on the same subnet as the IP addresses of the other participants. 
6.	Confirm your settings by clicking on the "Save" button.

Note

You can freely choose the camera settings of the network camera you are using. You do not need to create a special video profile for this application example.

2.5 Setting up JPerf

JPerf generates the additional data flow in the MICROBOX PC, which is controlled by the Traffic Shaper.

To do this, you must install and set up JPerf on the server side (PG/PC) as the data receiver and on the client side (MICROBOX PC) as the load generator.

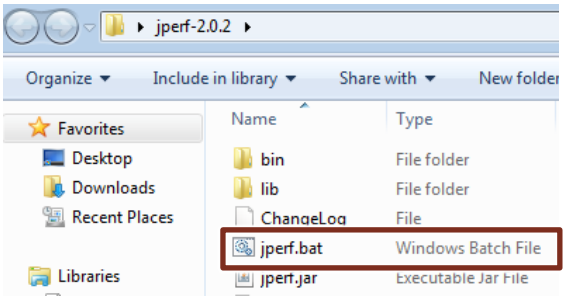
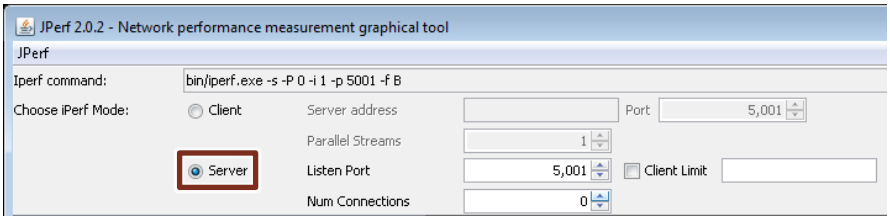
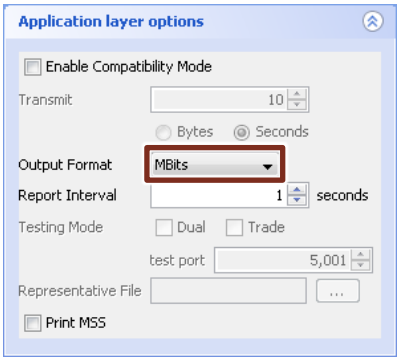
Note To install JPerf, follow the "README.txt" file included in the download.

Setting up JPerf on the PG/PC (server side)

To show the function of the Traffic Shaper with JPerf, you must first set up the JPerf server. The JPerf server indicates the maximum data flow it receives per second from the JPerf client.

The following table describes the settings that you must select for JPerf on the server side.

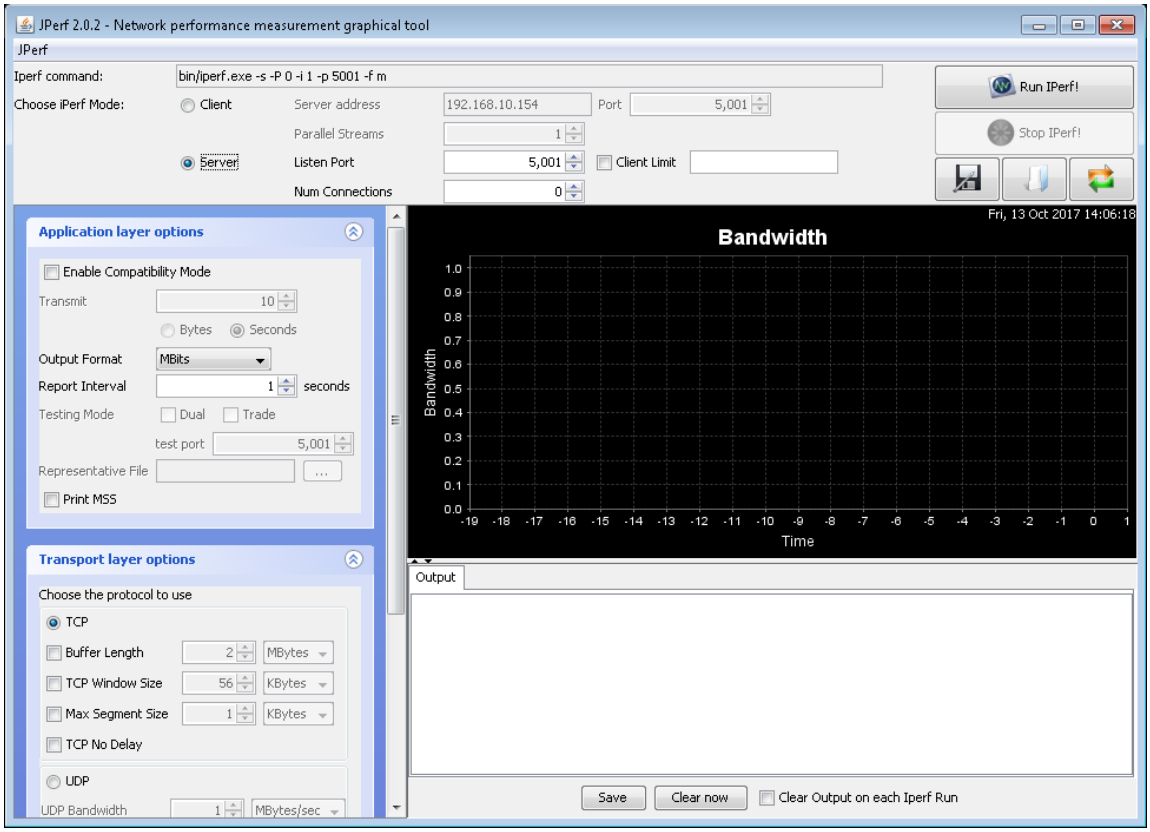
Table 2-7

No.	Action / image
1.	Open JPerf by running the jperf.bat file in the folder. 
2.	Change the mode of the application to "Server" by activating the check box "Server". 
3.	Choose how the bandwidth should be displayed. For this application example the "Output Format" "MBits" is used. 

With the changes made earlier, the JPerf server is configured for this sample application. Now you can see on the surface of the JPerf server how much data the client sends to the server.

The following figure shows the JPerf user interface on the server side for this sample application.

Figure 2-4

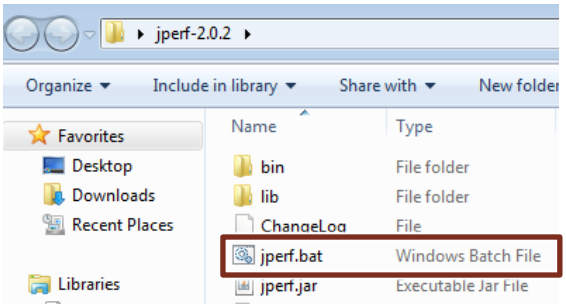
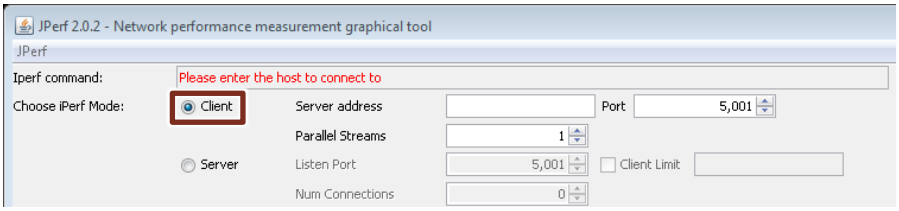
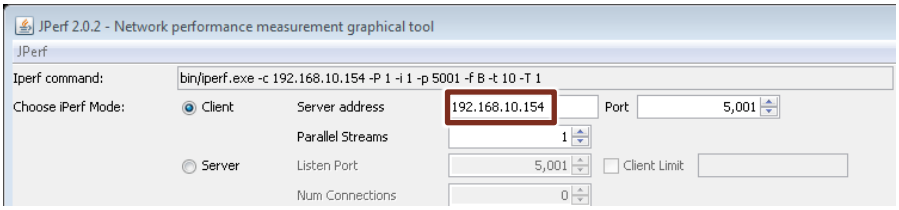
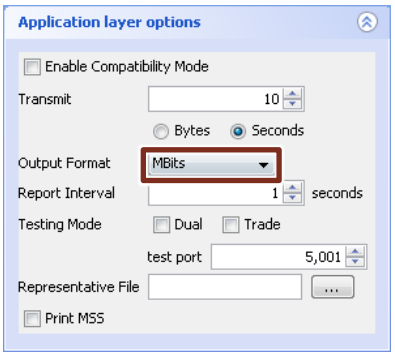


Setting up JPerf on the MICROBOX PC (client side)

After setting up the JPerf server, you must configure the JPerf client on the MICROBOX PC.

The following table describes the settings that you must select for JPerf on the client side.

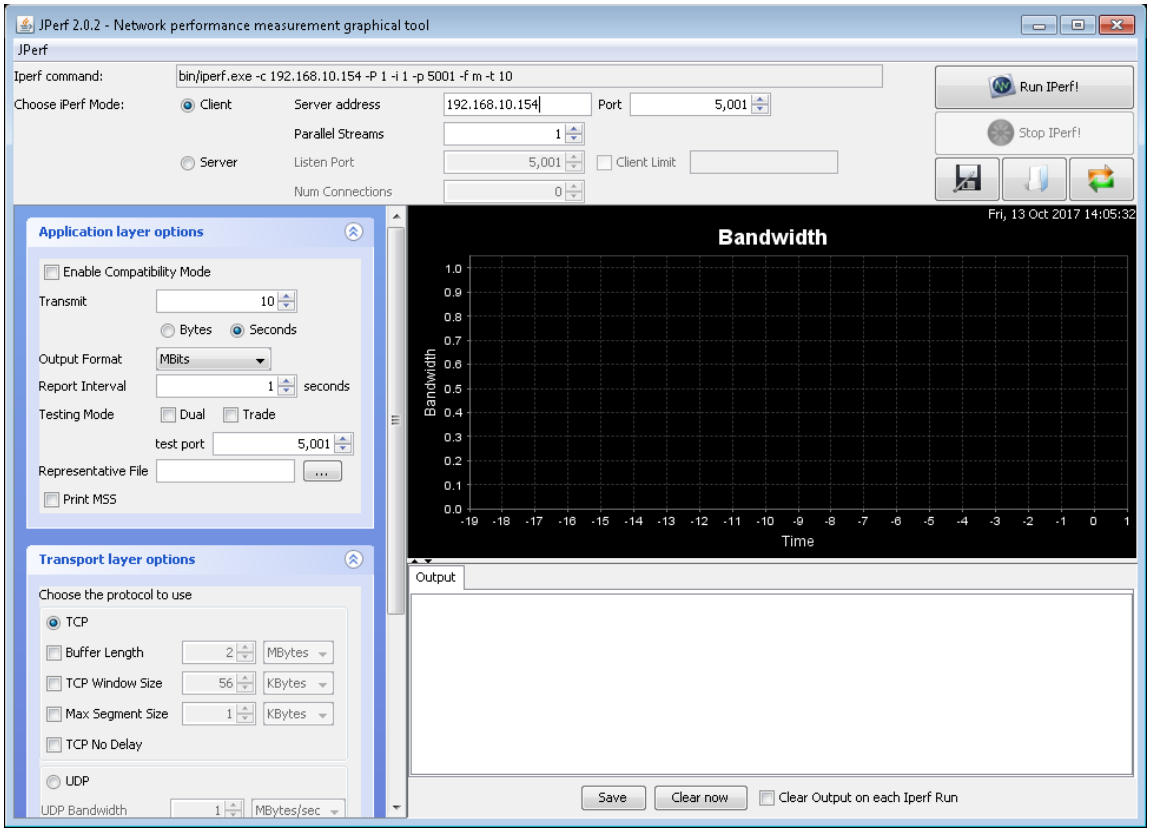
Table 2-8

No.	Action / image
1.	Open JPerf by running the jperf.bat file in the folder. 
2.	Change the mode of the application to "Client" by activating the check box "Client". 
3.	Under "Server address", enter the IP address under which the JPerf server can be reached (here "192.168.10.154"). 
4.	Choose how the outgoing bandwidth should be tested. The seconds mode, which is activated by the selection of the check box "Seconds" is best suited for displaying the bandwidth limitation. Choose how many seconds the outgoing bandwidth is tested for. Enter the number of seconds and the "Output Format" in the "Transmit" text box (here the data transfer is monitored for ten seconds and displayed in the Mbits format). 

Now you can generate data load from the JPerf client. This generated data flow corresponds to the maximum possible data flow that exists over the network in which the JPerf server and client reside.

The following figure shows the JPerf user interface on the client side for this sample application.

Figure 2-5

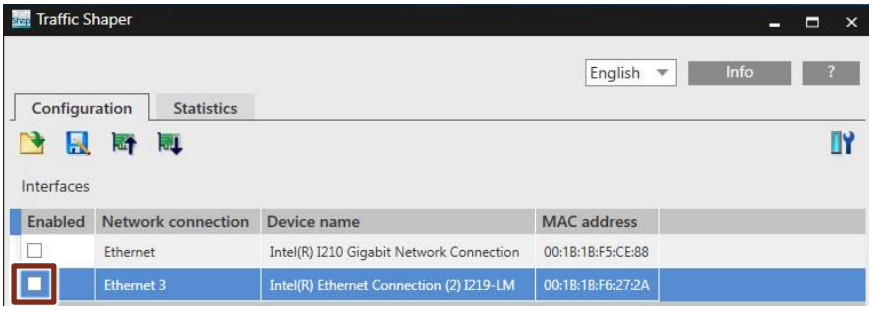
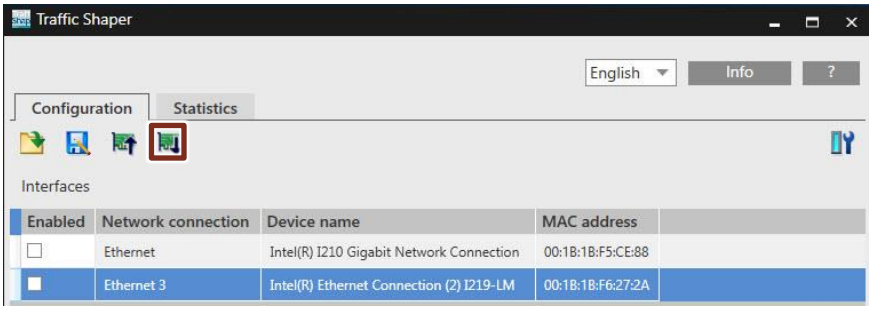
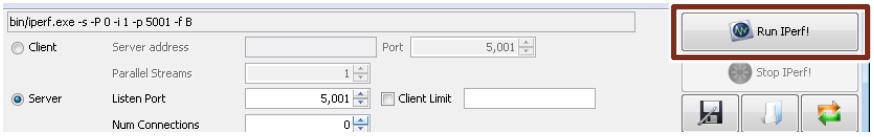
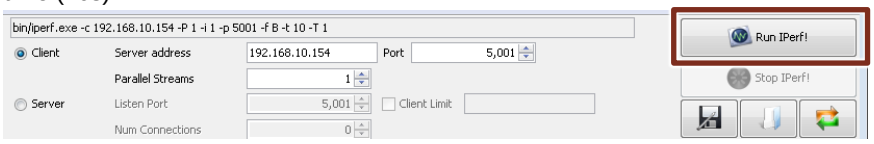


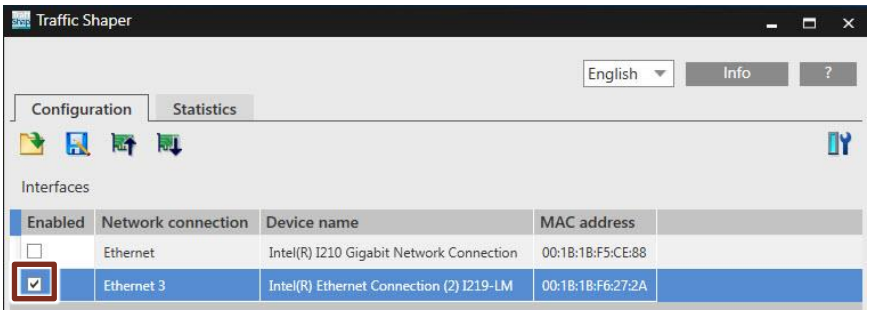
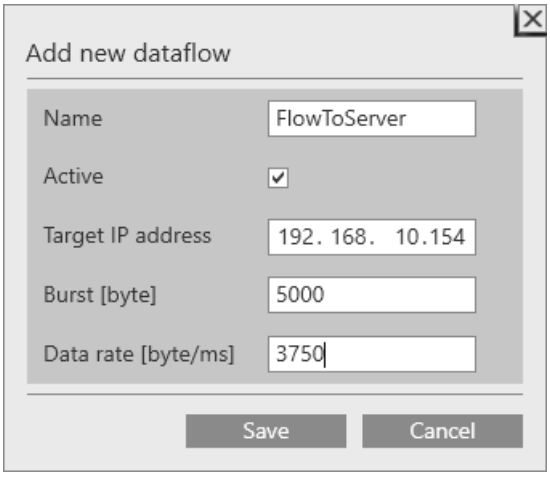
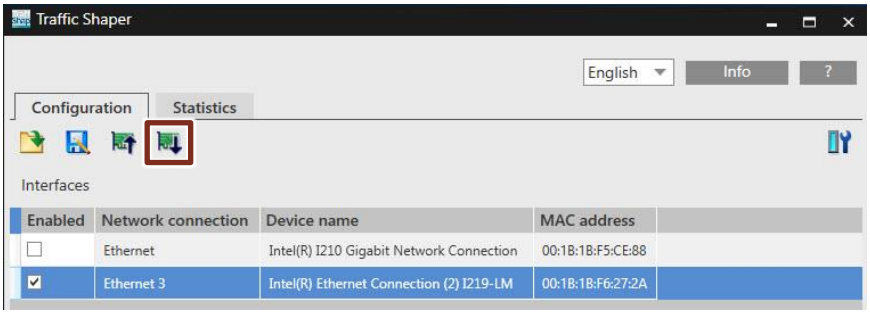
2.6 Checking the function

By setting up JPerf client on the MICROBOX PC and JPerf Server on the PG/PC you can test how large the bandwidth between the two network participants is.

This section shows you how to check the function of the Traffic Shaper with JPerf.

Table 2-9

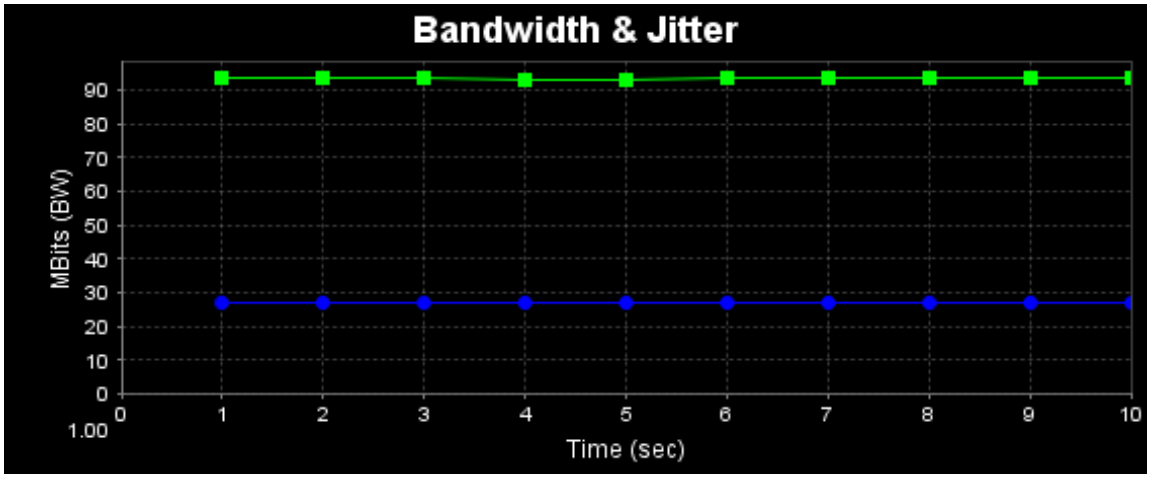
No.	Action / image
1.	Open the user interface of the Traffic Shaper on the MICROBOX PC.
2.	Disable the Traffic Shaper for the interface you are using. Remove the check mark in the table in the column "Enabled". 
3.	Load your configuration to the driver of the interface. 
4.	Set up the JPerf client and JPerf server side as described in Section 2.5.
5.	Activate the JPerf server on the PG/PC. Click on the button "Run JPerf!" top right on the user interface. 
6.	Now switch to the JPerf client on the MICROBOX PC.
7.	Start a data transfer to the JPerf server. Click on the button "Run JPerf!" for this too. **Note**: From now on the traffic generated by JPerf will run for the projected time (10s). 
8.	On the server side you can now see the maximum possible traffic between the two stations.
9.	Reopen the user interface of the Traffic Shaper.

No.	Action / image
10.	Now activate the Traffic Shaper for the interface you are using. Put the check mark in the table in the column "Enabled". 
11.	Create a flow in the Traffic Shaper, as described in Section 2.3.2, or use a previously created one. The following figure shows the parameter assignment used for the application example. 
12.	Load your configuration to the driver of the interface. 
13.	Repeat Steps 6 and 7 of this table.
14.	On the server side, you can now see that the maximum data flow that can be exchanged between the stations has been reduced. This ensures that the high priority data is not disturbed by the lower priority data. This prevents packet loss of the high priority data.

The following figure shows the two different bandwidths in the plot of the JPerf server (scale in Mbit per second). The green graph shows the maximum possible data flow without intervention of the Traffic Shaper. The blue graph shows the maximum possible data flow with intervention of the Traffic Shaper. The previously calculated limit of 30 Mbits is reached. The flow is set as described in Table 2-9 Step 11.

It can be clearly seen that the Traffic Shaper limits the data flow. This excludes data loss of the data flow with higher priority.

Figure 2-6



3 Appendix

3.1 Service and support

Industry Online Support

Do you have any questions or need assistance?

Siemens Industry Online Support offers round the clock access to our entire service and support know-how and portfolio.

The Industry Online Support is the central address for information about our products, solutions and services.

Product information, manuals, downloads, FAQs, application examples and videos – all information is accessible with just a few mouse clicks:
https://support.industry.siemens.com

Technical Support

The Technical Support of Siemens Industry provides you fast and competent support regarding all technical queries with numerous tailor-made offers – ranging from basic support to individual support contracts. Please send queries to Technical Support via Web form:
www.siemens.com/industry/supportrequest

SITRAIN – Training for Industry

We support you with our globally available training courses for industry with practical experience, innovative learning methods and a concept that's tailored to the customer's specific needs.

For more information on our offered trainings and courses, as well as their locations and dates, refer to our web page:
www.siemens.com/sitrain

Service offer

Our range of services includes the following:

- Plant data services
- Spare parts services
- Repair services
- On-site and maintenance services
- Retrofitting and modernization services
- Service programs and contracts

You can find detailed information on our range of services in the service catalog web page:
https://support.industry.siemens.com/cs/sc

Industry Online Support app

You will receive optimum support wherever you are with the "Siemens Industry Online Support" app. The app is available for Apple iOS, Android and Windows Phone:
https://support.industry.siemens.com/cs/ww/en/sc/2067

3.2 Links and Literature

Table 3-1

No.	Topic
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Link to this entry page of this application example https://support.industry.siemens.com/cs/ww/en/view/109750661

3.3 Change documentation

Table 3-2

Version	Date	Modifications
V1.0	05/2018	First edition