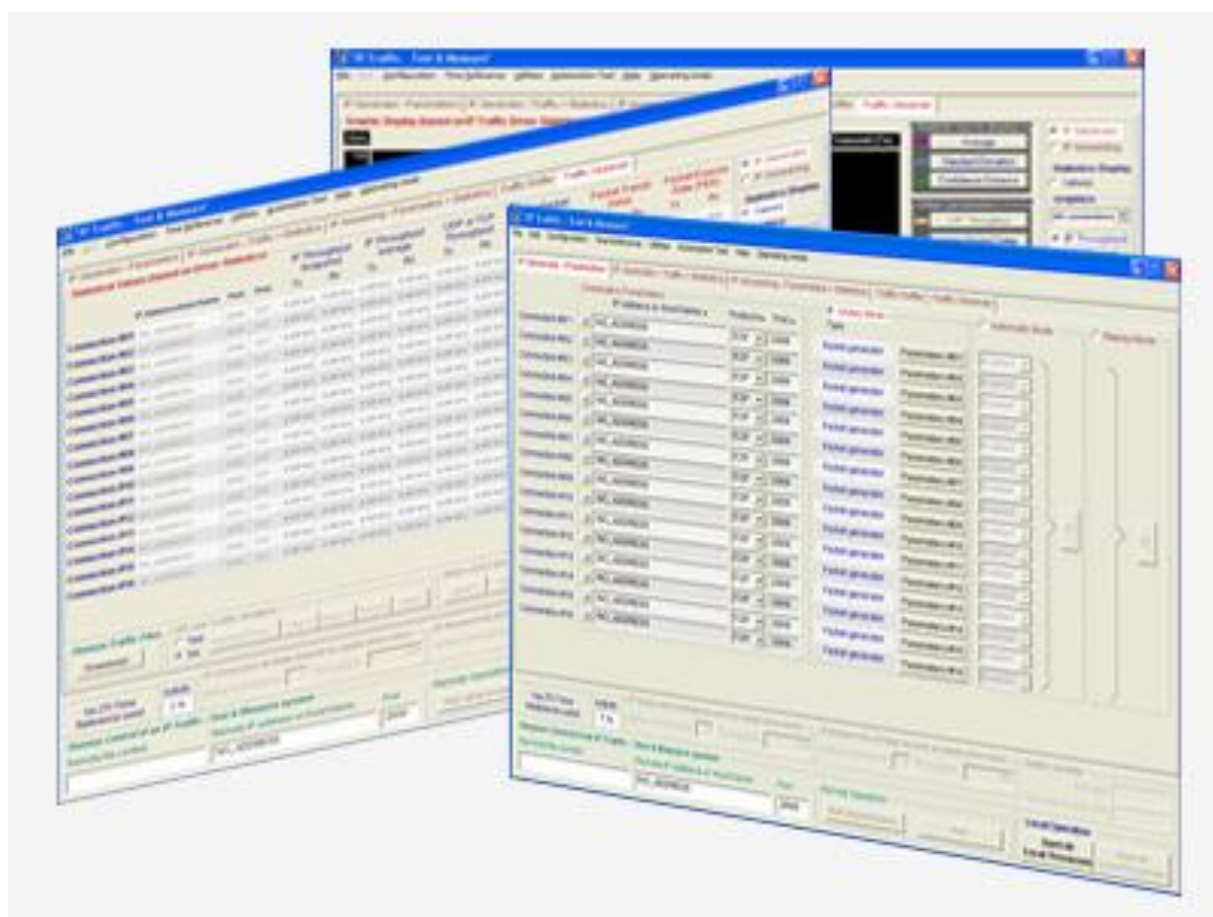


Version 2.7

IP Traffic Generator & QoS Measurement Tool for IP Networks (IPv4 & IPv6)

FTTx, LAN, MAN, WAN, WLAN, WWAN, Mobile, Satellite, PLC...



User Guide

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PART 0 Preface

0.1 Organization of this manual

This manual is aimed at helping you to discover and use **IP Traffic - Test & Measure**. It is organized as follows:

- **Part 1: Product Overview**

Describes the key features of the **IP Traffic - Test & Measure** and **Automation Tool for IP Traffic - Test & Measure**.

- **Part 2: What's new in IP Traffic - Test & Measure version 2.7**

Is a general overview of new features, main improvements provided with **IP Traffic - Test & Measure** version 2.7.

- **Part 3: Install IP Traffic - Test & Measure**

Presents the product requirements, how to install the software downloaded from the Internet or from the CD-ROM, provides important information to upgrade from previous versions and explains how to choose the most suitable **IP Traffic - Test & Measure** package.

- **Part 4: How to handle your license?**

Describes how to proceed for the license transfer

- **Part 5: Uninstall IP Traffic - Test & Measure**

Explains how to uninstall the software

- **Part 6: Getting Started**

New users can use this help as an introduction to **IP Traffic - Test & Measure** and generate or receive traffic with the IPv4 protocol in a few clicks.

- **Part 7: Run IP Traffic - Test & Measure**

Details how to run the software.

- **Part 8: IP Traffic - Test & Measure and Windows Firewall**

Gives details about the way to configure the Windows firewall to authorize the use of **IP Traffic - Test & Measure**.

- **Part 9: Graphical User Interface**

Presents the **IP Traffic - Test & Measure** Graphical User's Interface, i.e. the main rules and principles of representation and display.

- **Part 10: Using IP Traffic - Test & Measure**

How to use **IP Traffic - Test & Measure**. This part includes the menu and functionalities description. It is based on windows and tabs description. Each tab is presented separately.

- **Part 11: Calculation Mode for the Statistics**

This part describes the rules and methods used to calculate statistics displayed by **IP Traffic - Test & Measure**.

- **Part 12: Command Line Parameters**

How to use a command line with parameters to start or to stop **IP Traffic - Test & Measure**.

- **Part 13: Appendix**

Provides additional information about the mathematical laws used by **IP Traffic - Test & Measure**, **IP Traffic - Test & Measure** traces, configuration parameters saved in the Registry database, default values of a new context, information on external objects for the 'IP Generator' module (file or DLL).

- **Part 14: Examples of sniffed traffic files**

Eight sample files (containing IP packets captured with the '**Traffic Sniffer**') are provided with **IP Traffic - Test & Measure**. These files can be used with the off-line mode of the '**Traffic Observer**'.

0.2 Minimum System Requirements

To appropriately operate **IP Traffic - Test & Measure** you need the following minimum system requirements:

- All modern versions of Microsoft Windows are supported - from XP to Windows 8 with 32-bit or 64-bit environment, including Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows Seven and Windows 8.
- Pentium processor with 512 MB memory
- 1024 x 768 display
- 25 MB free hard disk space

0.3 References

[WINSOCK2] « Windows Socket 2 - Application Programming Interface » Revision 2.2.0 - May 10, 1996

[IPv6-XP] <http://www.microsoft.com/windowsserver2003/technologies/ipv6/ipv6.msp>

[RFC2544] "Benchmarking Methodology for Network Interconnect Devices"

[RFC2460] "Internet Protocol, Version 6 (IPv6) - Specification"

[RFC2373] "IP Version 6 Addressing Architecture"

[RFC1889] "RTP: A Transport Protocol for Real-Time Application" explaining the jitter calculation.

0.4 Terms used in this document

<i>Interface</i>	<i>Generic term used to reference a NIC (LAN adapter), a connected RAS connection (ISDN, ADSL, Modem) or a tunneling path.</i>
<i>Tooltip</i>	<i>A tooltip is a popup window displayed when you move the mouse over a sensitive area. IP Traffic - Test & Measure displays the tooltip during 5 seconds.</i>
<i>Automation</i>	<i>Automation is an add-on scripting tool used to pilot automatically IP Traffic - Test & Measure.</i>

0.5 Technical Support

ZTI Communications Technical Support can assist you with all your technical problems from installation to troubleshooting. Before contacting our Technical Support, please read the relevant sections of the product documentation and the “Read Me First” file.

Before contacting our technical support, make sure you record the following information:

- Product name and version.
- Demo version or licensed product.
- System configuration.
- Problem details: settings, error messages...
- If the problem is persistent, give the details of how to create the problem.

You can contact Technical Support by:

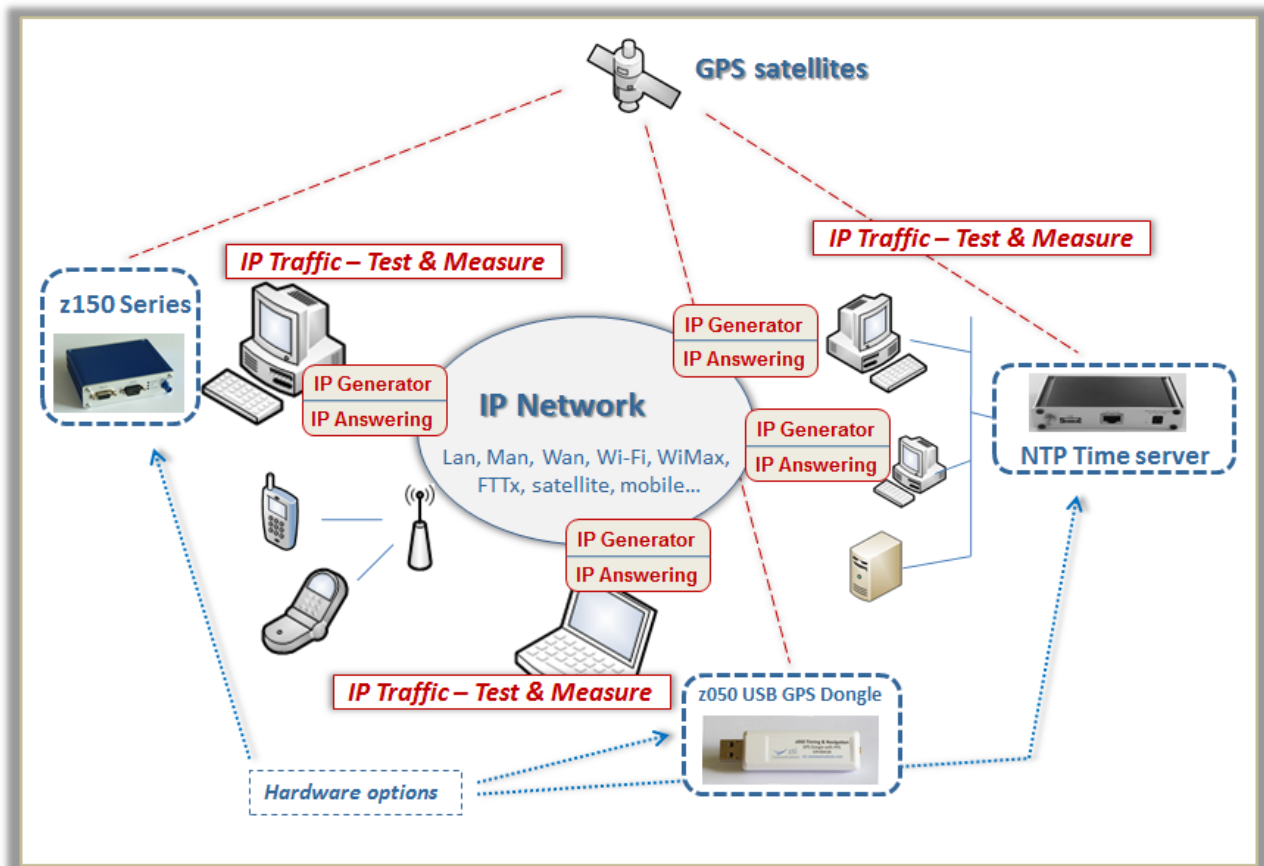
Email	Send as many details as possible to support@zti-communications.com
Telephone	Telephone support is available from 09:00 am to 06:00 pm (GMT Time +01:00 or +02:00), Monday to Friday. Call on +33 2 9613 4003

PART 1 Overview

1.1 General Description

IP Traffic - Test & Measure is a connection and data generation tool for IP networks. Data flows use TCP (Transmission Control Protocol), UDP (User Datagram Protocol) or ICMP (Internet Control Message Protocol) protocols, which are used by mailing exchanges, file transfers, ping programs and World Wide Web transmissions.

Various testing configurations can be implemented using more than two PCs. **IP Traffic - Test & Measure** establishes TCP, UDP or ICMP connections between PCs through IP networks.

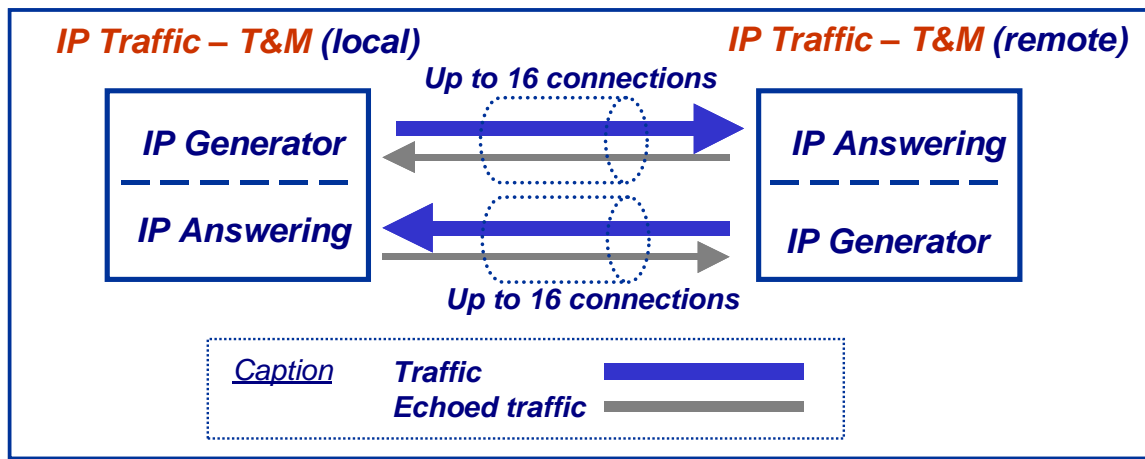


IP Traffic - Test & Measure is an IP software testing tool using the Microsoft Windows TCP/IP stack (Winsock2 interface). So, **IP Traffic - Test & Measure** is independent of any transmission or telecom link and can use any transmission link managed by the Windows operating system: LAN (Ethernet, Token-ring, hyperlan...), WLAN, WAN (modem, ISDN, ATM, ADSL, FTTx, satellite link...), remote access, mobile or cellular networks.

IP IP Traffic - Test & Measure can be used to get high accuracy measurements by using optional hardware providing a very precise time reference thanks to both the Time Devices synchronized by GNSS receivers GPS devices or Network Time Servers).

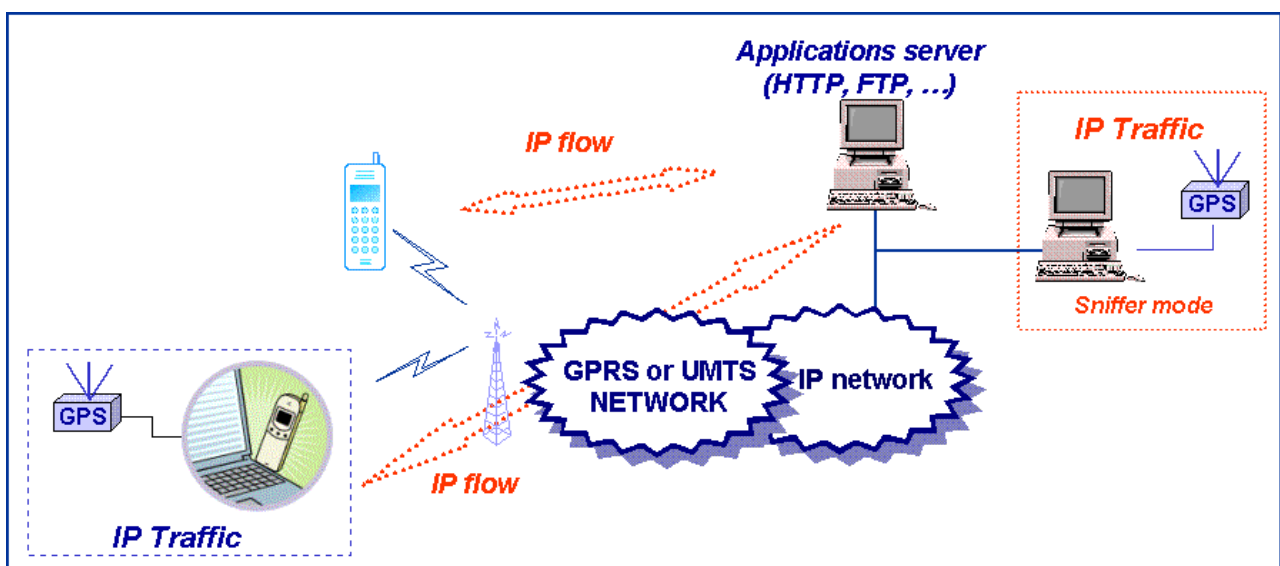
IP Traffic - Test & Measure is composed of four modules: 'IP Generator', 'IP Answering', 'Traffic Sniffer' and 'Traffic Observer'.

- 'IP Generator' is able to generate IP traffic on 16 simultaneous connections.
- 'IP Answering' is able to receive IP traffic on 16 simultaneous connections with different working modes (Absorber, Absorber file, Echoer, Echoer file and Generator).



The 'IP Generator' and 'IP Answering' modules

- **'Traffic Sniffer'** is able to capture traffic files at the driver level (under the TCP/IP stack) in order to calculate traffic statistics and to add a timestamp to the IP packets and to put them into a file. The **'IP Generator'** module can replay these traffic files.



IP Traffic - Test & Measure: Sniffer mode

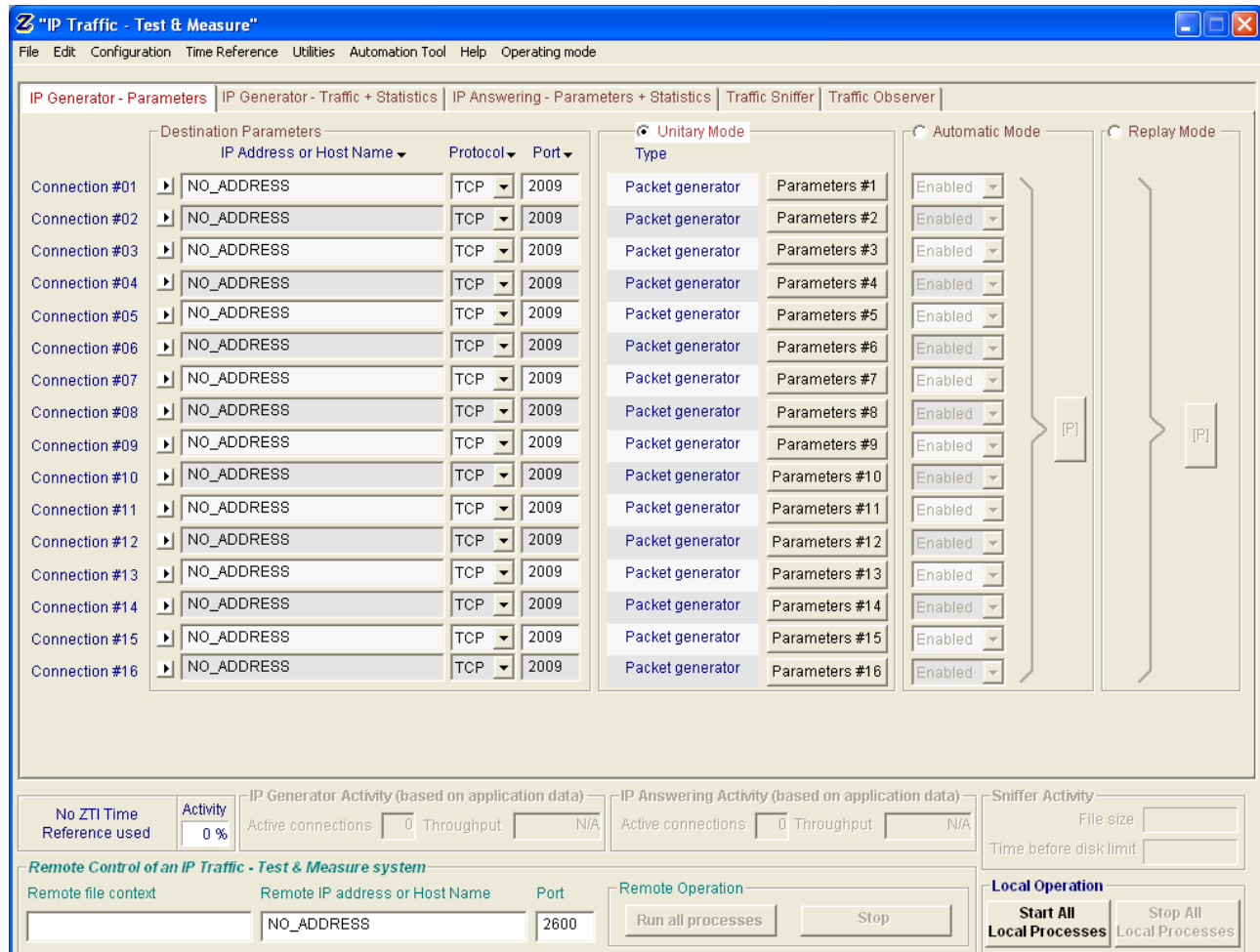
IP Traffic - Test & Measure can be used to capture IP traffic with the **'Traffic Sniffer'**: for example, the IP flows between a mobile and an application server (web, video telephony...) can be captured and saved in a file. IP packets are time-stamped, to replay IP traffic with the same timing as for the capture. The user can then use an internal **IP Traffic - Test & Measure** algorithm in order to obtain two traffic files (traffic client file and traffic server file). These traffic files can be used by the **IP Traffic - Test & Measure** generator as source traffic.

- **'Traffic Observer'** is a powerful **graphic tool** to display and visualize traffic statistics of IP connections. Statistics are displayed in real time [on-line mode] or by using an off-line mode [user can replay traffic files by using a 'video recorder' mode (play, pause, stop) with index management].
'Traffic Observer' online mode displays real time statistics for the **'IP Generator'** or the **'IP Answering'** modules.
'Traffic Observer' offline mode provides QoS statistics as 'Packet Erasure Rate' and 'Packet Transit Delay'.

IP Traffic - Test & Measure can be operated with two main modes:

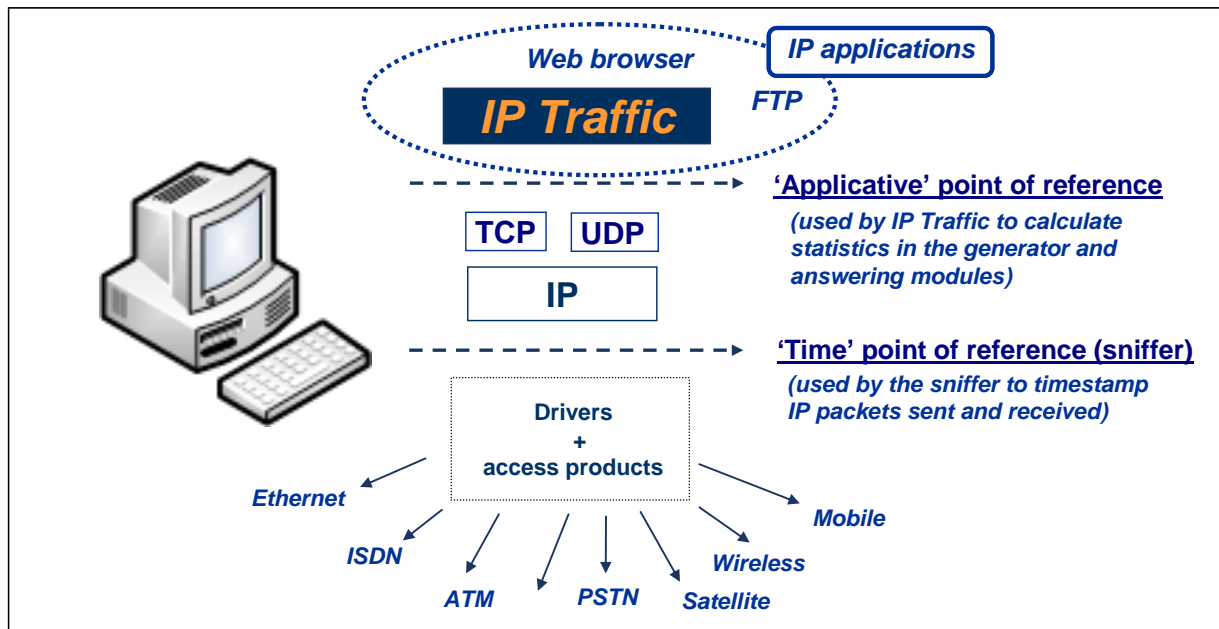
- The **normal** mode: the user can access all commands and functionalities
- The **remote control** mode: the user can't access locally commands of **IP Traffic - Test & Measure**. It's mainly used for control by a remote **IP Traffic - Test & Measure** system. It's very useful for example to use an **IP Traffic - Test & Measure** system as a server that the user can operate remotely.

The design of the **IP Traffic - Test & Measure** man machine interface offers a main window allowing easy access to all functionalities and commands. Counters and indicators give an overview of the overall traffic activities.



IP Traffic - Test & Measure main window

1.2 Architecture



Two points of reference are used by **IP Traffic - Test & Measure**.

'Applicative' point of reference

In the **'IP Generator'** and the **'IP Answering'** modules, statistics (e.g. throughput, RTT...) are calculated at the application level (above the TCP/IP stack). These statistics refer to data sent or received by **IP Traffic - Test & Measure**, and are independent of the protocol (TCP or UDP).

'Time' point of reference

The **'Traffic Sniffer'** uses this point of reference in order to timestamp sent and received IP packets. Timestamp of packets is made at the nearest of the physical link (under the TCP/IP stack). Therefore, **IP Traffic - Test & Measure** can identify lost and retransmitted IP packets. Values and statistics of the **'Traffic Observer'** tab use this point of reference.

To get a good accuracy to timestamp IP packets, additional time devices are available as described in the following paragraph.

When no additional hardware is used the **'Traffic Sniffer'** uses the PC internal clock to timestamp sent and received IP packets. Because the PC internal clock can't provide an absolute time reference and needs to be synchronized with all the PCs internal clocks used by **IP Traffic - Test & Measure**, ZTI Communications recommends an additional time device to allow a precise calculation of the propagation delays through IP networks.

1.3 Use a hardware time device to get high precision measurements

Thanks to our hardware add-ons, you are able to get a precise time reference which can be used to get precise measurements of QoS metrics provided by **IP Traffic - Test & Measure**. With such add-ons, you can measure for example the transit delay of IP packets sniffed on the network with an uncertainty of 1 millisecond maximum depending on the configuration you chose.

◆ GNSS Device (Timing & Navigation or High Precision Timing)



z050 Timing & Navigation Module: GPS USB Dongle with PPS (Pulse Per Second) usable for timing applications via serial port emulation). Based on the Trimble technology (Trimble OEM), this sensitive GPS receiver acquires autonomously GPS satellite signals and quickly generates reliable position in extremely challenging environments and even under poor signal conditions. It is recommended to use an outdoor antenna for best results.

z150 Series: GNSS Multi Receivers Platform for Timing & Navigation (Static or mobile application) in robust aluminum enclosure.

3 models available:

- * Model P200 (GPS): 1 port RS232 + 1PPS-out

- * Model P300 (GPS): 1 port RS232 + 1 port USB + 1PPS-out

- * Model P400 (GPS, GLONASS, GALILEO, COMPASS): 1 port RS232 + 1 port USB + 1PPS-out

Operating temperature range: -30°C (-22°F) to +85°C (185°F).



Designed to provide an accurate pps (pulse per second) signal to use in measurement and industrial applications, this GPS/Glonass/Galileo timing module is designed to be used in indoor or outdoor static applications, requiring accurate time stamp reference information. It delivers accurate pps signal, even in very poor signal level environments (indoor, urban canyons and obscured environments) or when only 1 satellite is visible and being tracked..

◆ NTP Time Server



As an example, z250 NTP Time Server has been designed around the Trimble® BD910 GNSS receiver module, originally for applications requiring high accuracy from multiple GNSS constellations in a very small enclosure. Mobile platforms can now embed proven Trimble RTK technology using a very compact enclosure 108.5 x 84 x 30mm form factor. z250 supports the L1 frequency from the GPS, GLONASS, Galileo, and Compass constellations. Customers benefit from the Ethernet connectivity available from RJ45 connection, allowing high speed data transfer and configuration via standard web browsers. USB and RS-232 are directly available from the enclosure..

♦ *Time Reference Accuracy vs configuration chosen*

Configuration	Absolute Time reference	Accuracy for Measurement
IP Traffic – Test & Measure	None or user defined.	Undefined (PC clock used)
IP Traffic – Test & Measure + z150 Series unit (Serial or USB port)	YES , provided by the time device synchronized by the GNSS chipset (GPS, GLONASS, etc.). Absolute reference.	5 milliseconds
IP Traffic – Test & Measure + z050 (USB GPS dongle)	YES , provided by the time device synchronized by GPS. Absolute reference.	1 millisecond
IP Traffic – Test & Measure + NTP Time Server (e.g. z250) (one unit for multiple PCs running IP Traffic – T&M)	YES , provided by the NTP Time Server synchronized by GNSS chipset (GPS, GLONASS, etc.). Absolute reference.	1 millisecond

1.4 IP Traffic - Test & Measure Key Features

Module 1: 'IP Generator' Overview

- The '**IP Generator**' module generates up to 16 simultaneous UDP (Unicast, Multicast or Broadcast) and/or TCP connections and/or ICMP connections. The connections can be established following three different testing modes:

⇒ **Unitary Mode:** you can choose among two type of data generator

Internal data generator: you can select the traffic generator data source and configure packets size and inter packet delay for each connection. With the ICMP protocol you can set:

- Request packet number and content: packet generator (fixed, randomized, alternated and increasing / decreasing).
- Request data size: fixed, randomized, alternated and increasing / decreasing.
- Reply receiving timeout: fixed, randomized, alternated, increasing / decreasing or use of a mathematical law.

IP Traffic - Test & Measure offers three different data sources:

- Automatic data generator by using mathematical laws⁽²⁾,
- Packets generator: many parameters can be defined (number of packets to send, inter packet delay, packet contents, ...)
- File: selection of a file to send ⁽²⁾.

External data source generator ⁽²⁾: select a file or an external DLL providing traffic to send (packet starting time, size, contents, inter packet delay...) and if needed use of a loop counter with an idle time between each loop.

⇒ **Automatic mode** ⁽²⁾: use of a mathematical law for connections generation starting time and another mathematical law for data volume to send, in order to generate up to 16 outgoing IP connections. This mode can not be used with ICMP connections.

⇒ **Replay sniffed traffic** ⁽²⁾: use of a traffic file previously captured by the Traffic Sniffer and the 'IP Generator' module replays this traffic file with timing accordingly to time capture (IP resolution addressing is made by the user before replay).

- **Statistics:** different statistics parameters are displayed by the 'IP Generator' module for each connection

- Sent throughput ⁽¹⁾
- Received throughput ⁽¹⁾
- Sent packet throughput ⁽¹⁾
- Received packet throughput ⁽¹⁾
- Sent data volume ⁽¹⁾
- Received data volume (volume of data sent by the remote) ⁽¹⁾
- Sent packets
- Received packets (packets sent by the remote)
- Data volume to send ⁽¹⁾
- Remaining volume (of data to send) ⁽¹⁾
- Seq. numb errors (sequence numbering errors)
- Mean RTT (Round Trip Time)
- Min RTT
- Max RTT
- Jitter ⁽¹⁾

⁽¹⁾ These statistics are not available with ICMP protocol.

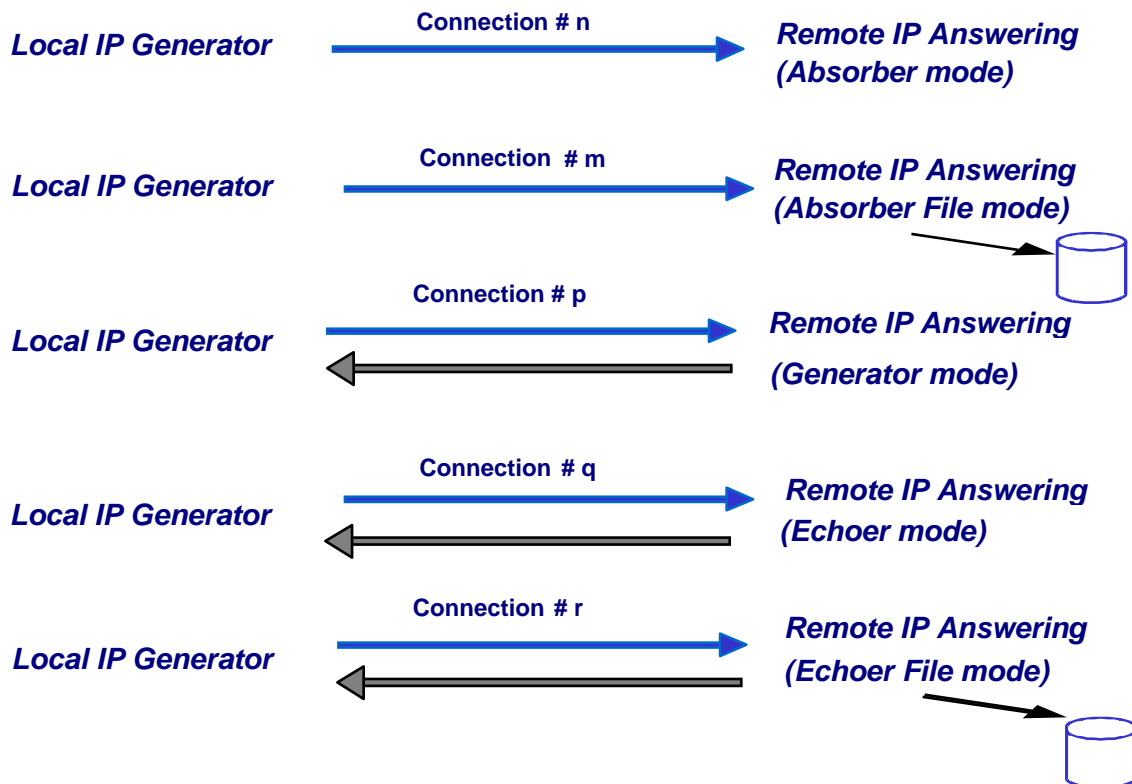
⁽²⁾ Not available with ICMP.

A RTT summary is also available. This summary shows the minimum, maximum and Mean RTT values for all connections of the 'IP Generator' part. These statistics can be saved in a CSV file defined by the user.

Module 2: 'IP Answering' Overview

- The '**IP Answering**' module receives traffic (up to 16 simultaneous connections), and operates for each connection following different working modes: '**Absorber**', '**Absorber file**', '**Echoer**', '**Echoer file**', '**Generator**' or '**Disable**'.

We will consider hereafter that the local machine is used for generating IP traffic and the remote one is used for IP answering.



- **Statistics:** different statistics parameters are displayed by the IP Answering module for each connection:
- Sent throughput
 - Received throughput
 - Sent packet throughput
 - Received packet throughput
 - Sent data volume
 - Received data volume (volume of data sent by the remote)
 - Sent packets
 - Received packets (packets sent by the remote)
 - Data volume to send
 - Remaining volume (of data to send)
 - Seq. numb errors (sequence numbering errors)
 - Data not echoed
 - Jitter

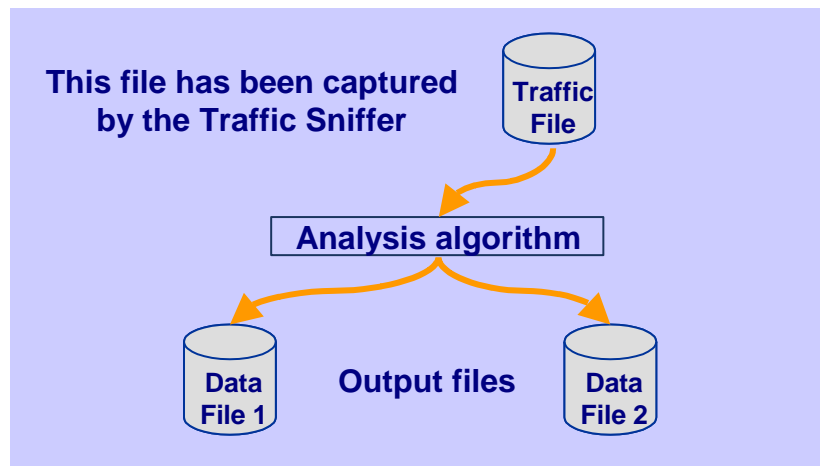
These statistics can be saved in a CSV file defined by the user.

Module 3: 'Traffic Sniffer' Overview

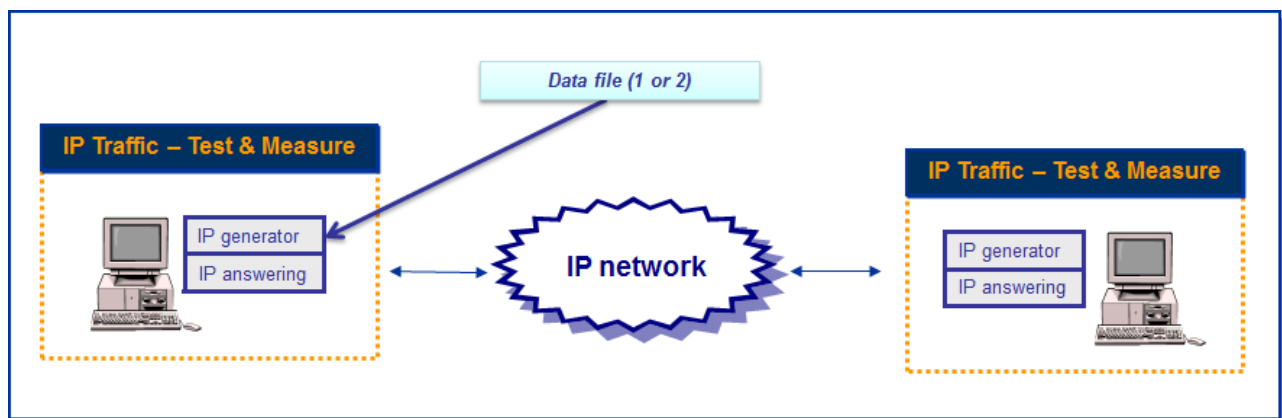
Sent and received IP packets are time-stamped by the '**Traffic Sniffer**' and then saved in a file to generate capture traffic files.

The user can define IP filters to capture IP traffic in a file.

From one traffic file captured by the 'Traffic Sniffer', an analysis algorithm produces two data files as shown below (because a traffic file contains IP packets sent and received):



Then it is possible to use a data file generated in order to replay traffic via the '**IP Generator**' module:

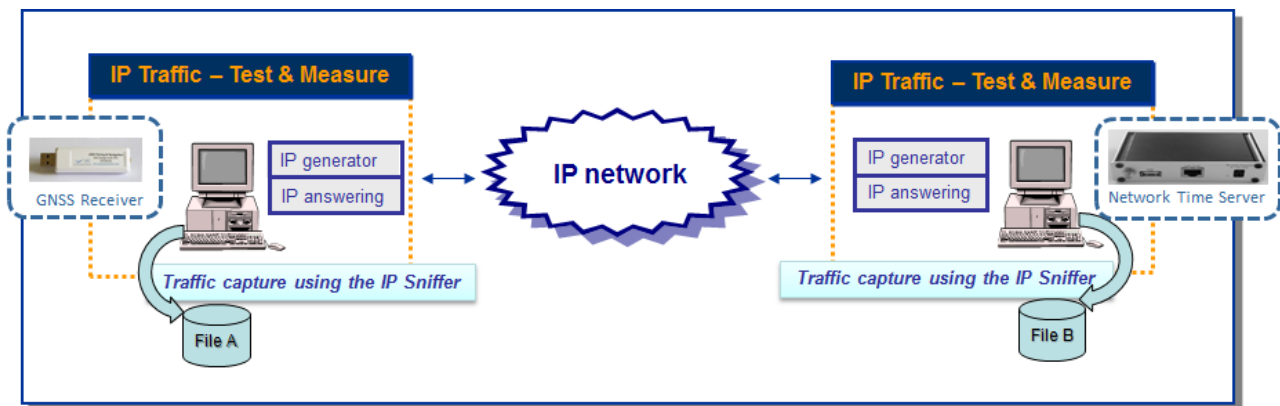


Module 4: 'Traffic Observer' Overview

The '**Traffic Observer**' online mode displays real time statistics for the '**IP Generator**' or the '**IP Answering**' modules.

The '**Traffic Observer**' offline mode provides QoS statistics as 'Packet Erasure Rate' and 'Packet Transit Delay'. But some QoS statistics as the packet Transit Delay need to have time-stamped packets from the local and the remote systems.

The off-line (batch mode) statistics are obtained using the two traffic files, File A and File B, produced by the local and remote '**Traffic Sniffer**' containing the sniffed traffic. Then, the '**Traffic Observer**' uses these files in order to calculate off-line statistics.



Below is the list of the statistics provided by the '**Traffic Observer**':

- In **red**, the statistics only available with the **offline mode**
- In **green**, the statistics available with **both modes**

□ Features available with the on-line mode

- ⇒ Select 'IP Generator' or 'IP Answering' display
- ⇒ Display of statistic parameters in a table for 16 connections:
 - IP throughput snapshot
 - IP throughput average
 - UDP or TCP throughput
 - Inter packet delay

Or

Graphic statistics display for the following parameters with triggers defined by user

- IP throughput
- Inter packet delay

The graphic display enables to choose 'all connections' or a specific connection (from 1 to 16) and to calculate in real time the following parameters: average, standard deviation and confidence distance

- ⇒ Export statistics in a CSV file with filters defined by user
- ⇒ Reset statistics
- ⇒ Help window

□ Features available with the off-line mode

- ⇒ Loading of the sniffed traffic files to analyze them and to check their coherency
- ⇒ User can replay traffic files by using a 'video recorder' mode (play, pause, stop) with index management (next, add, remove)
- ⇒ Display of statistic parameters in a table for 16 connections:
 - IP throughput snapshot
 - IP throughput average
 - UDP or TCP throughput

- Inter packet delay
- Packet erasure rate
- Packet transit delay

Or

Graphic statistics display for the following parameters with triggers defined by user

- IP throughput
- Inter packet delay
- PER (Packet Erasure Rate) quality
- Packet transit delay

The graphic display enables to choose 'all connections' or a specific connection (from 1 to 16) and to calculate the following parameters: average, standard deviation and confidence distance.

Or

Packet statistics display

For each packet:

- Packet Status: Lost or Sent
- Transit Delay
- Packet transit delay
- IP size
- IP Identification (available for each packet with IPv4 and only on fragment packets in IPv6)

For each connection (TCP or UDP) and for each side:

- Number of sent packets
- Mean Transit Delay
- Mean Jitter
- Number (and percentage) of lost packets
- Number of TCP packets which have been retransmitted (only for TCP connection)

- ⇒ Export statistics in a CSV file with filters defined by user (the GPS location is also exported in this CSV file).
- ⇒ Reset statistics
- ⇒ Help window

IP Traffic - Test & Measure performs the RFC 2544 with 2 differences:

- 1) It doesn't support the automatic recognition of the throughput.
- 2) Consequently, it doesn't generate the resulting graph for the automatic recognition of the throughput.

IP Traffic - Test & Measure performs latency calculation for each packet, and then calculates the average value, where RFC2544 expects the latency calculation for ONE packet in the flow of 120 seconds long (then calculate the average for 20 tests).

The RFC 2544 latency can be calculated using a script that gets 1 value returned from IP Traffic - Test & Measure for each test of 120 seconds long.

Multicast feature

IP Traffic - Test & Measure is able to generate and receive Unicast and Multicast IP traffic (IPv4 and IPv6). The multicast feature is used for UDP protocol only.

- **Multicast & IPV4:** IPv4 addresses from 224.0.0.0 to 239.255.255.255 are MULTICAST IP addresses. These addresses can be used to generate multicast IP traffic (define the multicast IP address in the Sender part) or to receive multicast IP traffic (define the multicast IP address in the Receiver part).
- **Multicast & IPv6:** IPv6 multicast addresses are defined in "IP Version 6 Addressing Architecture" [RFC2373].



This defines fixed and variable scope multicast addresses.

IPv6 multicast addresses are distinguished from unicast addresses by the value of the high-order octet of the addresses: a value of 0xFF (binary 11111111) identifies an address as a multicast address; any other value identifies an address as a unicast address (FE80::/10 are Link local addresses, FEC0::/10 are Site Local addresses where FF00::/8 are Multicast addresses).

Multicast addresses from FF01:: through FF0F:: are reserved.

The complete list of Reserved IPv6 multicast addresses can be found in "IPv6 Multicast Address Assignments" [RFC 2375].

The ICMPv6 messages are used to convey IPv6 Multicast addresses resolution.

Broadcast feature (with IPv4 only)

IP Traffic - Test & Measure is able to generate and receive Broadcast IP traffic (IPv4 only). The broadcast feature is used for UDP protocol only.



- **Broadcast & IPV4:** IPv4 addresses as 255.255.255.255 or 192.168.0.255 are BROADCAST IP addresses. These addresses can be used to generate broadcast IP traffic (define the broadcast IP address in the IP Generator part). To receive broadcast IP traffic, specify the unicast IP address of the IP Generator in the IP Answering part.
- **Broadcast & IPv6:** broadcast does not apply to IPv6.

IP version selection

Please note that **IP Traffic - Test & Measure** supports IPv6 for Windows XP and later versions. IPv6 is not installed by default under Windows XP and Server 2003: it should be added on the network interface you want to use.

IP Traffic - Test & Measure supports the IPv6 numerical address format (128 bits long) as well as canonical addresses. The IPv6 multicast is available with **IP Traffic - Test & Measure** in accordance to RFC 2373 where a multicast IPv6 address starts with FF. With IPv6 the maximum size of the packet to avoid fragmentation is **1440** bytes whereas it is 1460 bytes in TCP with IPv4.

Interface selection

The interface selection of a LAN card (NIC), a virtual NIC such as an IP tunneling protocol or a remote access is useful to control the data traffic hardware route.

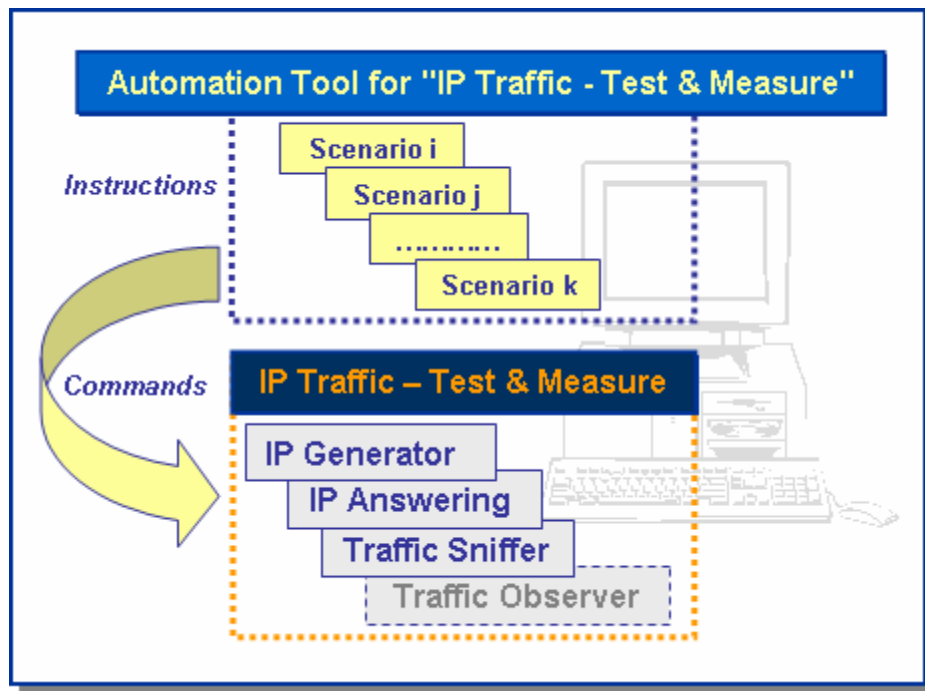
IP Traffic - Test & Measure is able to generate and receive Unicast, Multicast or Broadcast IP traffic on a selected interface, giving the user a deeper control where data are exchanged and makes multiple routes definition easily.



We have noticed that some operating systems may choose automatically the best network interface to use when several NICs are plugged on the same network when it comes to network interface selection. In that case, data can be sent on one interface and received on another one.

1.5 The Automation Tool for IP Traffic - Test & Measure

The add-on software **Automation Tool for IP Traffic - Test & Measure** allows to edit scenarios, carry out scenarios, set the **IP Traffic - Test & Measure** parameters and pilot **IP Traffic - Test & Measure** automatically on the same PC.



A scenario is a succession of **commands** and **instructions**.

A **command** is used to set parameters and/or activate a function of **IP Traffic - Test & Measure**.

For example the **Set and Start connection(s)** command helps to set parameters for IP connections and to start the traffic on these connections. With such command you specify the IP address, port number, protocol, packet size, inter packet delay, duration, etc. and you start the traffic generation for these connections.

An **instruction** is used by the Automation Tool to create an internal process. For example, the **Wait Date/Time** instruction suspends the scenario execution up to the specified date and time before to continue.

By using the **Automation Tool for IP Traffic - Test & Measure** you can:

- Set automatically the parameters of the **IP Traffic - Test & Measure** software,
- Start and stop IP connections based on timers,
- Execute the scheduled operations in accordance with your own timing,
- Make repetitive tests operations automatically,
- Simplify the tests reproduction,
- And more...

PART 2 What's new in Version 2.7

This part is a general overview of new features and main improvements of **IP Traffic - Test & Measure** version 2.7. You will find some important information on how to upgrade your software from previous versions. Details regarding features and corrections included in the different versions of **IP Traffic - Test & Measure** can be found in the version.txt file located in the installation directory (by default: C:\Program Files\IP Traffic).

To upgrade the software from the versions 1.3, 2.0 up 2.6 to the version 2.7, please refer to paragraphs below.

⇒ IP Traffic - Test & Measure (Version 2.7)

- Remove zClock support
- Add generic GNSS receiver
- Review the statistics calculation
- Add number of packets & bytes transferred
- Add handler for z050 device

The contexts created with versions 2.0 and higher are reused automatically. When saved, they become the new 2.7 context file format.

⇒ Automation Tool for IP Traffic - Test & Measure (Version 1.7.1)

- Remove zClock support
- Add Generic GNSS receiver

The scenarios created with older versions are reused automatically. When saved, they become the new 1.7 scenario file format.

PART 3 Install IP Traffic - Test & Measure

IP Traffic - Test & Measure requires less than 25 MB of free disk-space.

The default settings folder is C:\Program files\IP Traffic.

The **Automation Tool for IP Traffic - Test & Measure** add-on software is automatically installed with **IP Traffic - Test & Measure**.



** To run **IP Traffic - Test & Measure** your computer screen resolution must be at least 1024 X 768 and the DPI setting should be set up with the "Normal size (96 DPI)" value.
* To install **IP Traffic - Test & Measure** for Windows XP, Server 2003 or 2008, Vista, Seven or 8, you must log on with the administrator rights.*



*We recommend that you shutdown first your anti-virus application before installing **IP Traffic - Test & Measure**. Please note that you should mask the task bar in a 1024x768 screen resolution, so you get an optimal view of the software interface.*

The installation procedure is a standard installation program for Windows that needs Administrator rights.

3.1 Forewords before upgrading from version 2.0 and higher

There is no need to uninstall earlier version of **IP Traffic - Test & Measure** before upgrading to version 2.7. **IP Traffic - Test & Measure** version 2.5 has introduced a new protection using the USB Software Protection Key. But previous users of **IP Traffic - Test & Measure** can continue using their Site Key license.

When upgrading from a previous version of IP Traffic - Test & Measure, do not uninstall the previous version to keep your existing license: please refer to the following paragraph: "3.5.2

Which package should I install?" here after to get more details.

3.2 Forewords before upgrading from versions 1 (including version 1.3)

An upgrade from **IP Traffic - Test & Measure** versions earlier than version 2.0 needs to uninstall the current version before upgrading to **IP Traffic - Test & Measure** version 2.7. Due to changes in the license scheme introduced with version 2.0, the reinstallation will not keep the unlimited license information. You should contact ZTI Communications (contact@zti-communications.com) to get back a new unlimited license number when upgrading to version 2.7 with the new site code. Context files from version 1.3 and earlier are not compatible with the version 2.7. There is no converter tool to translate versions 1's context files into version 2.7.

3.3 Run the software installation from the downloaded file

If you have downloaded **IP Traffic - Test & Measure** trial version from our website, you have downloaded the "IPTraffic.zip" file including the software and the related documentation. You must first unzip this file in a temporary directory.

Then run [Setup_IPTrafficBundle.exe](#) from this temporary directory to launch the setup.

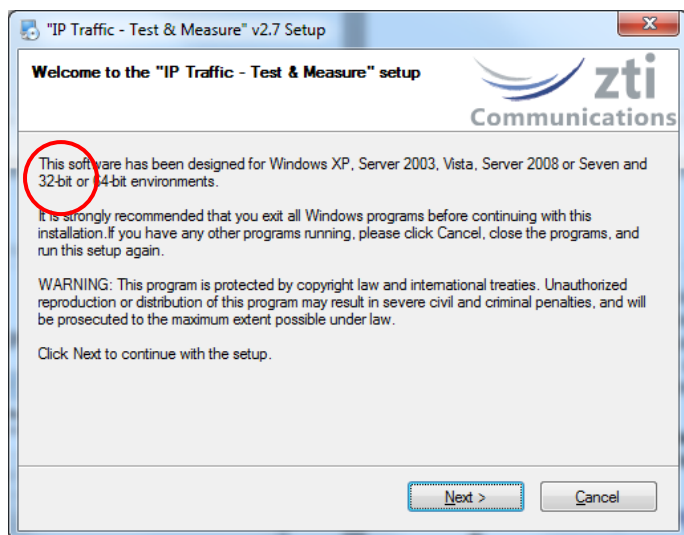
3.4 Run the software installation from the CD-ROM

The installation procedure is a standard installation program.

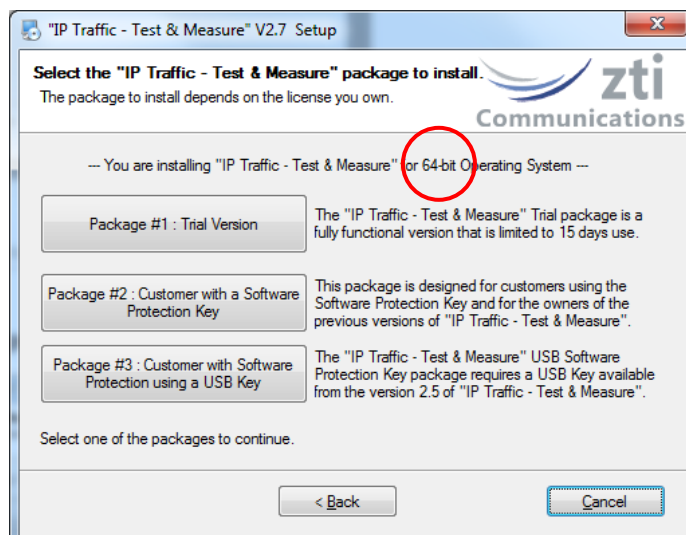
- First, insert the **IP Traffic - Test & Measure** CD-ROM in your CD-ROM drive.
- Click on "Start", "Execute" or "Run..." and type
`CD unit> \ Setup_IPTrafficBundle.exe`

3.5 During the installation

Follow the instructions until reaching the IP Traffic – T&M package selection window.



Install on a **32-bit** platform



Install on a **64-bit** platform



The setup procedure detects and installs automatically the 32-bit or 64-bit version depending of your target operating system.

3.5.1 IP Traffic - Test & Measure Packages in a few words

To use the **IP Traffic - Test & Measure** software, there are 3 license schemes:

- **Package #1:** the **IP Traffic - Test & Measure Trial package** allows you to use **IP Traffic - Test & Measure** during 15 days after the first run. When the trial period has expired, the license should be purchased.
- **Package #2:** the **IP Traffic - Test & Measure Software Protection Key package** has been designed for users owning a Software License key and for the users of the previous versions of **IP Traffic - Test & Measure**. It keeps your current installation and files, without additional requirement.
- **Package #3:** the **IP Traffic - Test & Measure USB Software Protection Key package** requires a USB key with the **IP Traffic - Test & Measure** license. The **USB key** is provided with **IP Traffic - Test & Measure** from version 2.5. This package allows the installation of **IP Traffic - Test & Measure** on several PCs but the only PC able to run **IP Traffic - Test & Measure** is the one having the USB key plugged in.



As previous users, you may be interested to move to a USB Software Protection Key: please contact your distributor or ZTI Communications to get more details about the license migration program (see 4.3 IP Traffic - Test & Measure & USB Software Protection Key for more details).



This software is licensed on a per workstation basis. This means that you need to get a separate license for each machine you will run it on. The license may be a software key (for previous users) or the USB Software Protection Key. Each licensed copy of the software gets a USB Software Protection key (except for customers with Electronic Software Delivery) that can be moved from one machine to another one.



**The USB Software Protection Key contains only the license information.
The software is available on a separate CD-ROM.**

3.5.2 Which package should I install?

Depending on your needs, please find here below the package most suitable for you.

♦ *I want to evaluate IP Traffic - Test & Measure V2.7*

In that case, choose the Package #1 *“IP Traffic - Test & Measure Trial Version”*.

You will be able to use **IP Traffic - Test & Measure** during 15 days only.

♦ *I already use IP Traffic - Test & Measure ...*



*This paragraph is dedicated to the users owning a previous version of **IP Traffic - Test & Measure**.*

... and I want to upgrade and keep my permanent license

In that case, choose the Package #2 *“Customers with a Software Protection Key”*.

Your installation will be upgraded and your existing permanent license will be kept.

... and I want to upgrade and use the USB Software Protection Key I bought

In that case, choose the Package #3 *“Customers with Software Protection using a USB Key”*. Plug the USB Software Protection Key before launching **IP Traffic - Test & Measure**.

♦ *I just bought IP Traffic - Test & Measure ...*



*This paragraph is related to the users purchasing **IP Traffic - Test & Measure V2.7** for running.*

... and I chose the Electronic Software Delivery (ESD)

In that case, choose the Package #2 *“Customers with a Software Protection Key”*.

When you launch the software for the first time, press the “Enter” key when the ZTI Communications logo appears. Then, get the Site Code and email it to us with your details and your purchase order reference at contact@zti-communications.com.

We will email you back the Site Key enabling your permanent license.

More details about the way to proceed are available in paragraph *“4.2.1 Installation of the Software Protection Key”*.

... and I received the CD-ROM & USB Software Protection Key

In that case, choose the Package #3 *“Customers with Software Protection using a USB Key”*.

Plug the USB Software Protection Key before running **IP Traffic - Test & Measure**.

... and I will receive the CD-ROM & USB Software Protection Key in a few days

In that case, choose the Package #2 *“Customers with a Software Protection Key”*.

You will get a fully functional but time-limited Software Protection Key.

3.6 What has been installed on my computer?

The **IP Traffic - Test & Measure** installation procedure installs the following files on your hard disk:

- IPTraff.exe: program file
- IP Traffic - Test & Measure User Guide: PDF file (use the free version of Adobe® Acrobat® Reader® software available on www.adobe.com).
- Aut_IPTraff.exe: program file (Automation tool)
- Automation Tool for IP Traffic - Test & Measure User Guide: PDF file
- IP Traffic license help file (with the Software Protection Key package only)
- Automation scenario samples and other files required by the software
- Samples of sniffed traffic files
- Viewer.exe: program file installed with the USB Software Protection package only
- ElevateIPTraff.exe : allows running IP Traffic as administrator (for Windows Vista only)
- Version.txt: a text file that contains information about the versions and the Registry parameters.



*All files created by **IP Traffic - Test & Measure** are saved in the folder where **IP Traffic - Test & Measure** has been installed.*

The installation procedure automatically installs the packet capture driver named 'znpf.sys' on your system in the 'IP Traffic' installation directory.

Start Menu shortcuts created:

Start > Programs > **IP Traffic - Test & Measure**

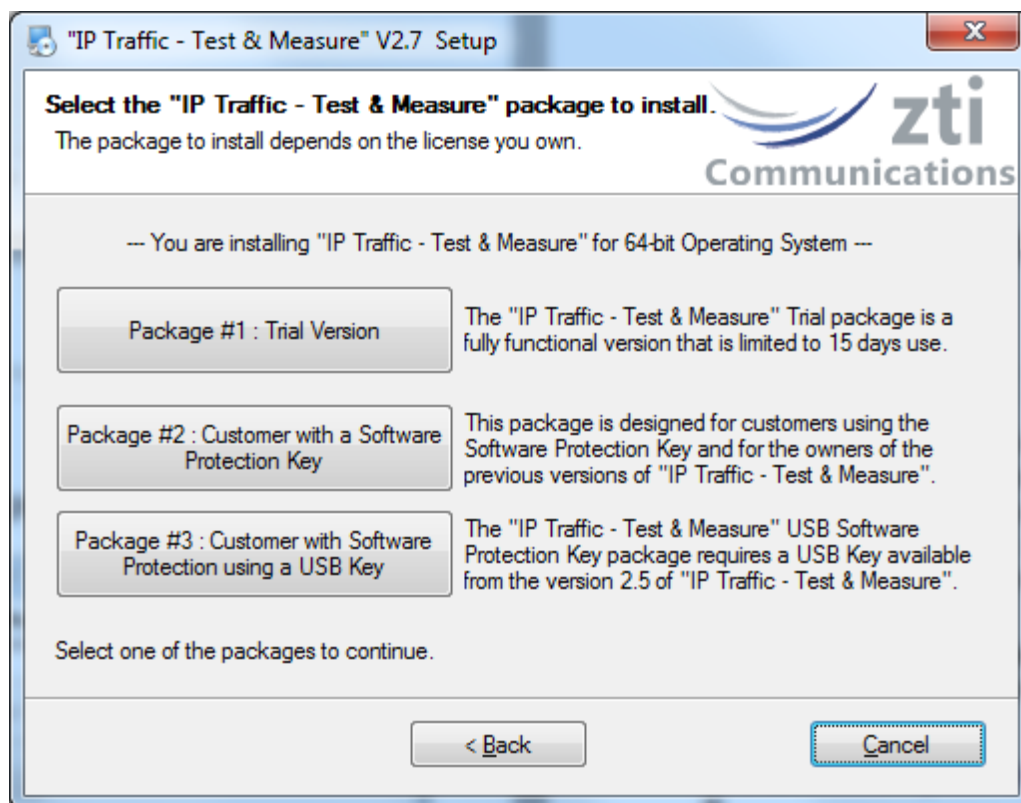
- ⇒ **IP Traffic - Test & Measure** (click to launch)
- ⇒ **Automation Tool for IP Traffic - Test & Measure** (click to launch)
- ⇒ **Uninstall IP Traffic - Test & Measure** (click to launch)
- ⇒ **IP Traffic - Test & Measure User Guide** (PDF file)
- ⇒ **Automation Tool for IP Traffic - Test & Measure User Guide** (PDF file)
- ⇒ **Read Me First** (PDF file)
- ⇒ **License help** (Software Protection Key only / Package #2)
- ⇒ **USB Software Protection Key Viewer** (Software Protection using a USB key only / Package #3)



*If the RPC mechanism is disabled, a message will ask automatically for the system reboot at the end of the installation. This is mandatory to allow the dialog between the Automation Tool and **IP Traffic - Test & Measure**.*

3.7 How to reinstall another package?

If you already have installed one of the **IP Traffic - Test & Measure** V2.7 packages, click [Setup_IPTrafficBundle.exe](#) and select, in the window below, the new package you want to install.



3.8 How to transfer the software to another computer?

Install the software on the target computer. You don't need to do any particular operation with the *"Customers with Software Protection using a USB Key"* and *"IP Traffic - Test & Measure Trial"* packages.

With **IP Traffic - Test & Measure** & USB Software Protection Key, you do need to plug the USB key before running the software on the target computer.

With the Package #2 *"Customers with a Software Protection Key"*, install the software on the target computer and refer to the paragraph *"4.2.2 Software Protection Key Transfers"* to know how to transfer the software license.

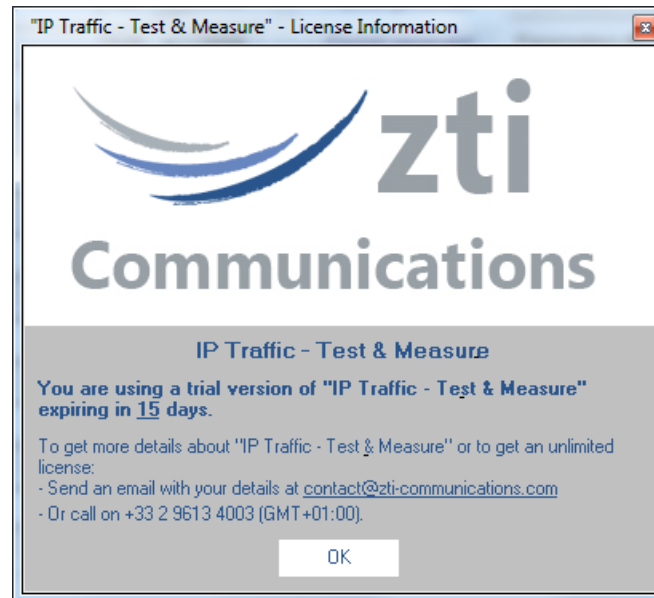
PART 4 How to handle your license?

4.1 IP Traffic - Test & Measure Trial Version

You don't require any license to use the trial version of **IP Traffic - Test & Measure**. After the first run of **IP Traffic - Test & Measure**, the **IP Traffic - Test & Measure** trial version can be used during 15 days.

4.1.1 IP Traffic - Test & Measure License Information window

When you run **IP Traffic - Test & Measure**, the information about your trial license is displayed, as shown below.



You are now able to use **IP Traffic - Test & Measure** during the next 15 days.

4.1.2 End of the 15-day trial period

Once the trial period is finished, you are not allowed to use **IP Traffic - Test & Measure** anymore, as shown below:



When you press the **OK** button, **IP Traffic - Test & Measure** will stop running.

To continue to use the software please contact your local distributor or ZTI [Communications](#) to get a permanent license.

4.2 IP Traffic - Test & Measure & Software Protection Key

Licensed users of **IP Traffic - Test & Measure** that are already using the Software Protection Key should not need to refer to the section 4.2.1. To transfer the owned license to another PC or to another directory, please go directly to section 4.2.2.

4.2.1 Installation of the Software Protection Key

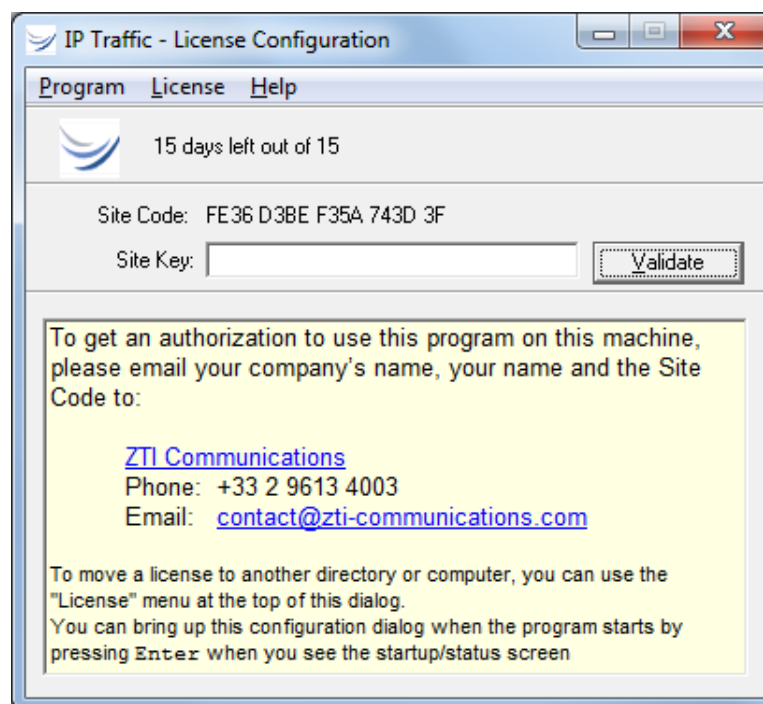


This software is licensed on a per workstation basis. This means that you will need to get a separate license for each machine you will install it on. Each licensed copy of the software installed on a system has a unique **Site Code** that requires a corresponding unique **Site Key** to work. A period of 15-day is automatically enabled at the first installation of the software. If you try to install the software again, the Software Protection Key will disable the trial period.

If you want to configure your Software Protection Key before the time-limited period end, press **Enter** just after launching the **IP Traffic - Test & Measure** when the following message is displayed:

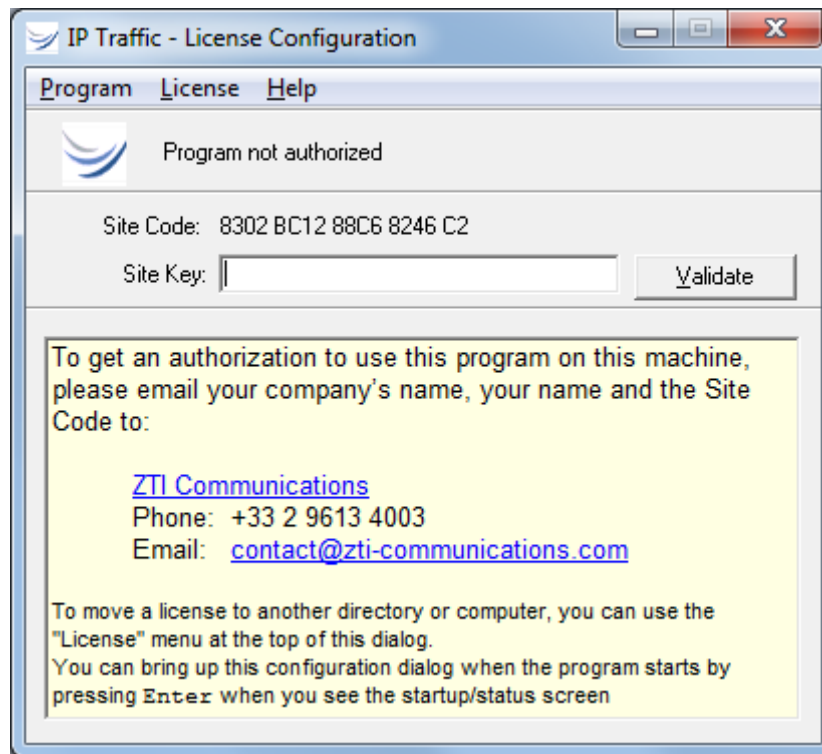


Then, you will see the following license configuration window:





At the end of the trial period when you launch **IP Traffic - Test & Measure**, the same license configuration window appears, but saying "Program not authorized" instead of showing the remaining days of use.

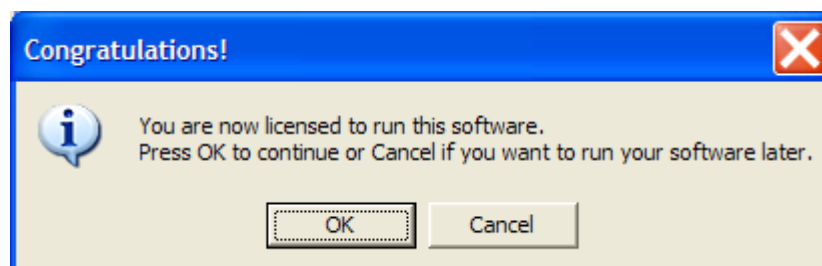


To get the **Site Key** and obtain a permanent license, please send an email to contact@zti-communications.com with the following information:

- The **Site Code** (you can copy and paste the Site Code displayed in the license window)
- The name of the software: **IP Traffic - Test & Measure**
- The OS used
- Your details
- The purchase order's number and date of purchase

We will then email you the **Site Key**. You can now close the license's window.

After you have received the email with the **Site Key**, open the license configuration window again by pressing the Enter key as explained before. Copy the Site Key in and then click "Validate". After validation of the Site Key, you will get the following message:



⇒ **Important:** one **Site Code** is associated with one **Site Key**, and only one. A **Site Code** is unique for each PC installed. For security reasons, as soon as you validate a **Site Key**

(trial or unlimited), the Software License program generates a new **Site Code** automatically.

⇒ For any question or further information, please contact our technical support:
Email: support@zti-communications.com

Phone: +33 2 9613 4003

*When you launch **IP Traffic - Test & Measure** with a Software Protection Key related to a permanent license, you will see the following window:*



4.2.2 Software Protection Key Transfers



A Software Protection Key transfer is not a duplication of any type. Please contact ZTI Communications or your authorized distributor for site Software Protection Key information and for several Software Protection Keys purchase.

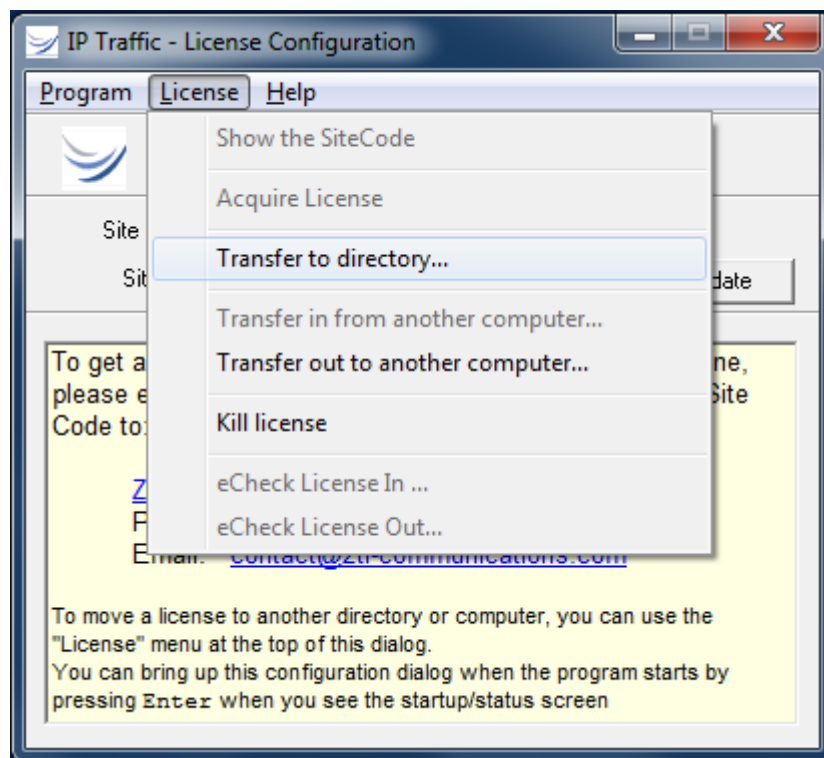
Software Protection Keys can be transferred using one of the following methods:

- ⇒ **Direct transfer:** move the Software Protection Key to another directory of the same PC or between two PCs linked to the same network.
- ⇒ **Transfer by media:** move the Software Protection Key from a source PC to a target PC by using a USB key or an external hard disk.

◆ *Direct Transfer: move the Software Protection Key from one local directory to another*

This transfer mechanism must be used to move a Software Protection Key in two cases:

- From a source to a target directory of the same PC
 - From a source to a target directory of networked PCs
- First, copy the program (copy the **IP Traffic - Test & Measure** folder) to the target directory.
For example from "C:\Program Files\IP Traffic" to "C:\Temp\IP Traffic"
 - Then run the program from its original directory (from "C:\Program Files\IP Traffic"). When the Software Protection Key configuration window appears, press **Enter** and select "License > Transfer to directory ..." in the License menu as shown below:



- Provide the path name of the target program (for example *C:\Temp\IP Traffic \IPTraff.exe*)
- The Software Protection Key is now transferred to the new directory.

♦ **Transfer by Media (USB key) from a source PC to a target PC**



A USB key or an external hard disk is needed for this kind of transfer.

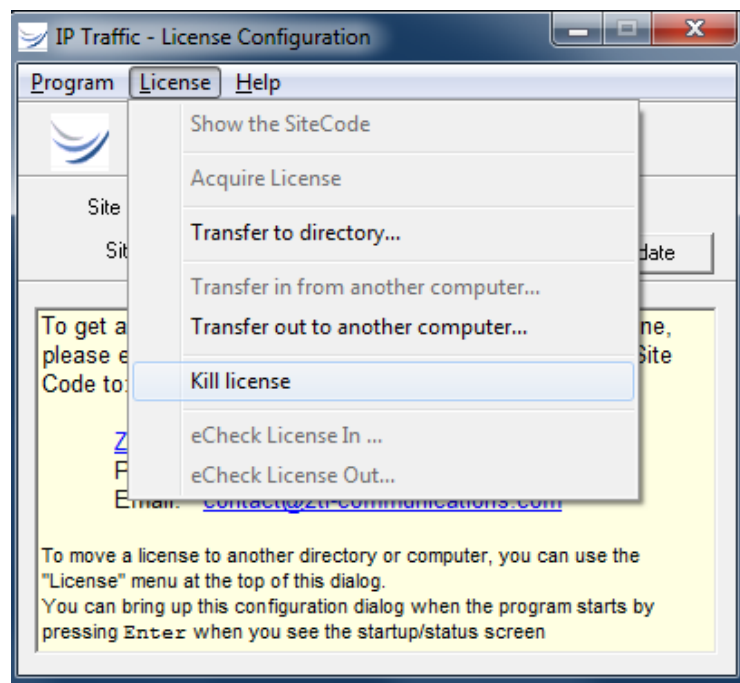
To transfer the Software Protection Key from the source PC (PC #1) to the target PC (PC #2), proceed as described in the following order:

- 1) First install the program on the target PC (PC #2).
- 2) Run the software on PC #2 and kill the time-limited license in order to get an unauthorized license on this PC.

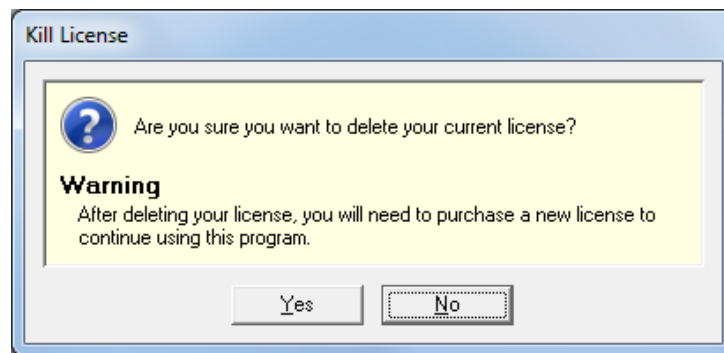
If the "Transfer in from another computer ..." item of the license menu is disabled, you must kill the time-limited license.

How to kill the Software Protection Key?

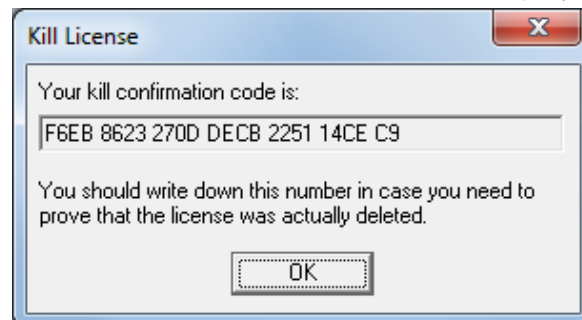
When the license configuration window appears, press **Enter** and select "License > Kill license" in the license menu.



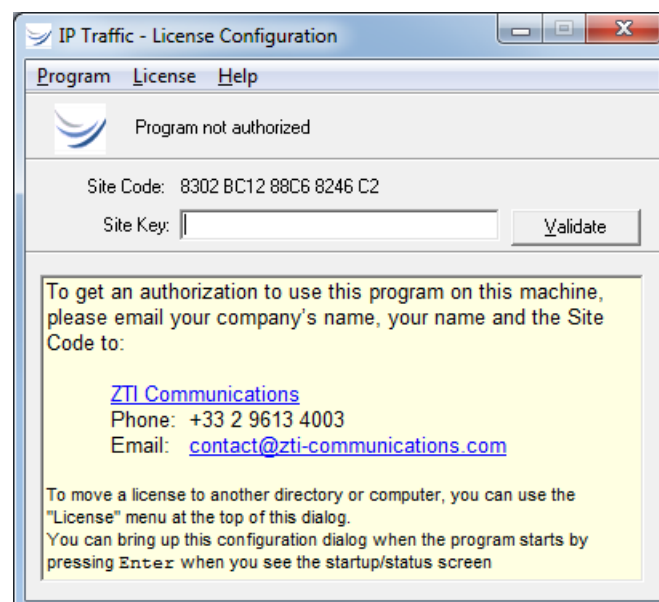
A message box will appear:



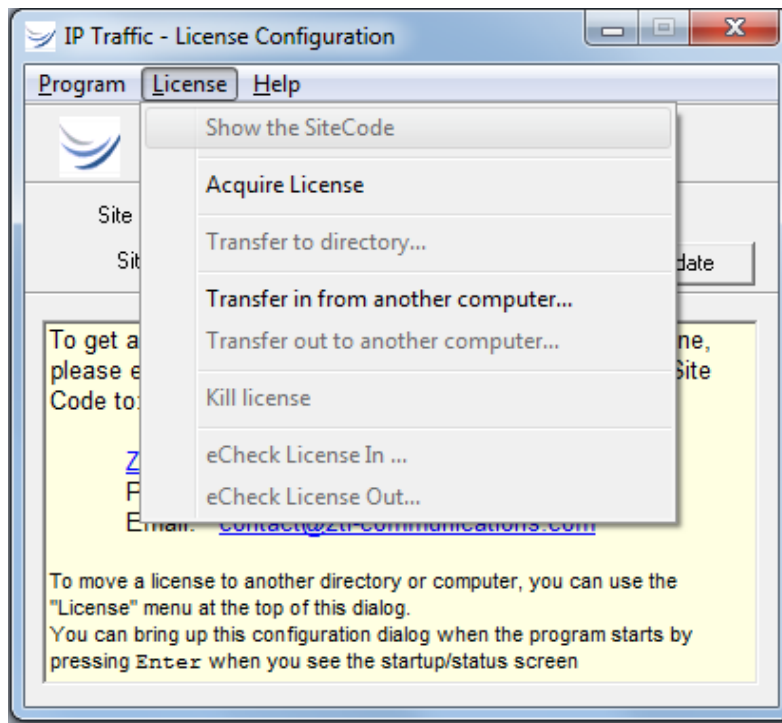
Press 'Yes' to kill the license and a confirmation code is displayed:



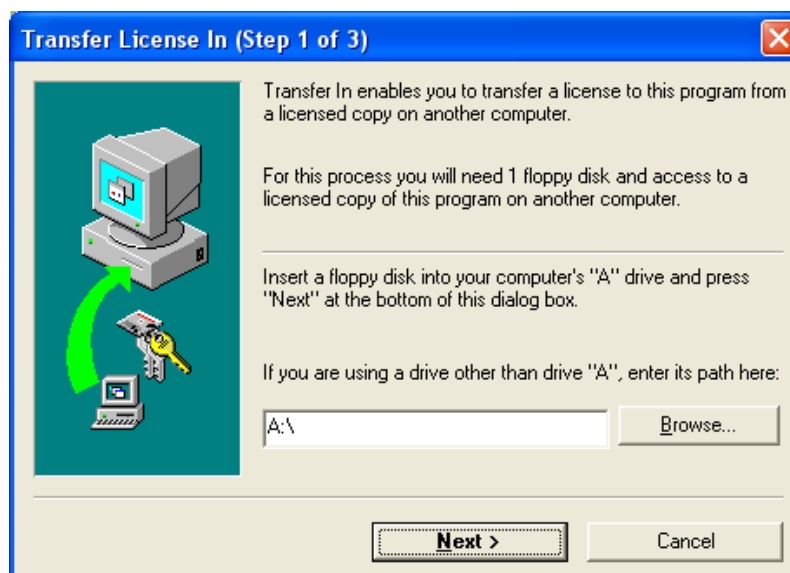
Click 'OK' and the license configuration window displays now "Program not authorized":



3) Select "License > Transfer in from another computer ..." in the License menu:

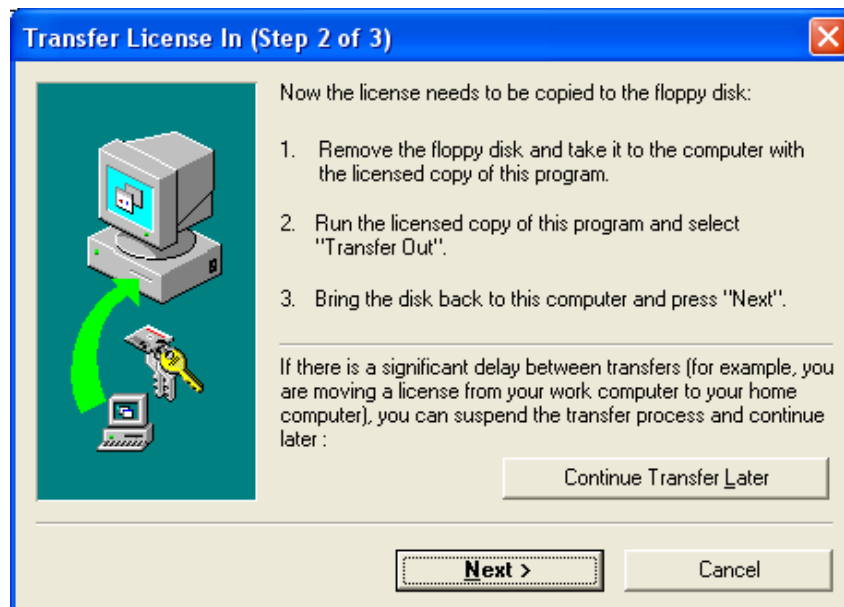


The "Transfer License In (Step 1 of 3)" window is displayed:

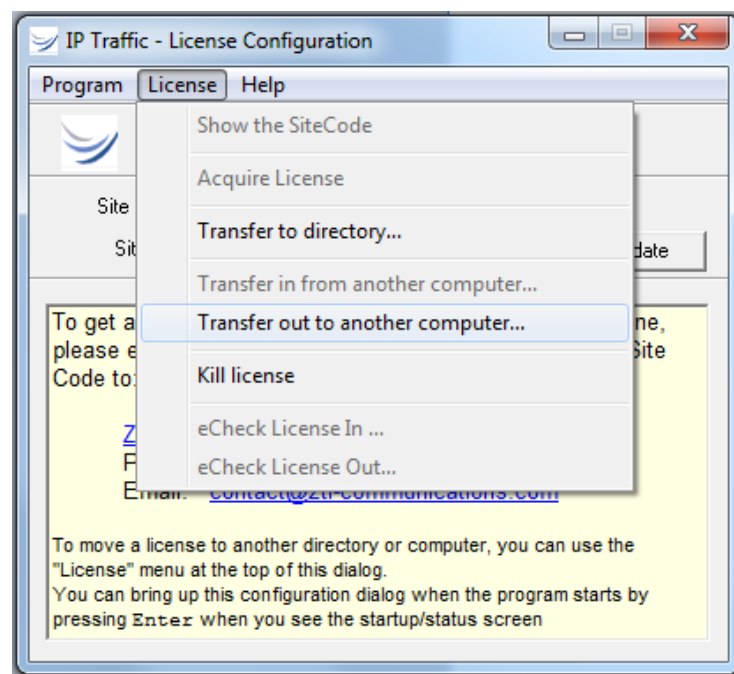


4) Insert a USB key as requested in step 1 of 3 and specify the path.

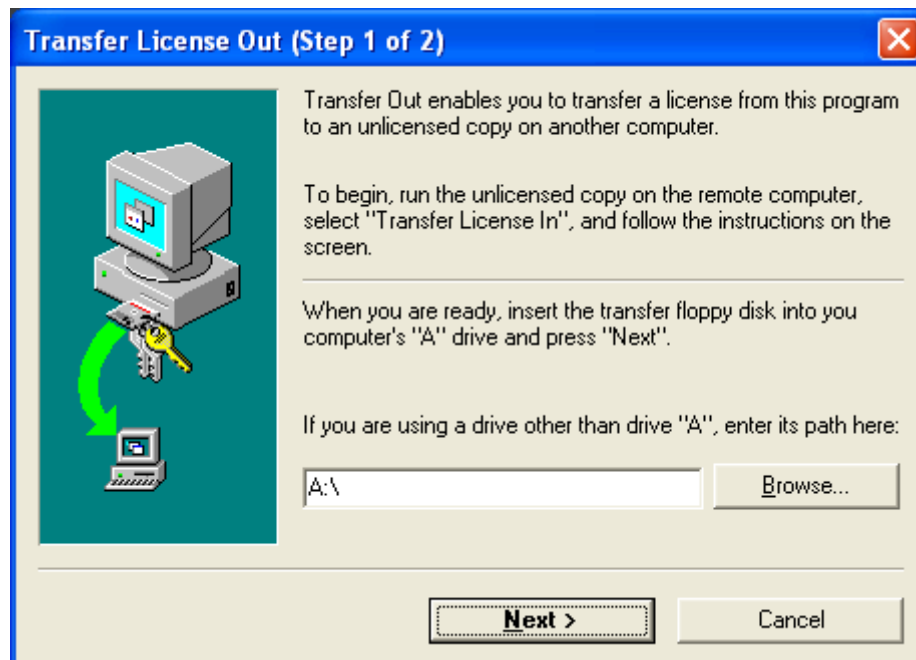
Then press "Next >": the "Transfer License In (Step 2 of 3)" window is displayed:



5) Go to the source PC (PC #1) and insert the media (USB key or external hard disk). Then start the program on PC #1. When the license configuration window appears, press **Enter** and select "License > Transfer out to another computer ..." as shown below:

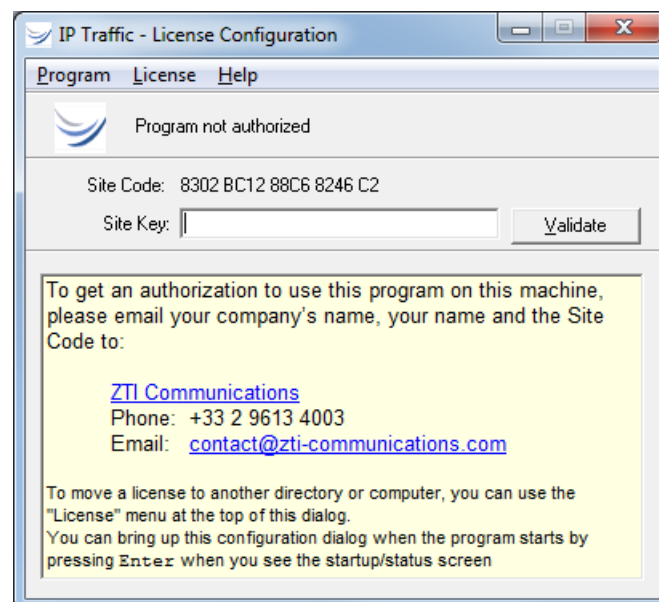


The following window is displayed:



Input the media path (USB key) and then press "Next >".

When the license is put on the media, you get the "Program not authorized" message:



*You can check that the license is not available anymore on the source PC since the **IP Traffic - Test & Measure** software license is on a workstation basis. Contact us to get information on a Site Software Protection Key (contact@zti-communications.com).*

6) Remove the media from PC #1 and return to PC #2.

Click the 'Next' button on the step 2 of 3 of the "Transfer license in" window (on PC #2) to complete the transfer.

The license is now transferred from the source PC to the target PC, and you get the following message:



Click Finish to continue.

4.3 *IP Traffic - Test & Measure & USB Software Protection Key*

The USB Software Protection Key is the most flexible way to transfer your license to any other PC. Plug it in the computer you want to use **IP Traffic - Test & Measure** on.

If you are a user of a previous version of **IP Traffic - Test & Measure** (version 2.4 and under) change for more flexibility to a **USB Software Protection Key** by contacting ZTI Communications Sales Offices (sales@zti-communications.com) and get some information about how to exchange your software key to a **USB Software Protection key**.

PART 5 Uninstall IP Traffic - Test & Measure

The uninstall procedure is a standard uninstall program.

To uninstall **IP Traffic - Test & Measure** select “Uninstall IP Traffic - Test & Measure” in the “Start > Programs > IP Traffic - Test & Measure” menu.

PART 6 Getting Started

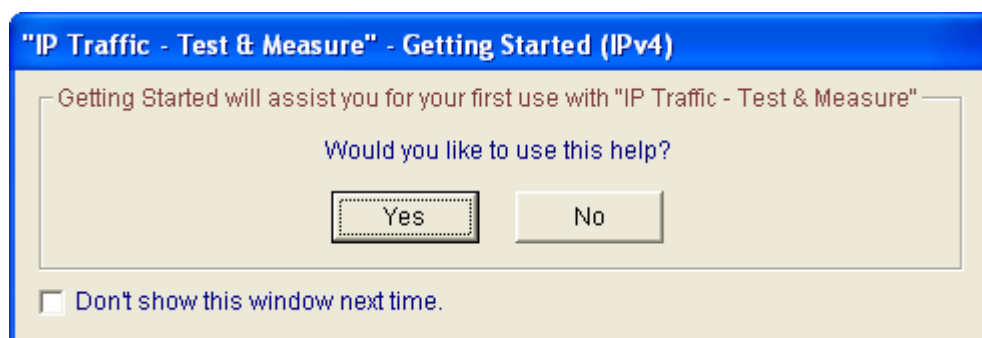


Anti-virus or firewall applications may disrupt **IP Traffic - Test & Measure** when sending or receiving data.

Please set up your security software before using **IP Traffic - Test & Measure** (see PART 7 and 0).

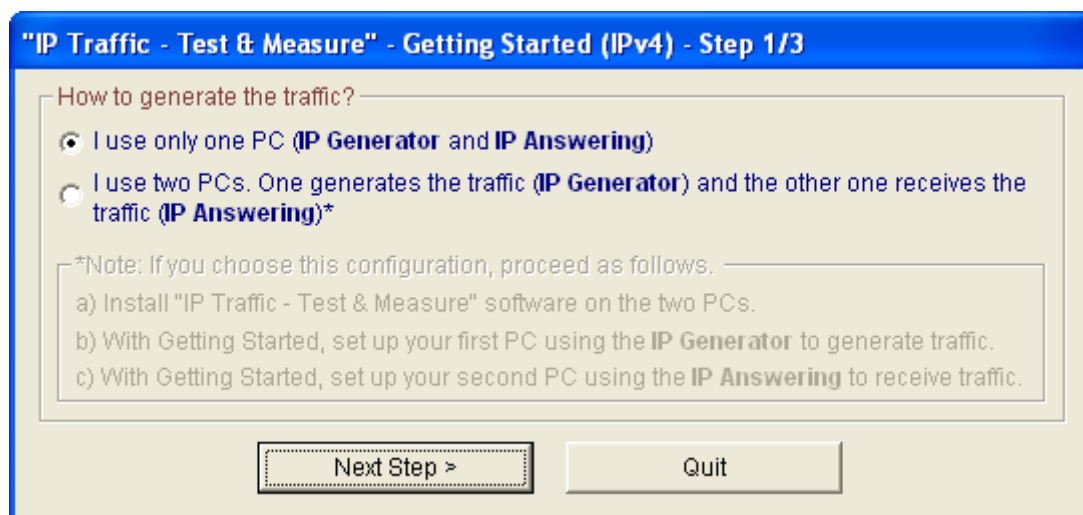
New users can use this help as an introduction to **IP Traffic - Test & Measure** and generate or receive traffic with the IPv4 protocol in a few clicks.

Just after launching **IP Traffic - Test & Measure**, the Getting Started Window is displayed:

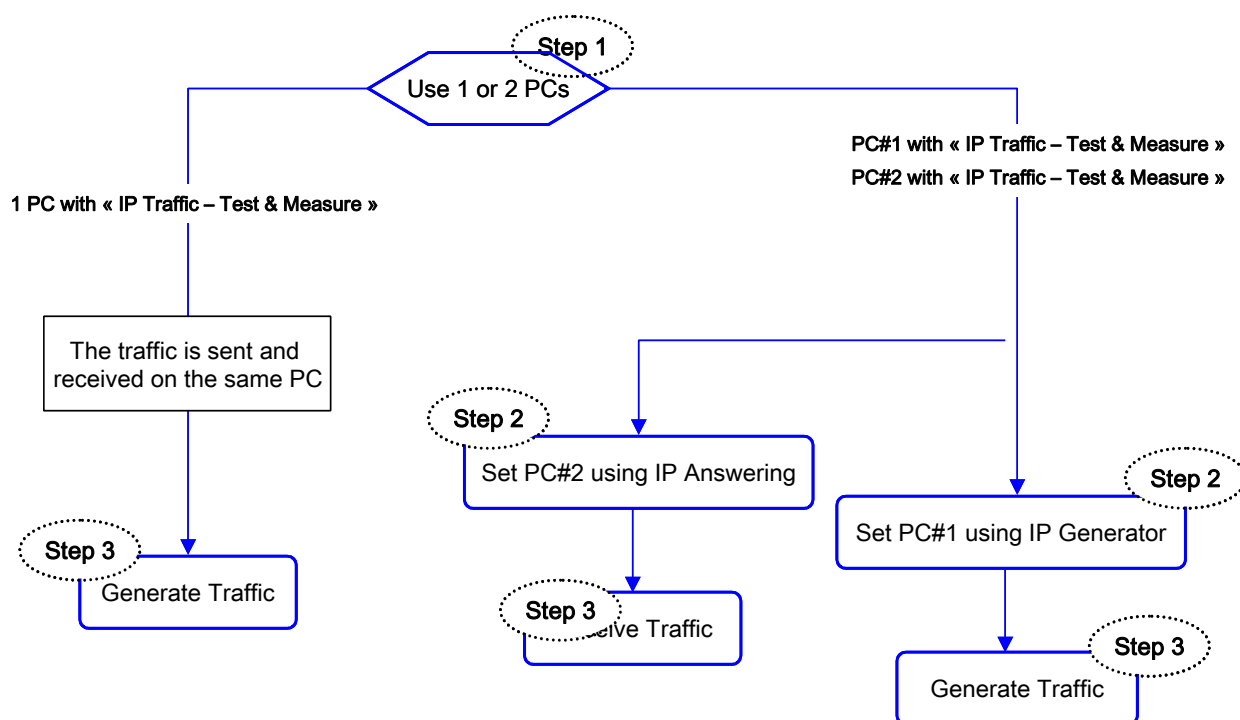


Press **No** if you don't want to use this help.

Press **Yes**, the next window will ask you if you want to use 1 or 2 PCs:

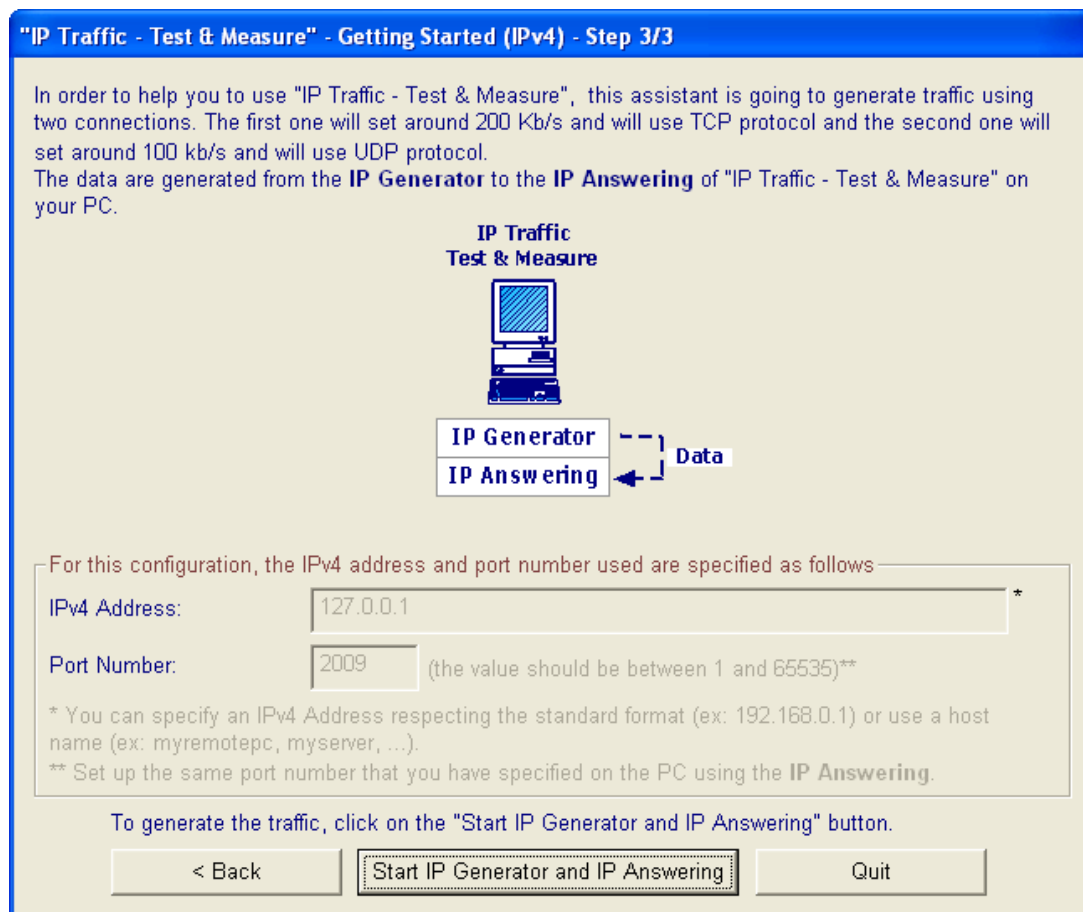


Depending on your choice to use 1 or 2 PCs, the plan below shows the steps:

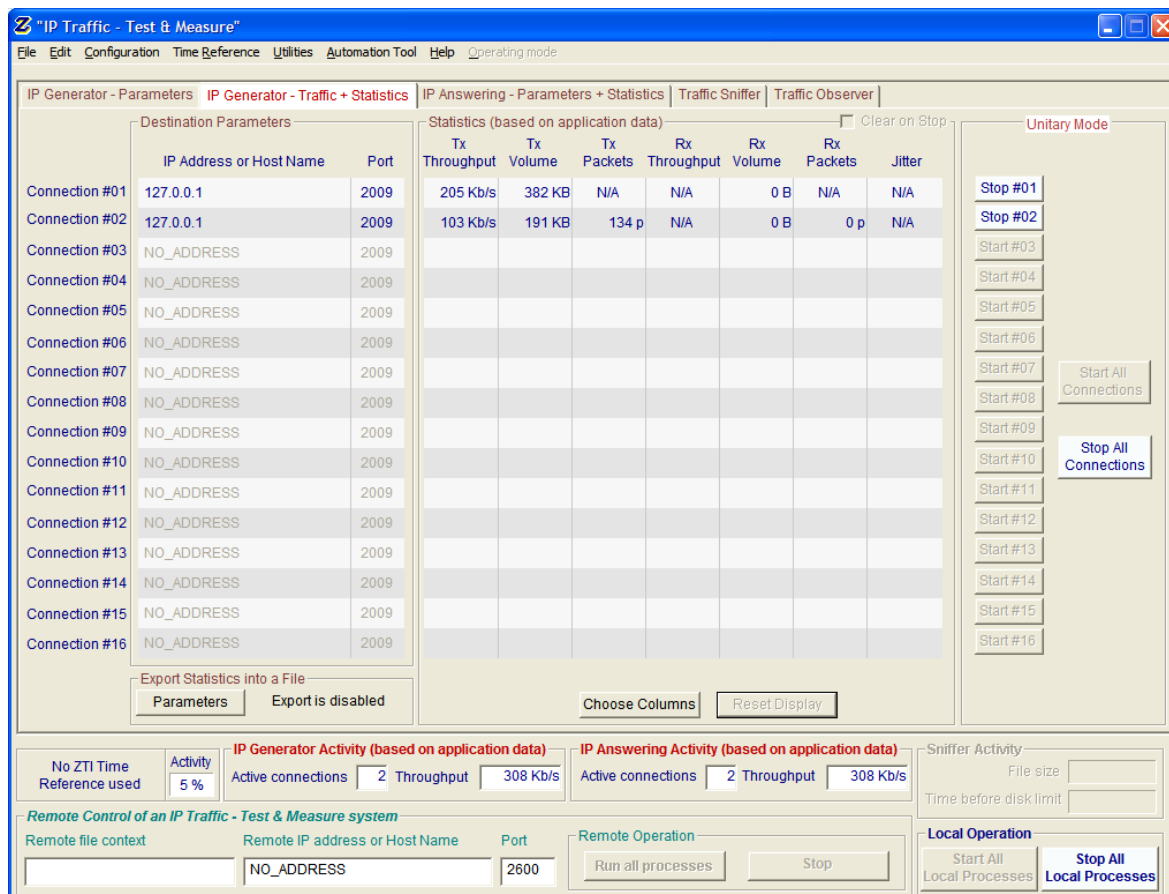


For the use of 1 PC

The following windows are displayed.



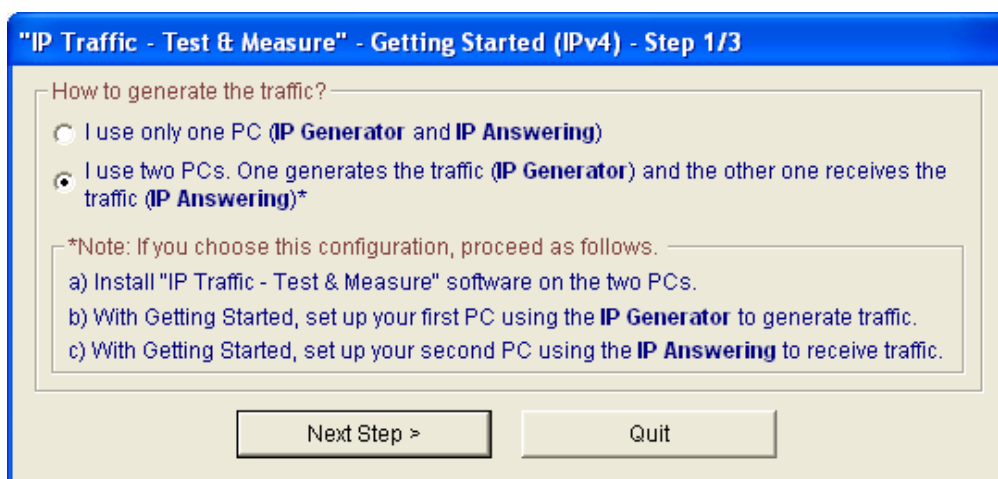
Then press the "Start IP Generator and IP Answering" button to continue. The "IP Generator – Traffic + Statistics" tab of **IP Traffic - Test & Measure** will display the two first active connections as shown on the following window:



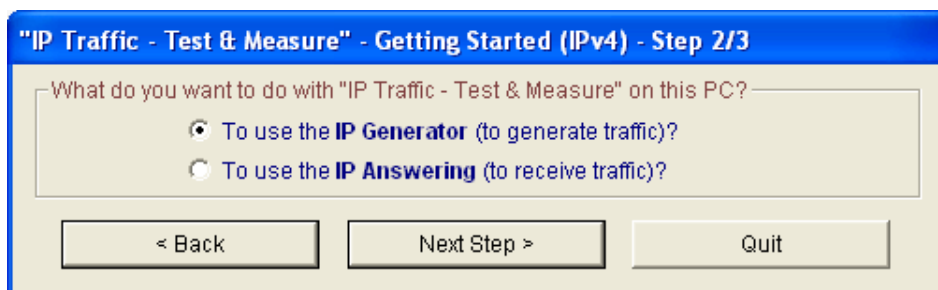
For the use of 2 PCs

If you select the option: **I use two PCs**, read the following instructions.

IP Traffic - Test & Measure must be installed on the two PCs.

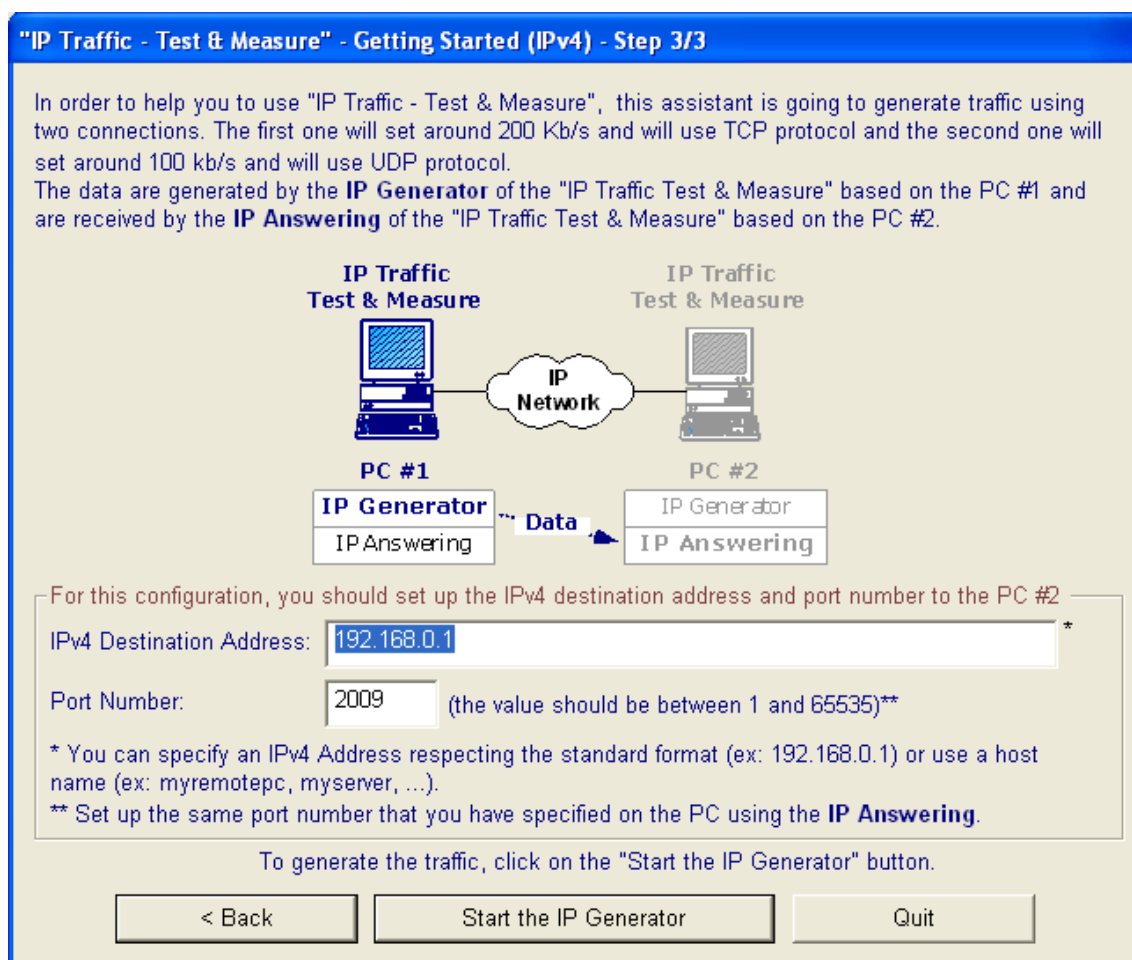


Press "Next Step >" to continue.



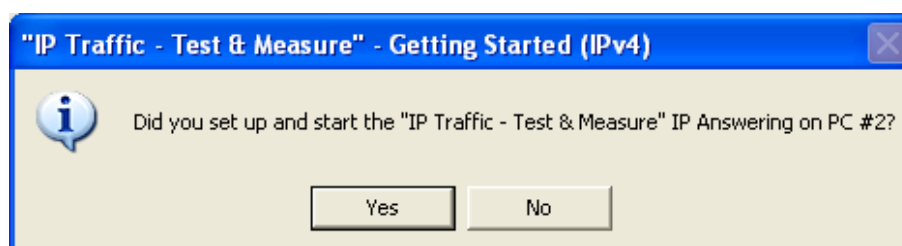
Then choose if you want to generate or receive the traffic on this PC.

If you select "Use the IP Generator" the following window will appear:

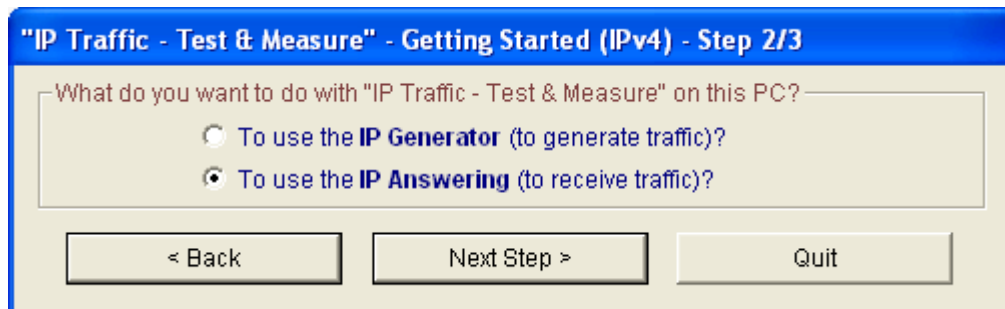


Define the IPv4 address and port number to use.

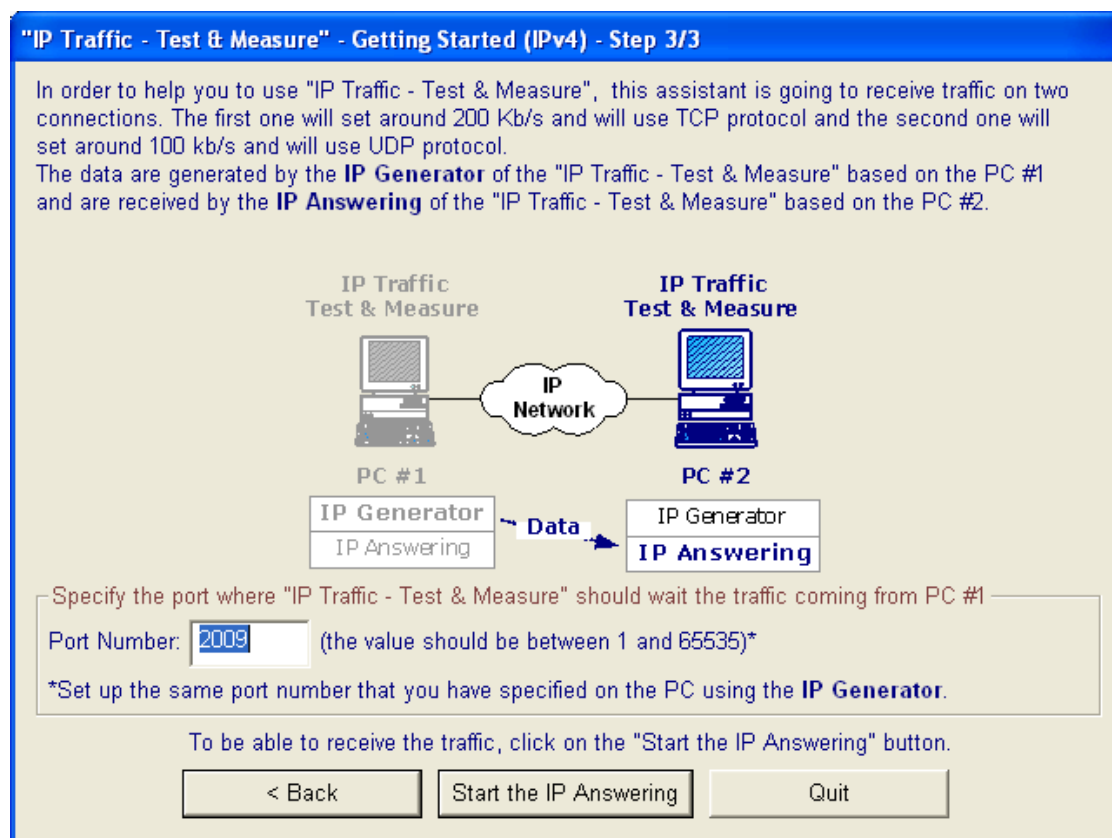
Then press the "Start the IP Generator" button and a warning dialog is displayed:



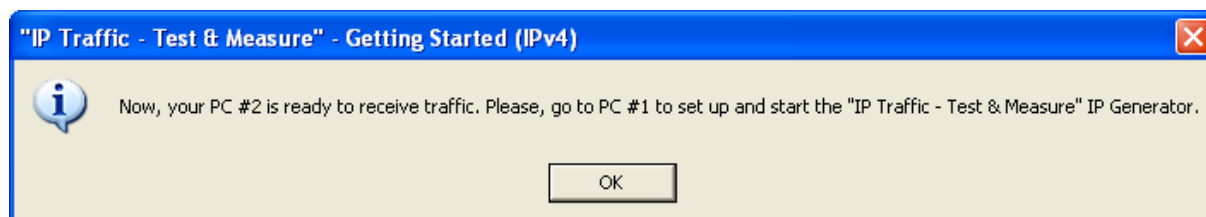
Before generating traffic towards PC #2, the PC #2 must be configured as IP Answering.



Press "Next Step >" to continue on PC #2.



After pressing the "Start the IP Answering" button, a warning message will appear:



Press "OK" and the "IP Answering – Parameters + Statistics" tab of **IP Traffic - Test & Measure** is displayed on PC #2.

Then go to PC #1 and start the **IP Traffic - Test & Measure** IP Generator. The "IP Generator–Traffic + Statistics" tab of **IP Traffic - Test & Measure** displays now the two first active connections.

You have now 2 connections generating traffic from PC #1 to PC #2.

PART 7 Run IP Traffic - Test & Measure

Use the Windows start menu:

Start ► All Programs ► IP Traffic - Test & Measure ►





Click here.



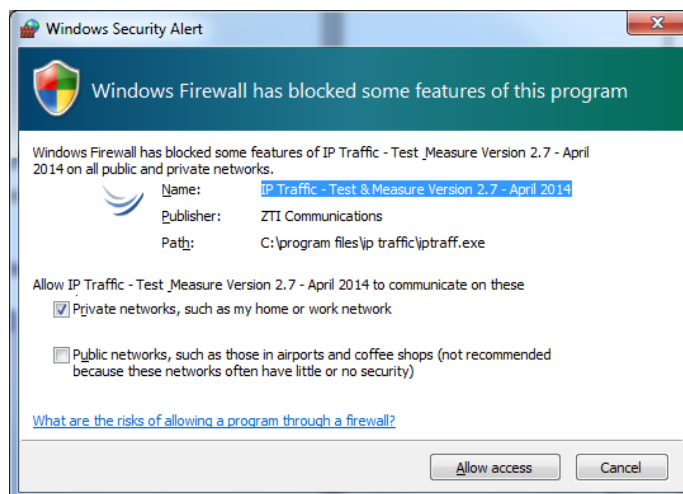
For Vista and after, you must have the administrator rights to be able to use the DSCP field. To launch IP Traffic with the administrator rights, right-click on the IP Traffic - Test & Measure shortcut as shown above and choose “Run as administrator”.

After a few seconds and depending on your license, you will get one of the following license windows:

15-day Trial Version	Software Protection Key Version
 <p>The screenshot shows a window titled "IP Traffic - Test & Measure" - License Information. It features the ZTI Communications logo and states: "You are using a trial version of 'IP Traffic - Test & Measure' expiring in 15 days." It provides contact information for an unlimited license: "To get more details about 'IP Traffic - Test & Measure' or to get an unlimited license: - Send an email with your details at contact@zti-communications.com - Or call on +33 2 9613 4003 (GMT+01:00)." An "OK" button is at the bottom.</p>	 <p>The screenshot shows a window with the ZTI Communications logo and the text: "Unlimited license Please wait".</p>
USB Software Protection Key Version	
If you use a USB Software Protection Key, there is no window!	

With some Windows O.S., the window below may appear. This window allows configuring the Windows Firewall settings for **IP Traffic - Test & Measure**.

Click on the “Unblock” button to add **IP Traffic - Test & Measure** into the authorized programs list.



PART 8 IP Traffic - Test & Measure and Windows Firewall



Anti-virus or firewall applications may disrupt **IP Traffic - Test & Measure** from sending or receiving data. Please set up your security software before using **IP Traffic - Test & Measure**.



Windows Firewall may also disrupt the **IP Traffic - Test & Measure** performances. To get best performances, you should disable Windows Firewall.



To use a NTP Server under Windows Vista, the ICMP exchange must be allowed. Please refer to the paragraph 8.3 "How to authorize ICMPv4 and ICMPv6 traffic under Windows

Some anti-virus configurations can stop **IP Traffic - Test & Measure** working because of their security settings. For commercial anti-virus, please refer to the related documentation to authorize **IP Traffic - Test & Measure** to work.

8.1 How to authorize TCP and UDP connections under Windows XP Service Pack 2 and Windows Server 2003

Windows Firewall on Windows XP Service Pack 2 and Windows Server 2003 blocks incoming network connections except for the authorized programs. To allow **IP Traffic - Test & Measure** receiving incoming TCP or UDP connections, you must add it in the exceptions list of Windows Firewall by proceeding as follows:

Step1: Open a command prompt window. You should be logged on an account giving the administrator rights to be able to modify the firewall configuration.

Step 2: type the command line below and press "Enter".

```
%> netsh firewall add allowedprogram program="C:\Program Files\IP Traffic\IPTraff.exe" name=IP Traffic - Test & Measure mode=ENABLE scope=ALL profile=ALL
```

Make sure that "C:\Program Files\IP Traffic\" is the installation directory of **IP Traffic - Test & Measure**. A message of confirmation is returned by *netsh* if the command is succeeded. If the path you have specified is invalid, *netsh* returns an error message close to the following message: *The system cannot find the file specified*. In that case, please renew Step 2.



Unlike under Windows Vista and after, the firewall allows the incoming echo replies. You don't need to add a rule to be able to receive ICMPv4/ICMPv6 "echo reply" messages.

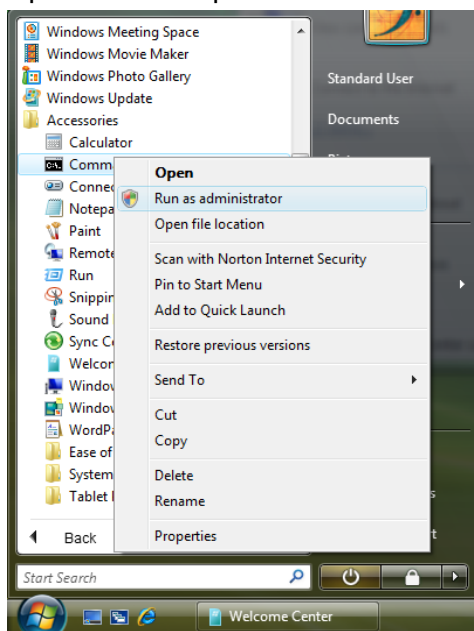


This command line allows IGMP protocol used by the IPv4 multicast connections.

8.2 How to authorize UDP and TCP connections under Windows Vista and after

Windows Firewall on Windows Vista and after blocks incoming and outgoing network connections except for the authorized programs. By default, all outgoing connections are allowed. But to authorize **IP Traffic - Test & Measure** receiving incoming connections, you must add it in the exceptions list of Windows Firewall by proceeding as follows:

Step 1: Open a command prompt window with the administrator rights. The administrator rights are mandatory to set up the firewall configuration. Open the "All Programs / Accessories" folder and right-click on the "Command Prompt" icon as shown on the figure below and choose "Run as administrator". A command prompt window is opened.



Step 2: type the command line below and press "Enter".

```
%> netsh firewall add allowedprogram program="C:\Program Files\IP Traffic\IPTraff.exe" name="IP Traffic - Test & Measure" mode=ENABLE scope=ALL profile=ALL
```

Make sure that "C:\Program Files\IP Traffic\" is the installation directory of **IP Traffic - Test & Measure**. A message of confirmation is returned by *netsh* if the command is succeeded. If the path you have specified is invalid, *netsh* returns an error message close to the following message: *The system cannot find the file specified*. In that case, please renew Step 2.



With Windows Vista, the firewall blocks the incoming echo replies. You must add a rule to be able to receive ICMPv4/ICMPv6 "echo reply" messages. Please refer to the paragraphs here after.



This command line allows IGMP protocol used by the IPv4 multicast connections.

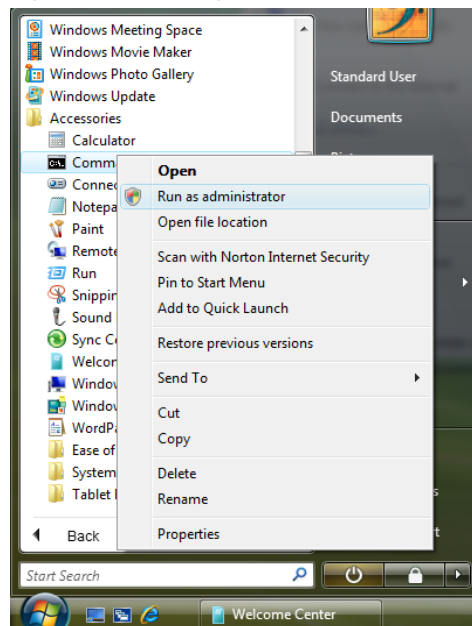


To use a NTP Server under Window Vista and after, the ICMP exchange must be allowed. Please refer to the paragraph 8.3 "How to authorize ICMPv4 and ICMPv6 traffic under Windows Vista."

8.3 How to authorize ICMPv4 and ICMPv6 traffic under Windows Vista and after

Windows Firewall on Windows Vista blocks incoming ICMPv4 and ICMPv6 "echo reply" messages. To be able to receive these messages, you must add two new rules by proceeding as follows:

Step 1: Open a command prompt window with the administrator rights. The administrator rights are mandatory to do the firewall configuration. Open the "All Programs / Accessories" folder and right-click on the "Command Prompt" icon as shown on the figure below and choose "Run as administrator". A command prompt window is opened.



Step 2: To create the rule for ICMPv4 echo reply messages, type the command line below and press "Enter".

```
%> netsh advfirewall firewall add rule name="Echo Reply ICMPv4 (used by IP Traffic - Test & Measure)"  
dir=in action=allow profile=any localip=any remoteip=any protocol=icmpv4:0,0 interfacetype=any
```

A message of confirmation is returned by *netsh* if the command is succeeded.

Step 3: To create the rule for ICMPv6 echo reply messages, type the command line below and press "Enter".

```
%> netsh advfirewall firewall add rule name="Echo Reply ICMPv6 (used by IP Traffic - Test & Measure)"  
dir=in action=allow profile=any localip=any remoteip=any protocol=icmpv6:129,0 interfacetype=any
```

A message of confirmation is returned by *netsh* if the command is succeeded.

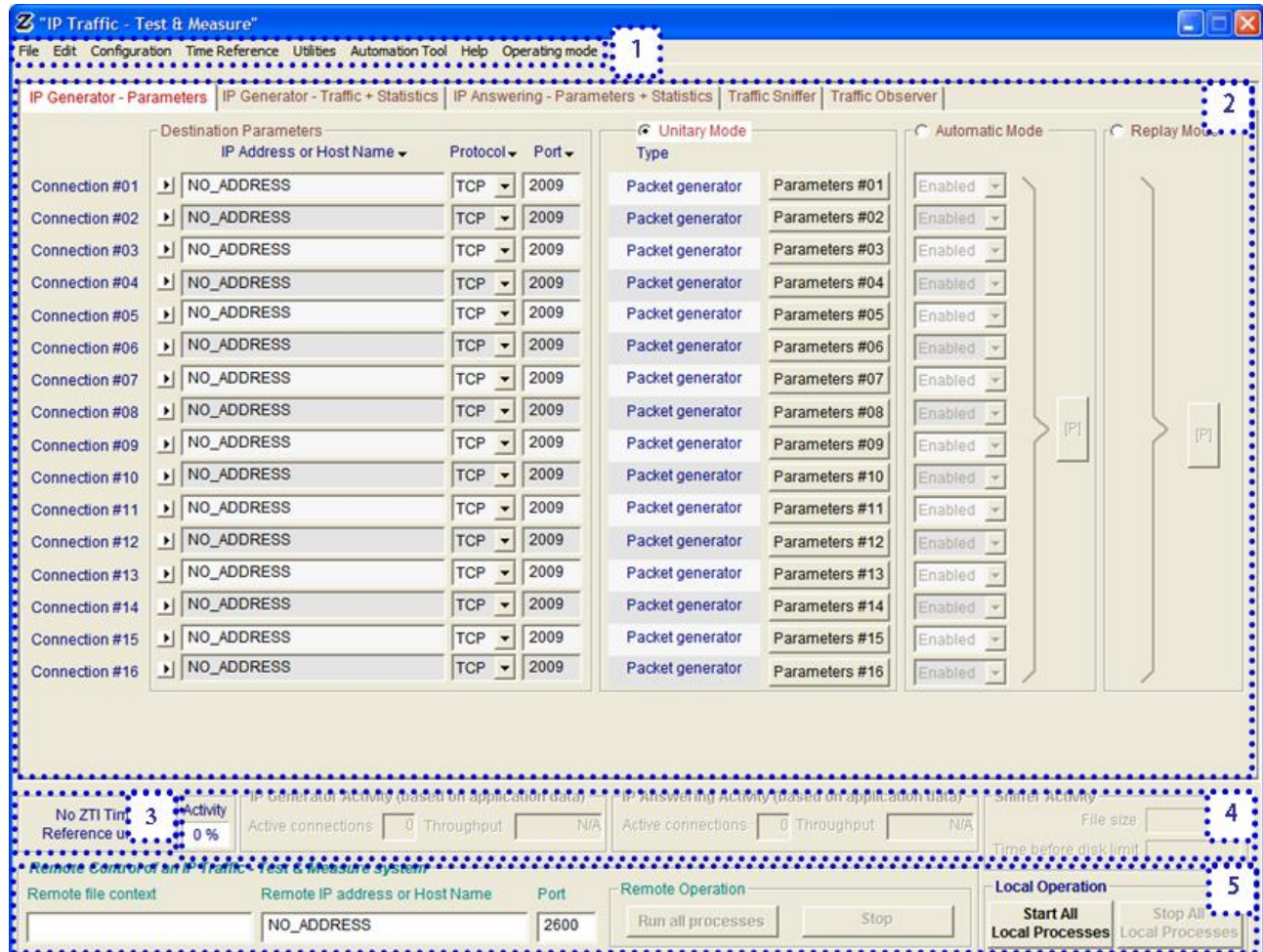


ICMP exchanges must be allowed to enable the use of the z300 Time Device.

PART 9 Graphical User Interface

9.1 Main Window

When you launch **IP Traffic - Test & Measure**, the following window is displayed:



IP Traffic - Test & Measure main window

The **IP Traffic - Test & Measure** main window is composed of four parts:

- 1 **Menu bar:** File, Edit, Configuration, Tools, File downloading, Automation Tool, Help, Operating mode.
- 2 **Tabs area:** this main area displays the five tabs. To see a tab, click on the tab title you want to display.
- 3 **Time Reference display:** this area shows the status of the time device(s) used as Time Reference by **IP Traffic - Test & Measure**.
- 4 **Activity display:** 'Activity' parameter, 'IP Generator Activity', 'IP Answering Activity' and 'Sniffer Activity'.
- 5 **General commands:** for remote control or local operations.

Menu bar, Time Reference display, activity display and global commands are always visible whatever the tab displayed.

9.2 *Display General Rules of the IP Traffic - Test & Measure GUI*

The fields of the **IP Traffic - Test & Measure** software interface can be filled following four situations:

- Fields in which you can enter values

All the fields in which you can enter or choose values are recognizable by black writing on white background color. If an address is not valid, the red color is displayed instead of black.

- Statistics fields

Statistics fields are automatically filled in. They are identifiable by blue writing on white background color. You can only configure the refresh time of statistics display or reset statistics display by pressing the “Reset Display” buttons.

When a statistic value cannot be computed, “N/A” for Not Applicable is displayed in the field.

- Fields generated further to user action and displayed as information use only

These fields are filled automatically by **IP Traffic - Test & Measure** further to use enter or parameters selection. They are displayed as reminder and will be modified by another user action.

These fields are recognizable by black writing on gray background.

- Fields turned out of reach further to user action

User actions and parameters selection may turn some **IP Traffic - Test & Measure** GUI fields and action buttons out of reach. Usually all the out of reach fields are grayed.

Fields can become out of reach in several cases, for example:

- As soon as a connection is running, it is impossible to change its parameters. You must stop the connection in order to change the parameters of the connection.
- When a testing mode (unitary or automatic) is selected, it is impossible to change parameters of the unselected testing mode.

If you enter a non valid value in a field, the connection could be disabled or actions button in the configuration's window could become out of reach.

9.3 Used Units in Information Display

All information used by **IP Traffic - Test & Measure** is displayed with its unit and unit is changing in order to limit figure size.

9.3.1 Volume units

Display	Meaning
10 B	10 Bytes
1 KB	1 Kilo Bytes (1024 bytes)
1 MB	1 Mega Bytes (1048576 bytes)
1 GB	1 Giga Bytes (1073741824 bytes)
1 TB	1 Tera Bytes (1099511627776 bytes)
1.23^65	1.23 x 10^65 Bytes
1 p	1 packet

9.3.2 Throughput units

Display	Meaning
10 b/s	10 bits per second
1 Kb/s	1 Kilo bits per second (1024 b/s)
1 Mb/s	1 Mega bits per second (1048576 b/s)
1 Gb/s	1 Giga bits per second (1073741824 b/s)
1 Tb/s	1 Tera bits per second (1099511627776 b/s)
1.23^65	1.23 x 10^65 bits per second
1 p/s	Packet per second



Throughput computing

The **IP Traffic - Test & Measure** displayed throughputs correspond to payload data on the sampling period (defined in the **IP Traffic - Test & Measure** configuration menu) and bring back to a bits/second number. The displayed throughput is an “application” throughput. At some instant, it could be different from the physical network throughput because data can be split and buffered at various system levels.

9.3.3 Duration units

Display	Meaning
31ms	31 milliseconds
1s	1 second
1mn32s	1 minute 32 seconds
1h24mn	1 hour 24 minutes
>24h	Time superior to 24 hours



Unit changing

To change, a volume value in KB to a volume value in MB, **IP Traffic - Test & Measure** divides the first value per 1024. Ex: 1000 KB = 0.98 MB. The same rule is applied with throughput values. In order to have a throughput in Mb/s coming from a throughput in Kb/s, **IP Traffic - Test & Measure** divides the first value per 1024. Ex: 2048 Kb/s = 2.00 Mb/s.

PART 10 Using IP Traffic - Test & Measure

10.1 Main steps

The main steps to use IP Traffic - Test & Measure are:

◆ **To send data:**

1. *In Tab 1 'IP Generator – Parameters':*
Configure IP Generator parameters (IP address or Host Name, port number, and protocol),
Select and configure testing mode,
2. *In Tab 2 'IP Generator – Traffic + Statistics':*
Run connections,
3. Results: see and exploit statistics in the 'Traffic Observer' tab.

◆ **To receive data:**

1. *In Tab 3 'IP Answering - Parameters + Statistics'*
Configure IP Answering parameters (connected remote, working mode),
2. *In Tab 3 'IP Answering - Parameters + Statistics':*
Start receiving connections,
3. Results: see and exploit statistics in the "Traffic Observer" tab.



About the context file

*In order to avoid entering again all parameters for a new testing session, or to create again mathematical laws, all **IP Traffic - Test & Measure** parameters can be saved in a context file (see File menu description below).*

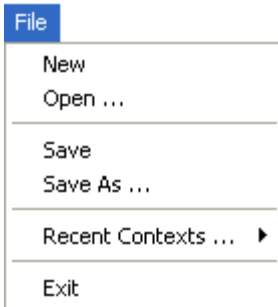
So, if you want to repeat a test session with the same parameters later, do not forget to save the current parameters in a context file before changing any parameter.

10.2 Menu description

The menu's bar is made of 8 items:

File Edit Configuration Time Reference Utilities Automation Tool Help Operating mode

10.2.1 File Menu



◆ File/New

This command opens a new default context in **IP Traffic - Test & Measure**. Before opening a new default context, running connections must be stopped. The default values of a new context are presented in PART 13 Appendix.

◆ File/Open

“Open” command allows reading a context file (.ctx file), which contains a previously saved configuration. Before opening a context, running connections must be stopped.

Note:

Context file contains configuration parameters and a copy of the laws defined by the user. Reading of a context file will delete currently used laws and replace them by the laws saved in the context file.

◆ File/Save

“Save” option allows saving the entire configuration parameters and parameters of the laws defined in the opened context file.

◆ File/Save as

This option allows saving all the configuration parameters and the parameters of the laws defined in a context file (.ctx file), which name is requested in a standard enter dialog box.

◆ File/Recent Contexts

This option allows charging the 4 most recent used context files (.ctx file).

◆ File/Exit

This command stops **IP Traffic - Test & Measure**. To stop **IP Traffic - Test & Measure**, all active connections (‘IP Generator’ and ‘IP Answering’) shall be stopped. A message box will ask you to save or not changes made to parameters in a context file.

10.2.2 Edit menu

Edit

Destination Parameters: IP Address or Host Name ▶
Destination Parameters: Protocol ▶
Destination Parameters: Port ▶

Active tab: "IP Generator – Parameters"

Edit

Listening To: Port ▶
Listening To: Protocol ▶
Coming From: Remote IP Address or Host Name ▶

Active tab: "IP Answering – Parameters + Statistics"

◆ *Edit/Destination Parameters: IP Address or Host Name (for IP Generator)*

One option is available:

Copy the IP Address from Connection #01 to all Connections

By selecting this item, the 'IP Address' field from connection #01 is copied out for all connections from #02 to #16.

◆ *Edit/Destination Parameters: Protocol (for IP Generator)*

Two options are available:

Select TCP for all Connections
Select UDP for all Connections

By selecting one option, the 'Protocol' field for the connections #01 to #16 is set to TCP or UDP.

◆ *Edit/Destination Parameters: Port (for IP Generator)*

Four options are available:

Increase only UDP Ports (from first UDP Connection)
Decrease only UDP Ports (from first UDP Connection)
Increase all Ports (from Connection #01)
Decrease all Ports (from Connection #01)

With this menu, you can:

- Set the port number increasingly or decreasingly for all UDP connections, based on the port number of the first UDP connection.
- Set the port number increasingly or decreasingly for all connections, based on the port number of the first connection without taking considering the protocol in use.

◆ *Edit/Listening To: Port (for IP Answering)*

Four options are available:

Increase only UDP Ports (from first UDP Connection) Decrease only UDP Ports (from first UDP Connection)
Increase all Ports (from Connection #01) Decrease all Ports (from Connection #01)

With this menu, you can:

- Set the port number increasingly or decreasingly for all UDP connections, based on the port number of the first UDP connection.
- Set the port number increasingly or decreasingly for all connections, based on the port number of the first connection without taking considering the protocol in use.

◆ *Edit/Listening To: Protocol (for IP Answering)*

Two options are available:

Select TCP for all Connections Select UDP for all Connections
--

By selecting one option, the 'Protocol' field for the connections #01 to #16 is set to TCP or UDP.

◆ *Edit/Coming From: Remote IP Address or Host Name (for IP Answering)*

One option is available:

Copy the IP Address from Connection #01 to all Connections
--

By selecting this item, the IP Address field from connection #01 is copied out for all connections from #02 to #16.

10.2.3 Configuration menu

Configuration

Microsoft Windows TCP stack parameters
General parameters
File Operating Modes
AutoComplete ...
Disable the "Traffic Observer" tab to increase performances

♦ Microsoft Windows TCP Stack Parameters



The "Stack Parameters" window is not available under Windows Vista. The TCP Window Size and the selective acknowledge are automatically handled by the operating system.

IP Traffic - Test & Measure uses the Microsoft TCP/IP stack via the Winsock2 interface (or API). This interface enables modifying some parameters of the Microsoft TCP/IP stack. **IP Traffic - Test & Measure** enables modifying the TCP Receive Window size and enables the TCP Selective Acknowledgements. When the Stack Parameters command is selected, the following window is opened:

Microsoft Windows TCP stack parameters window



The TCP Receive Window Size value must be included between 1,024 and 1,073,741,823 bytes.

The "OK" button allows saving changes made to the TCP/IP stack Parameters. If some changes have been made, you must restart your PC.



Important: these values are saved in the Registry and influence all applications using the TCP/IP stack.

The path to these parameters on the registry with Windows XP or Server 2003 is:

Key: HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\TCPIP\Parameters

Values: TcpWindowSize & Tcp1323Opts & SackOpts.

◆ General parameters

This command allows configuring parameters applied to graphical display, timeouts for echoed connections and the size of buffers used by **IP Traffic - Test & Measure**. When selected, the following window is pop up:

"IP Traffic - Test & Measure" - General Parameters

Refresh Time and Throughput Sampling Period

The refresh time parameter defines the frequency of statistics updates on "IP Traffic - Test & Measure". This parameter also applies to statistics exportation. The throughput sampling period defines the number of seconds of traffic needed to calculate the throughput.

Refresh Time (1 to 60 seconds)

Throughput Sampling Period (1 to 60 seconds)

TCP and UDP received Data Timeout

These parameters are for the IP Generator Part only. When there is no more data to be sent, "IP Traffic - Test & Measure" continues to receive data until the timeout expires. Then the connection is released. When the timeout is 0, the connection is stopped as soon as there is no more data to be sent.

Timeout for TCP Packets echoed (1 to 9,999 ms)

Timeout for UDP Packets echoed (1 to 9,999 ms)

"IP Traffic - Test & Measure" Buffer Size (SO_RCVBUF and SO_SNDBUF)

The buffers used by "IP Traffic - Test & Measure" to dialog with the Winsock API influence the throughput performance for high speed network. The best performance can be reached with a high buffer size. Change in one of these sizes concerns the new connections only.

Receive Buffer Size (1,024 to 65,535 bytes)

Transmit Buffer Size (1,024 to 65,535 bytes)

General parameters window

Parameters applying to the GUI display

Refresh time: the value entered in this field configures the display refresh time for all statistics displayed in **IP Traffic - Test & Measure**.

Throughput sampling period: the value entered in this field is used to compute the throughput for the statistics display.

Parameters applying to echoed connections

Timeout for TCP packets echoed (ms): value entered in milliseconds. This field is used for echoed TCP connections. When the connection is stopping, **IP Traffic - Test & Measure** continues TCP data acquisition during a time defined by this timeout except if this value equals zero.

Timeout for UDP packets echoed (ms): value entered in milliseconds. This field is used for echoed UDP connections. When the connection is stopping, **IP Traffic - Test & Measure** continues UDP data acquisition during a time defined by this timeout except if this value equals zero.

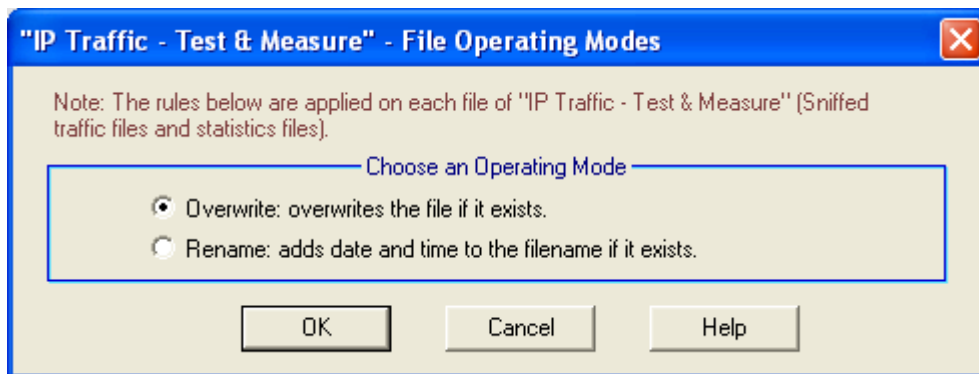
Parameters applying to the data buffer size

Receive buffer size: this value is saved in the current context only and is used when receiving data from the Microsoft Winsock2 interface.

Transmit buffer size: this value is saved in the current context only and is used when sending data to the Microsoft Winsock2 interface.

◆ File Operating Modes

This command allows selecting the file operation mode for every file generated by **IP Traffic - Test & Measure** except for the context file. When selected, the following window is displayed:



File Operating Modes window

Overwrite

If you choose this mode, each time you start a statistics export process or the traffic capture, IP Traffic overwrites the file you have defined if it exists.

Rename

By choosing this mode, IP Traffic adds a suffix to the file name, if the file still exists. The suffix follows the format: mmddyyyy_hhmmss

Example: For a file name IPGenerator_Statistics, the resulting file name generated by IP Traffic will be IPGenerator_Statistics_01242004_193020.

◆ AutoComplete

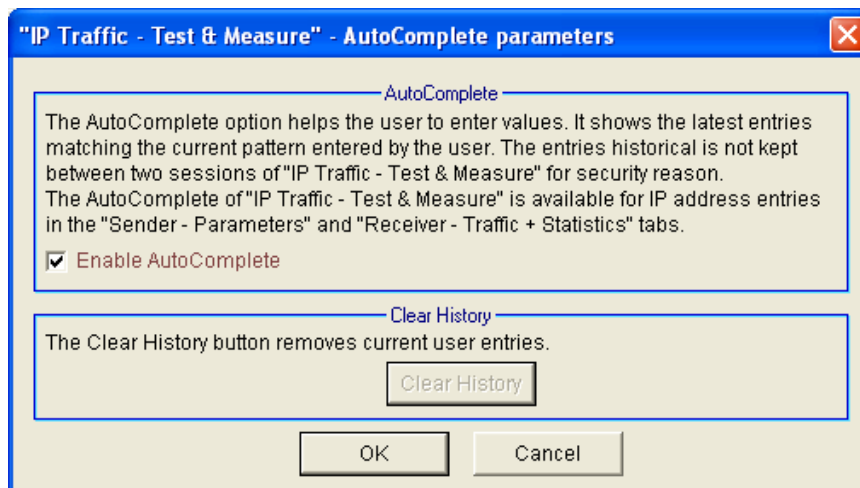
The AutoComplete option is a help mechanism to input values for the user. It lists possible entries that match user entries typed before. The AutoComplete mechanism with **IP Traffic - Test & Measure** is available for IP address entries in the “IP Generator – Parameters” and “IP Answering – Parameters + Statistics” tabs.



There are 5 different historical records:

- Historical record for IP address entry in the IP Generator tab,
- Historical record for IP address entry in the IP Answering tab
- Historical record for IP address in the File Downloading dialog box.
- Historical record for IP address on the Remote Control panel
- Historical record for IP address entry in user-defined filter edition window on the Traffic Sniffer tab.

The AutoComplete parameters dialog is used to enable/disable and to clear all historical records.



Up to 30 entries can be kept in the historical record. When a 31st entry is typed, the 1st entry is deleted: the historical record is handled like a FIFO list.

The **Clear History** button removes user entries from historical records leaving two predefined entries:

- **NO_ADDRESS:** this is the default IP Address of the Traffic Generator - a void address, used to disable the connection.
- **ANY_ADDRESS:** this is the default IP Address of the Answering, used to accept any incoming connection.

When AutoComplete is disabled, the historical record doesn't continue to be filled. User entries available - before AutoComplete deactivation - remain when AutoComplete is activated again.

*Note: the historical record is associated to the **IP Traffic - Test & Measure** session. For confidential reasons, the historical record is not kept between sessions and is lost at the end of the **IP Traffic - Test & Measure** session.*

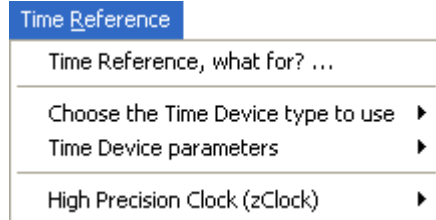
Note: The IP address entries contained in a context are automatically added to the historical record when loading it

◆ **Disable the 'Traffic Observer' tabs to increase performances**

This item allows disabling the 'Traffic Observer' tab in order to free processors and memory resources for traffic generation on slow computers.

When this option is selected, IP level statistics (and graphics) are not available any more.

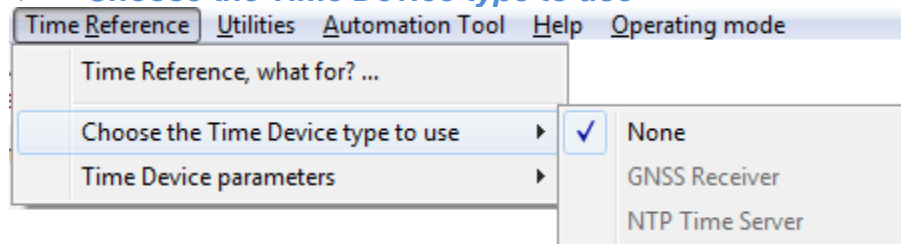
10.2.4 Time Reference menu



◆ Time Reference, what for? ...

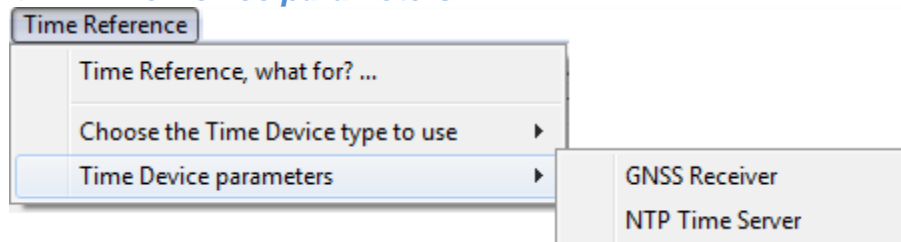
This command opens a window showing a short presentation of the different time devices that can be used with **IP Traffic - Test & Measure**.

◆ Choose the Time Device type to use



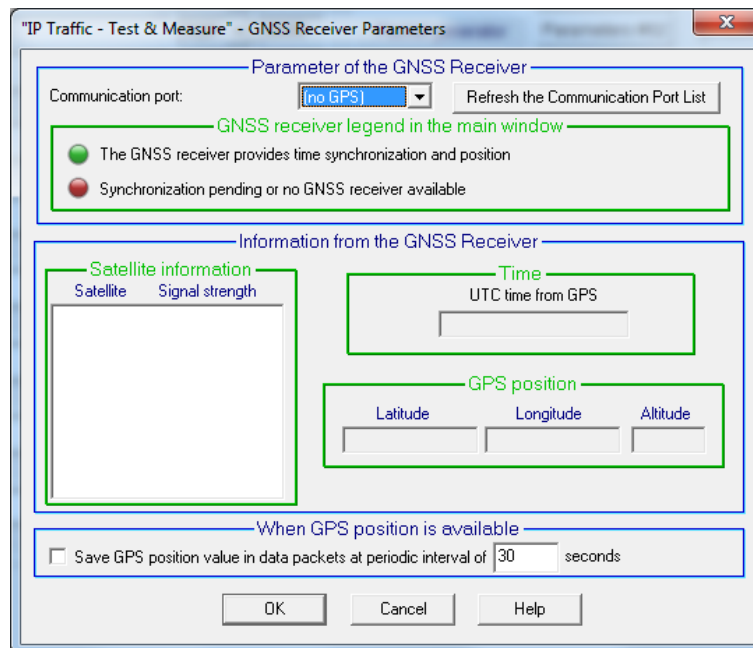
Thanks to this menu, you can select the Time Device you want to use. Select “None” (no time device used) or one of the Time Device Reference. Get more details on those Time Devices at paragraph “1.3 Use a hardware time device to get high precision measurements”.

◆ Time Device parameters



GNSS Receiver

This command allows configuring parameters applying to the GNSS Receiver connected to the PC via a serial link.



This window is divided into four sections:

- **Communication port for the GNSS Receiver:** to select the GNSS Receiver communication port otherwise select “no GPS”.
- **GNSS Receiver legend in the main window:** colored icons giving information on the state of the GNSS Receiver (see the colored light on the lower left of the **IP Traffic - Test & Measure** main window)
 - ⇒ **Green color:** the GNSS Receiver provides synchronization and position information (3D). For this status, the GPS system is synchronized with at least three satellites.
 - ⇒ **Red color:** no information is available from the GNSS Receiver: either the time device is not operational (no time device plugged or no power by example), or there is not enough satellites seen by the GPS to get precise timing information and position. In this case, change the position of the antenna of the GNSS Receiver and wait for a few minutes to see the result.
- **Information from GNSS Receiver:**
 - ⇒ **Satellite information:** for each satellite recognized by the GPS, the satellite number and the signal level are displayed.

Satellite information	
Satellite	Signal strength
10	12.20
13	3.80
2	7.80
(23)	0.00
(24)	0.00
(27)	0.00
(4)	0.00
(8)	---

In this example, 8 satellites are displayed, and only the satellites number 10, 13 and 2 have a significant level.

Satellite information

XX means that the satellite XX is used for computation.

[XX] means that the satellite XX is not used for computation (time and localization).

Signal strength information (in dBm)

xx.yy indicates the signal level

--- means that the signal level is not too low

- ⇒ **Time:** time provided by the GPS system (GMT time).
- ⇒ **GPS position:** 3D reference (latitude, longitude and altitude).

- *When GPS position is available:* the GPS position (latitude, longitude and altitude) can be added to data packets at a user-defined rate. IP Traffic - Test & Measure, stores this additional information in a specific record of the Traffic sniffed file and it is not included in the data packets. By saving the GPS position, IP Traffic is able to provide the location of the computers when they receive or send packets. (see ☐ Statistics Display = Packet Statistics).

In the “GPS parameters” window, a **Help** button gives information about ‘How GPS works’ and how to use it.

Example of GPS parameters window (obtained in Lannion, FRANCE)

In this example, three satellites have a high signal level, and the GPS position is available.

"IP Traffic - Test & Measure" - GNSS Receiver Parameters

Parameter of the GNSS Receiver

Communication port: **COM9 [USB]** Refresh the Communication Port List

GNSS receiver legend in the main window

- ☒ The GNSS receiver provides time synchronization and position
- ☐ Synchronization pending or no GNSS receiver available

Information from the GNSS Receiver

Satellite information

Satellite	Signal strength
13	15.00
16	28.00
21	32.00
23	22.00
25	31.00
27	24.00
29	32.00
3	14.00
31	29.00
6	16.00

Time

UTC time from GPS

2013/10/25 08:45:09

GPS position

Latitude	Longitude	Altitude
+48° 44' 0.62"	-3° 28' 0.34"	83.4

When GPS position is available

☐ Save GPS position value in data packets at periodic interval of **30** seconds

OK Cancel Help



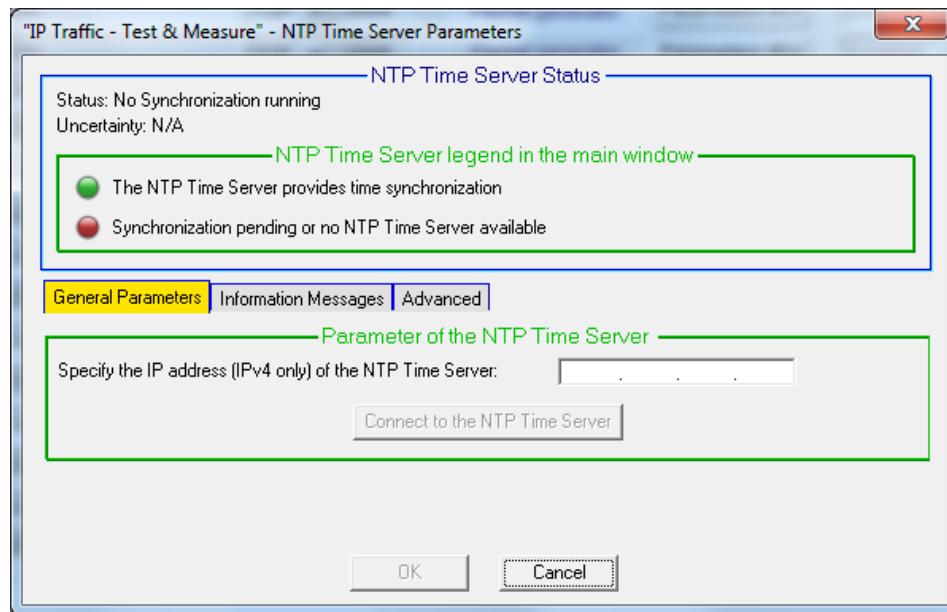
When loading a context having the GNSS Receiver enabled, IP Traffic checks each COM Port to find the GPS unit.



Moreover, if a GNSS Receiver is already active when loading a context having the GNSS Receiver enabled, IP Traffic doesn't resynchronize itself

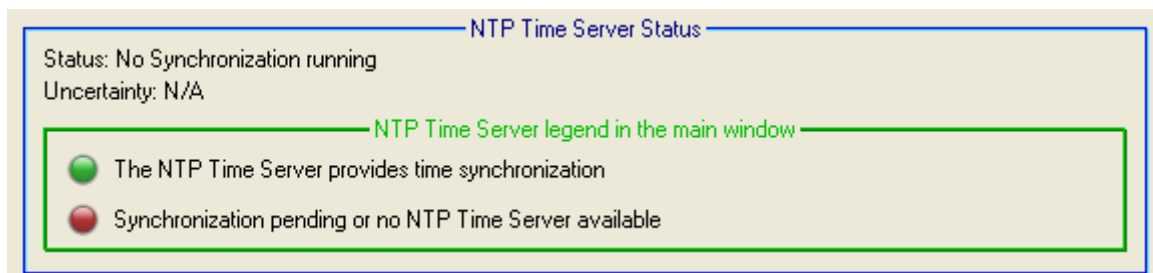
NTP Time Server

This command allows configuring parameters applying to the NTP Time Server connected to the PC through the network.



This window is made of four parts.

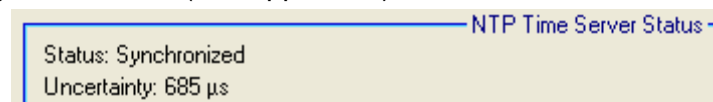
◆ *NTP Time Server Status*



At the top of this window, you can follow the synchronization status. Three statuses exist:

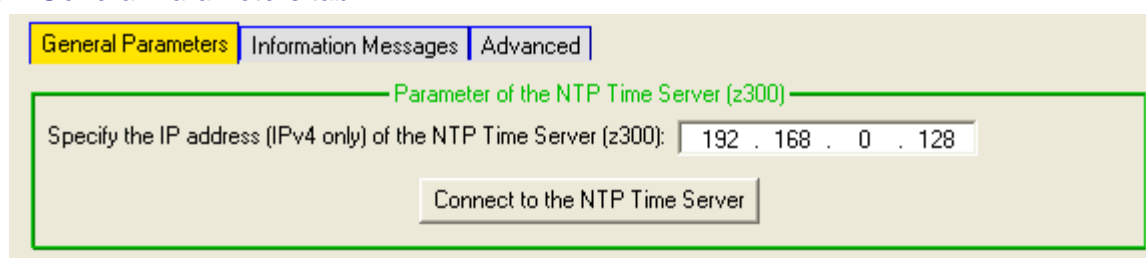
- No Synchronization running
- Synchronizing
- Synchronized

When **IP Traffic - Test & Measure** is synchronized, you get the uncertainty value. In the other cases, the uncertainty value is N/A (Not Applicable).

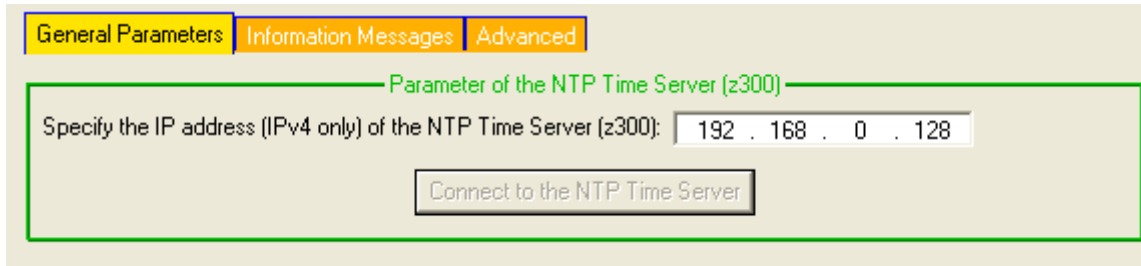


This part explains also the legend shown in the main window. If the red light is on, there is no NTP Time server available or the synchronization is pending. If the green light is on, **IP Traffic - Test & Measure** is synchronized with the NTP Time Server.

◆ *General Parameters tab*



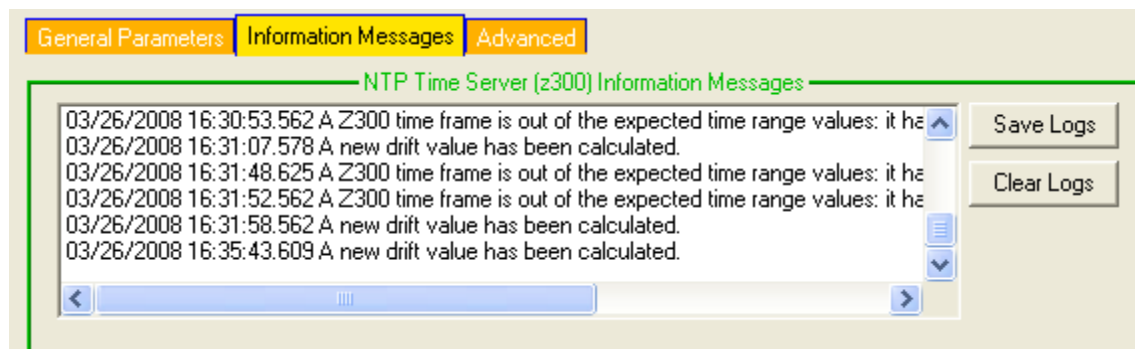
The General Parameters tab allows specifying the IP Address of the NTP Time Server plugged on the network. By clicking on the button “Connect to the NTP Time Server”, you activate the dialog with the NTP Time Server. In that case, the status presented in the last paragraph changes from “No Synchronization running” to “Synchronizing”. Moreover, since the dialog is initiated, you can access to the other tabs, “Information Messages” and “Advanced”.



The screenshot shows a software interface with three tabs: "General Parameters" (highlighted in yellow), "Information Messages" (highlighted in orange), and "Advanced" (highlighted in orange). Below the tabs, there is a green-bordered box containing the text "Parameter of the NTP Time Server (z300)". Inside this box, there is a label "Specify the IP address (IPv4 only) of the NTP Time Server (z300):" followed by a text input field containing the IP address "192 . 168 . 0 . 128". Below the input field, there is a button labeled "Connect to the NTP Time Server".

◆ *Information Messages tab*

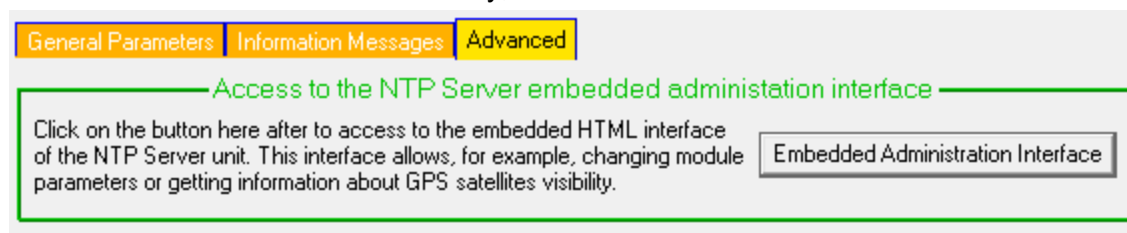
This tab shows the important messages related to the dialog between the NTP Time Server and **IP Traffic - Test & Measure**.



By using the “Clear Logs” button, you can delete all previous messages. By using the “Save Logs” button, you can save into a file all the current messages displayed in the list box.

◆ *Advanced tab*

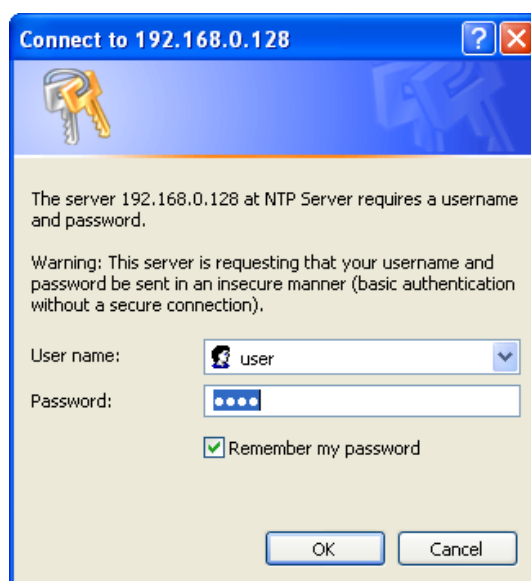
The “Advanced” tab allows having the access to embedded HTML interface of the NTP Time Server (zx00 NTP Server only). This interface allows the parameters configuration and gives information about the satellite visibility, the GPS status ...



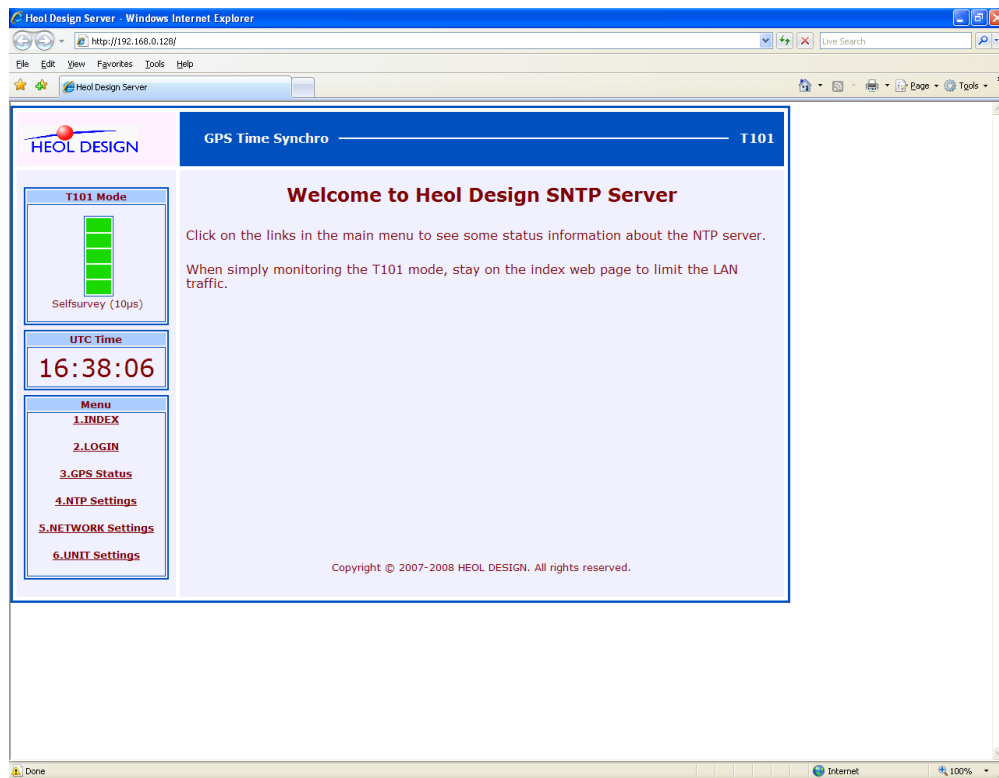
By clicking on the “Embedded Administration Interface”, a browser window is opened asking for a login and password. To be able to access to the interface, enter the following information:

Login: **user**

Password: **heol**



Once you click on the OK button, you have access to the HTML interface. Please refer to the z300 documentation to get more details on the way to configure it.



10.2.5 Utilities menu

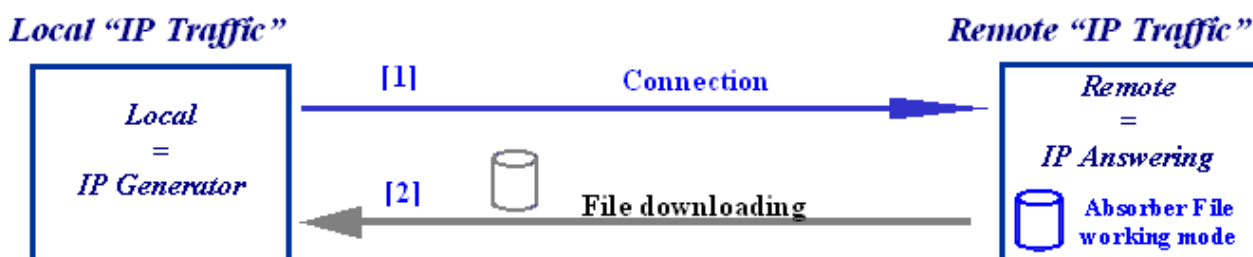
Utilities

File Downloading
Convert Sniffed Traffic File to Ethereal Format File...

◆ File downloading

This command allows downloading a file from one **IP Traffic - Test & Measure** machine to another one. In order to avoid confusion, “Local” and “Remote” terms are used to indicate the machines for this command.

File Downloading is mainly used when a receiving connection is operating in Absorber File working mode. It is aimed at repatriating the absorbed file from IP Answering to IP Generator, as shown in the following scheme (any file from the remote machine can be downloaded).



Example of File downloading in File absorber receiving working mode environment

[1] The Remote 'IP Answering' stocks received data in a file.

[2] The user of the Local 'IP Generator' machine can get the file back by using the File downloading function.

Example of File Downloading usage:

File Downloading may be used when a receiving connection at the Remote side is operating in Absorber File working mode. It is aimed at repatriating the absorbed file from the 'IP Answering' part to compare it to the file sent by the 'IP Generator' part, as shown below.

The Remote 'IP Answering' is configured in the Absorber file Mode, for TCP connection.

The Local 'IP Generator' establishes a TCP connection and sends data from a file.

When the connection is finished, the 'IP Generator' uses the File downloading function to get received data from the Remote 'IP Answering'. The user of Local 'IP Generator' can check if data transfer was successful.

Process a file downloading

When clicking on the file downloading command, the following window appears:

File downloading window

To process a file transfer, do the following steps:

On local and remote machines:

[1] Configure port number – Port number must be the same for local and remote machines.

On local machine:

[2] Give the name and path of the remote file to download. To be downloaded, file must not be read or enriched on the remote machine at the same time.

[3] Give the IP address of the remote machine from which file is downloaded. Can be an IPv4 or an IPv6 address.

[4] Give local name of the destination file.

[5] If necessary, the remote file can be deleted after the downloading

[6] Press the “Start” button to begin file downloading from remote machine.

“OK” button allows saving the entered parameters and closes the window.

Note:

When the “Start” button is pushed, it is impossible to press OK or to close the window. You should press “Stop” or wait the end of file transfer operation.

On the remote machine, the following message box will warn that a file downloading is in progress:

Warning message displayed on the remote machine from which file is downloaded

- Remote IP address is the IP address or host name of the machine from which you want to download the file. Can be an IPv4 or an IPv6 address.
- Port number is the port number for the file downloading process (it must be the same for remote and local machines).

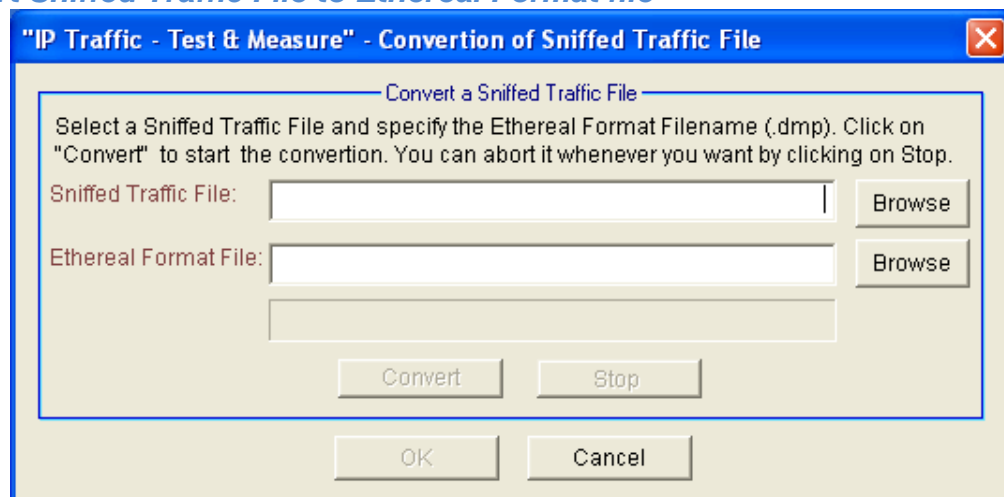
- Local filename downloaded by remote is the name of the downloaded file.
- Data volume to send is the total volume of the file to download.
- Data remaining volume is the volume still to send.

During a file transfer, you will not be allowed to close the application on the Remote machine.

File downloading is working as follows:

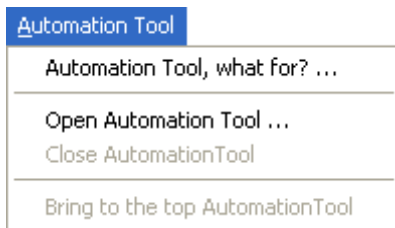
- The Local requests the file that is sent by the Remote machine.
- The Local establishes the connection.
- When the Remote receives the connection demand, it stops all of its running processes.
- The Remote accepts the connection and waits for the filename (with a timeout - default 10 s. This value can be customized. For more information, see the parameter TCP_INACTIVITY at 13.3 Configuration parameters saved in the Registry database).
- When connected, the Local sends the filename.
- When the Remote receives the filename, it checks if the file exists and sends the size (0 means no file or file access error) and data.
- When the Local wants to stop the reception of the file, it disconnects.
- When the Remote has sent the file, it waits for an ACK (with a timeout – 5 s. by default).
- When the reception of the file is complete, the Local sends an ACK.
- When the Remote receives an ACK, it waits for the deletion order
- If the Local receives the whole file, it sends the deletion order (the order can be: “delete” or “do not delete” the file).
- If the file should not be deleted:
 - When the Remote receives the deletion order, it disconnects (no more operation to do).
- If the file should be deleted:
 - When the Remote receives the deletion order, it deletes the file and sends back the result of the deletion (succeeded or not). Then, it disconnects.
- When the Remote receives an expiration of the Timeout, it disconnects.

◆ **Convert Sniffed Traffic File to Ethereal Format file**



This tool allows converting the Sniffed Traffic files by **IP Traffic - Test & Measure** format to Ethereal standard format. By realizing this operation, the result file (dmp) can be opened by a Network Analyzer software such as Ethereal or Network Instruments Observer. This tool can convert capture traffic files containing IPv4 and IPv6 packets.

10.2.6 Automation Tool menu



◆ *Automation Tool, what for?...*

This command opens a window showing a short presentation of the **Automation Tool for IP Traffic - Test & Measure**.

◆ *Open Automation Tool*

The Open command launches the **Automation Tool for IP Traffic - Test & Measure**.

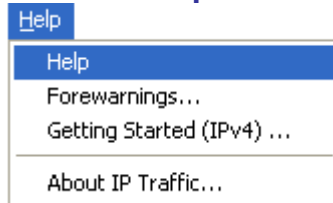
◆ *Close Automation Tool*

The Close command stops the **Automation Tool for IP Traffic - Test & Measure**.

◆ *Bring to the top Automation Tool*

The Bring to the top command displays the **Automation Tool for IP Traffic - Test & Measure** on the top of other windows.

10.2.7 Help Menu



◆ *Help*

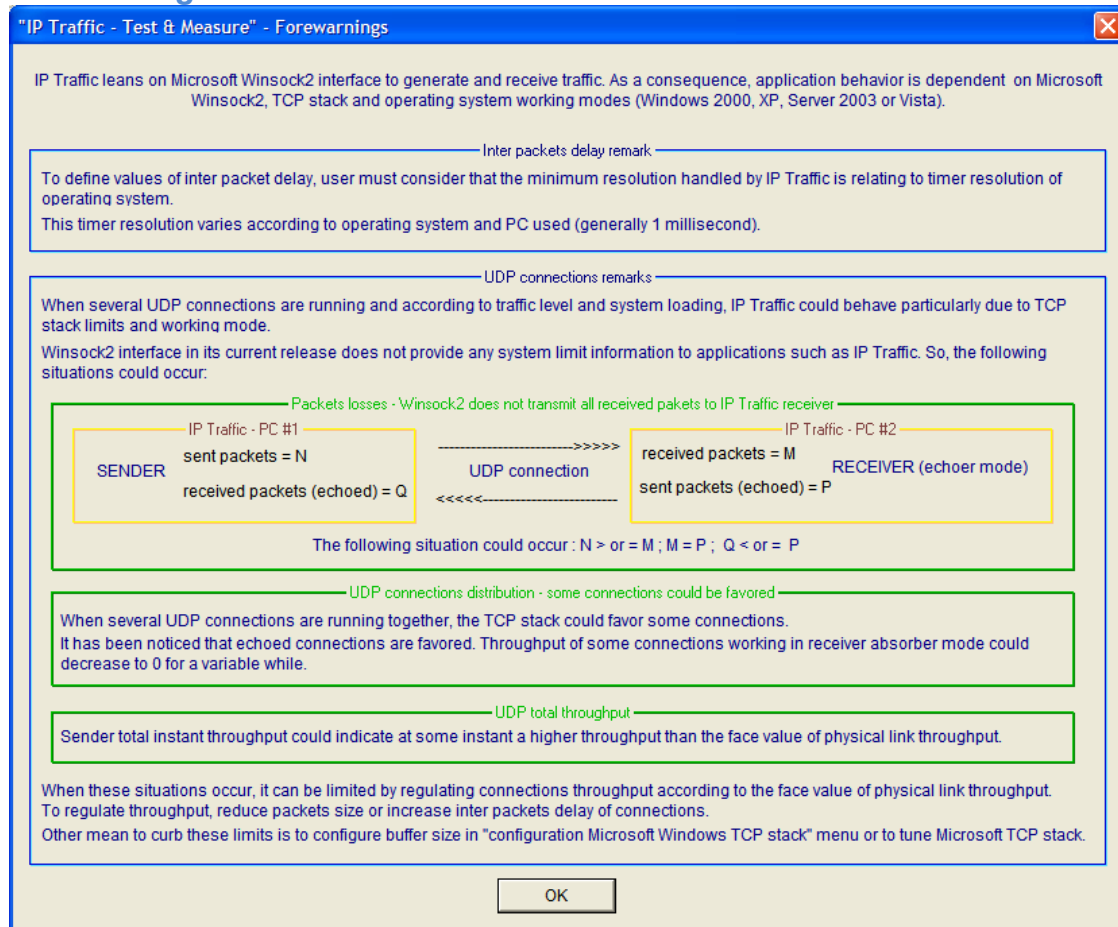
Help command displays help on **IP Traffic - Test & Measure**. Pressing the **F1** key can also activate help. To display the **IP Traffic - Test & Measure** Help, Acrobat Reader should be installed. If Acrobat reader is not installed, a warning message is displayed.

You can download the latest version from <http://www.adobe.com>, or use the version of Acrobat Reader provided with the **“IP Traffic – Test & Measure» CD ROM**.



IP Traffic - Test & Measure doesn't support other PDF readers than Acrobat Reader.

◆ Forewarnings menu



This menu is aimed to inform you of **IP Traffic - Test & Measure** special behaviors due to system limits.

IP Traffic - Test & Measure leans on Microsoft Winsock 2 Interface to generate and receive TCP or UDP traffic. Therefore, **IP Traffic - Test & Measure** behavior, as any Winsock 2 application, is dependent on Winsock 2 Interface, Microsoft TCP Stack and operating system working modes.

Inter packets Delay

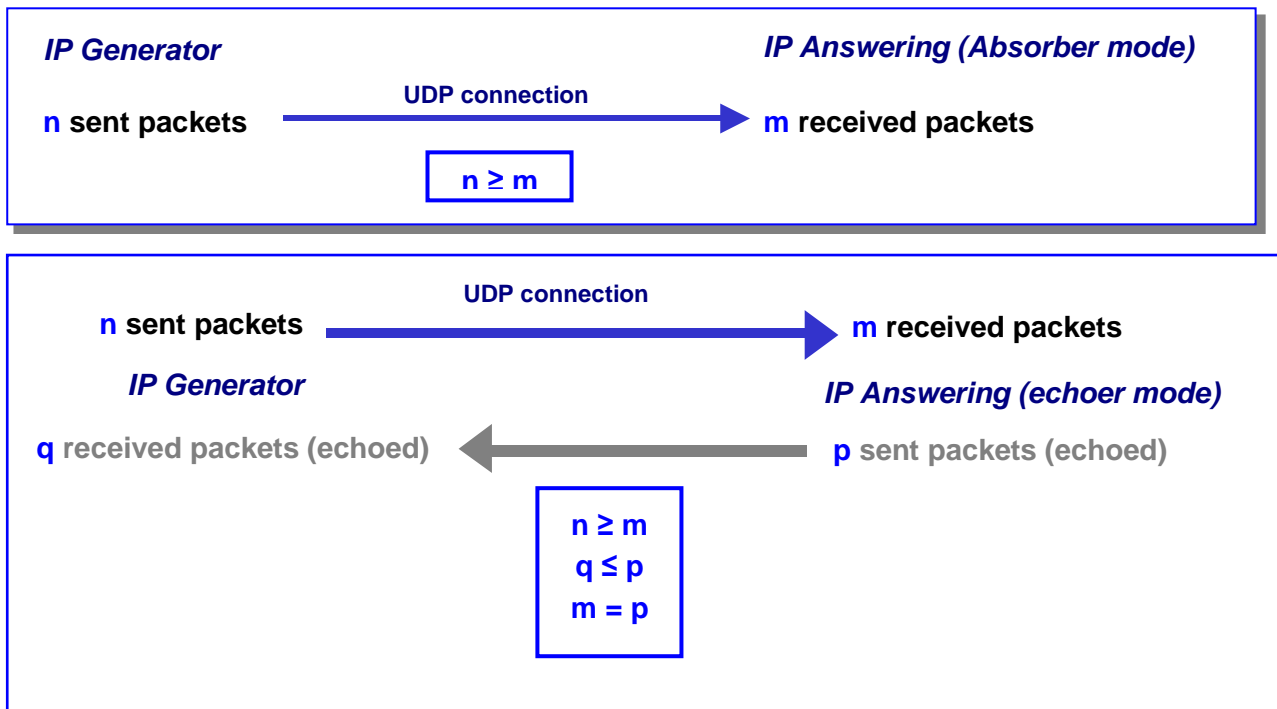
When defining Inter packet delay, the user must consider that minimum resolution handled by **IP Traffic - Test & Measure** is related to timer resolution of operating system. This timer resolution varies according to the used operating system and PC. Usually, timer resolution is 10 or 15 ms.

UDP connections

When several UDP connections are running and according to traffic level and system loading, **IP Traffic - Test & Measure** can have strange behavior due to TCP stack limits and working mode.

◆ Packet losses

UDP connection from Local IP Generator to Remote IP Answering - the working mode of the Remote IP Answering is absorber.



UDP connection from Local IP Generator to Remote IP Answering - the working mode of the Remote IP Answering is echoer.

In this case, the number of received packets (m) will be equal to the number of echoed packet (p) in the 'IP Answering' part. Nevertheless, the number of received packets (q) in the 'IP Generator' part could be inferior to the number of packets (p) sent by the Remote 'IP Answering' in echoer mode.

◆ *UDP connection distribution*

When several UDP connections are running together, the TCP/IP stack may be favor echoed connections.

Throughput of some connections working in the 'IP Answering' absorber mode may decrease to zero for a variable time.

◆ *UDP total throughput*

IP Generator total instant throughput could indicates at some instant a higher throughput than the face value of physical link throughput.

When these situations occur, it can be limited by regulating connections throughput according to the face value of physical link throughput. To regulate throughput, reduce packets size or increase inter packets delay of connections. Other mean to curb these limits is to configure buffer size in "configuration-Microsoft Windows TCP stack" menu or to tune the Microsoft TCP stack.

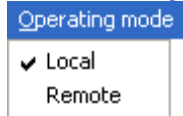
◆ *Help/Getting Started (IPv4)*

The "Getting Started (IPv4)" command displays the Getting Started procedure.

◆ *About IP Traffic - Test & Measure...*

"About" command displays the version number and the copyright of **IP Traffic - Test & Measure** and ZTI Communications contact information.

10.2.8 Operating mode menu



Operating mode

✓ Local

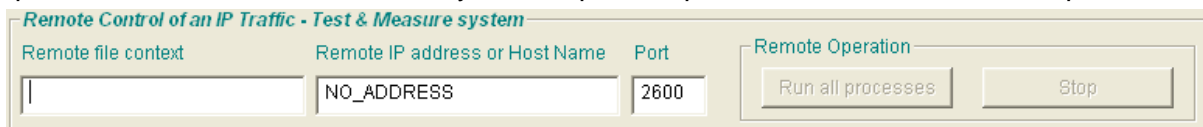
Remote

◆ Local mode

By selecting this mode, all **IP Traffic - Test & Measure** functionalities and commands are available.

◆ Remote control mode

The “Remote” item is enabled only if you have previously filled in the port number in the “Remote control of an «IP Traffic – Test & Measure» system” (for example, 2600 in the example below). Therefore, this system will wait an incoming TCP connection on this port in order to operate under control of a remote system. A port is opened with IPv4 and another port with IPv6.



Remote Control of an IP Traffic - Test & Measure system

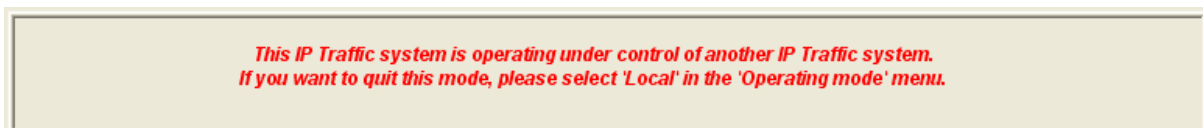
Remote file context Remote IP address or Host Name Port

NO_ADDRESS 2600

Remote Operation

Run all processes Stop

When the remote control mode is selected, a message is displayed at the bottom of the **IP Traffic - Test & Measure** main window as described below, and all button commands and tabs are inhibited.

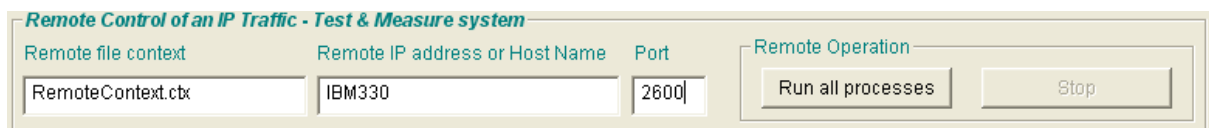


This IP Traffic system is operating under control of another IP Traffic system.
If you want to quit this mode, please select 'Local' in the 'Operating mode' menu.

The “Traffic Observer” tab is displayed and you can see the connections activity if any.

To quit this mode, select the item menu “Normal” of the Operating mode menu. A message is then displayed. Press OK to return in normal operating mode.

A remote **IP Traffic - Test & Measure** system can operate with another **IP Traffic - Test & Measure** system in remote control mode by using commands at the bottom of the **IP Traffic - Test & Measure** main window (left part):



Remote Control of an IP Traffic - Test & Measure system

Remote file context Remote IP address or Host Name Port

RemoteContext.ctx IBM330 2600

Remote Operation

Run all processes Stop

First, you define the remote context file to load on the remote **IP Traffic - Test & Measure** machine, and define the remote IP address or host name (**IPv4 or IPv6**) and the port number.

*Note: the remote **IP Traffic - Test & Measure** machine must be set before in the ‘Remote’ mode (by using the ‘Remote’ item of the ‘Operating mode’ menu).*

When the “Run all processes” button is pressed, a TCP connection is established with the remote system in order to supervise the link between the two systems. Then the context filename previously defined is sent to the remote. The remote system loads this file context and then executes the “Run all processes”. This specific TCP connection between local and remote is stopped when you press the “Stop” button of the ‘Remote operations’ on the local system.

10.3 Main window: the five tabs

Tabs general presentation:

IP Traffic - Test & Measure presents five tabs:



IP Traffic - Test & Measure tabs titles

- ⇒ The first two tabs are related to the 'IP Generator' module. They are named "**IP Generator - Parameters**" and "**IP Generator - Traffic + Statistics**".
- ⇒ The third one is related to the 'IP Answering' module, it is named "**IP Answering - Parameters + Statistics**".

For the first three tabs related to the 'IP Generator' and 'IP Answering' modules, each one of the 16 connections is represented by one line (from "connection #01" to "connection #16"). Columns represent parameters or status of connections and statistics.

- ⇒ The fourth tab concerns the management of the Sniffer allowing IP traffic capture: the "**Traffic Sniffer**".
- ⇒ The fifth tab is named "**Traffic Observer**": all statistics and graphs are displayed in this tab with many user commands and parameters.

Each tab is composed of several areas. For each tab, we will present in this guide each area separately.

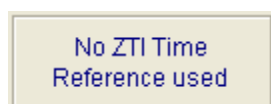
10.4 Main window: the Time Reference display and the activity display

IP Traffic - Test & Measure displays four information areas:

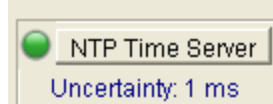


- The left area contains two kind of indicators:
 - **Time Reference** status with the uncertainty value:

**No Time Device and
no zClock used**

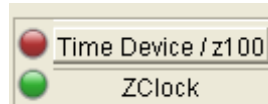


**z100, z200 or z300
Time Device used**



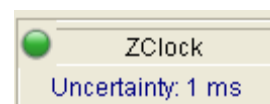
*You can click on the
button to reach the
configuration window.*

**z100 or z200 +
zClock**



*When zClock is coupled
with a z100 or z200 Time
Device, the uncertainty is
not displayed.*

zClock only



The colored light (green or red) gives the status of the device (Time Device or zClock). If green, zClock or the Time device is present and operational otherwise you get the red light.

- The **Activity** counter expressed in % indicating the general O.S. activity. Under Windows Vista, the **Activity** counter is available only when **IP Traffic - Test & Measure** is launched with administrator rights. In the other case, the value N/A is displayed.
- **IP Generator Activity** with the total number of active connections and the total throughput for these connections. This throughput shows Rx **and** Tx activities for the IP Generator part.
- **IP Answering Activity** with the total number of active connections and the total throughput for these connections. This throughput shows Rx **and** Tx activities for the IP Answering part.
- **Sniffer Activity** to indicate the current Sniffer activity (saving files) with the current total file size already saved on disk and time available before disk limit.

Statistics display refresh time, and sampling period to compute throughputs are configured in *Configuration / General Parameters* menu.

10.5 Main window: the general commands

IP Traffic - Test & Measure offers two command blocks at the bottom of the main window:

- On the left: commands for **Remote control of an IP Traffic - Test & Measure system**

For remote control, you must first specify the following parameters:

- ⇒ Remote file context: filename of the **IP Traffic - Test & Measure** context to load located on the remote
- ⇒ The remote IP address or host name (IPv4 or IPv6)
- ⇒ The associated Port number

Then you control the remote **IP Traffic - Test & Measure** system with these commands:

- ⇒ **Run all processes**: the 'IP Generator' and 'IP Answering' modules of the remote system are started. Moreover, if the option is selected, this button can handle the Traffic Sniffer and the statistics export process of the Traffic Observer.
- ⇒ **Stop**: the 'IP Generator' and 'IP Answering' modules of the remote system are stopped.

Note:

*The previous commands are used to control a remote **IP Traffic - Test & Measure** system. The remote system must be switched before in 'Remote control mode' by using the "Operating mode" menu (and you must specify on this remote system the same port number as the one defined previously for the local system).*

- On the right: **Local Operation**

The user can launch four main functionalities independently: IP Traffic Generator ("Run All Connections"), IP Answering ("Start receiving traffic"), Traffic Sniffer ("Start") and Export statistics of the Traffic Observer tab ("Start"). For the Traffic Sniffer and the Traffic Observer tabs, read the note below.

The command button "**Start All Local Processes**" is used to activate simultaneously these functions. The command button "**Stop All Local Processes Stop**" stops all active functions.

Note:

User must first define if the start commands for the 'Traffic Sniffer' and the export of statistics in the 'Traffic Observer' tab are included in the "Run all processes" command. See the check boxes in the 'Traffic Sniffer' (Enable automatic start and stop in local operation) in the paragraph 10.9.2 Capture sniffed traffic into a file and in the parameters button of 'Export statistics' in the 'Traffic Observer' (Enable automatic export in local operation) in the paragraph 10.10 The 'Traffic Observer' tab.

10.6 The 'IP Generator – Parameters' tab

The 'IP Generator' module is composed of two tabs:

- ⇒ **IP Generator – Parameters** tab: to configure connections and testing mode.
- ⇒ **IP Generator – Traffic + statistics** tab: to command traffic generation and visualize traffic statistics.

The "IP Generator – Parameters" tab is described in this chapter. The "IP Generator – Traffic + statistics" tab is explained in the next chapter.

The 'IP Generator' module handles up to 16 simultaneous connections and traffic can be generated following three exclusive testing modes:

- Unitary mode
- Automatic mode
- Replay sniffed traffic

The "IP Generator – Parameters" tab allows:

- ⇒ Entering the destination parameters (IP address, port number, protocol) for each connection.
- ⇒ Selecting files in which to save the received data when connections are working in echoer or Generator mode on the remote IP Answering part.
- ⇒ Selecting and configuring the testing mode: Unitary, Automatic or Replay.

These actions are represented by the "IP Generator-Parameters" tab in 4 distinct areas and detailed below.

Destination Parameters			
	IP Address or Host Name	Protocol	Port
Connection #1	192.168.0.30	UDP	2009
Connection #2	192.168.0.30	UDP	2010
Connection #3	192.168.0.30	UDP	2011
Connection #4	192.168.0.30	UDP	2012
Connection #5	192.168.0.30	UDP	2013
Connection #6	NO_ADDRESS	TCP	2014
Connection #7	192.168.0.30	TCP	2015
Connection #8	192.168.0.30	TCP	2016
Connection #9	192.168.0.30	TCP	2017
Connection #10	192.168.0.30	TCP	2018
Connection #11	192.168.0.30	TCP	2019
Connection #12	192.168.0.30	TCP	2020
Connection #13	192.168.0.30	TCP	2021
Connection #14	192.168.0.30	TCP	2022
Connection #15	192.168.0.30	UDP	2023
Connection #16	192.168.0.30	TCP	2024

Unitary Mode	
Type	Parameters
Mathematical law	Parameters #01
Packet generator	Parameters #02
File to send	Parameters #03
User file	Parameters #04
User DLL	Parameters #05
Packet generator	Parameters #06
Packet generator	Parameters #07
Packet generator	Parameters #08
Packet generator	Parameters #09
Packet generator	Parameters #10
Packet generator	Parameters #11
Packet generator	Parameters #12
Packet generator	Parameters #13
Packet generator	Parameters #14
Packet generator	Parameters #15
Packet generator	Parameters #16


Automatic Mode	
Parameters	Mode
Parameters #01	Enabled
Parameters #02	Enabled
Parameters #03	Enabled
Parameters #04	Enabled
Parameters #05	Enabled
Parameters #06	Enabled
Parameters #07	Enabled
Parameters #08	Enabled
Parameters #09	Enabled
Parameters #10	Enabled
Parameters #11	Enabled
Parameters #12	Enabled
Parameters #13	Enabled
Parameters #14	Enabled
Parameters #15	Enabled
Parameters #16	Enabled

Replay Mode	
Parameters	Mode
Parameters #01	Enabled
Parameters #02	Enabled
Parameters #03	Enabled
Parameters #04	Enabled
Parameters #05	Enabled
Parameters #06	Enabled
Parameters #07	Enabled
Parameters #08	Enabled
Parameters #09	Enabled
Parameters #10	Enabled
Parameters #11	Enabled
Parameters #12	Enabled
Parameters #13	Enabled
Parameters #14	Enabled
Parameters #15	Enabled
Parameters #16	Enabled

IP Generator – Parameters tab

10.6.1 Destination Parameters

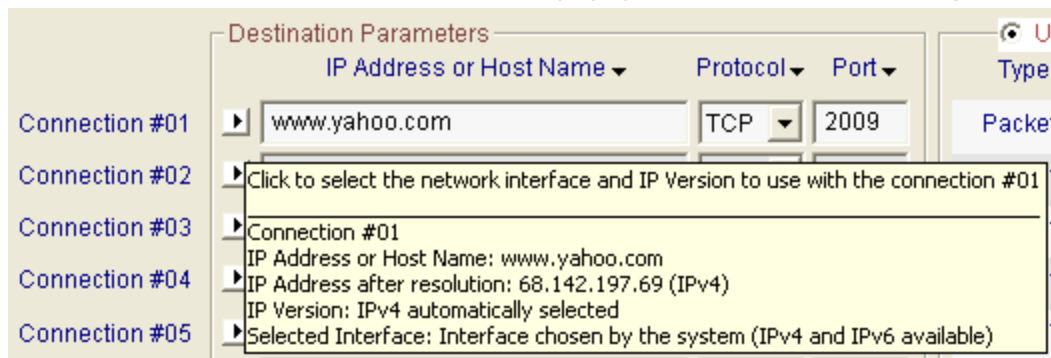
Located at the left part of the tab, this area allows configuring the destination parameters of each sending connection. You can enter the following information:

Network interface selection and IP version 	<p>The black arrow has two purposes:</p> <ul style="list-style-type: none"> • To display a summary of the connection's parameters. • To select the network interface, the IP version, the IP source address or the source port for a connection.
IP address or Host Name	<p>IP address should be entered following the numerical writing of IP address (i.e. xxx.xxx.xxx.xxx) or using the canonical format (e.g. an URL).</p> <p>The default IP address is NO_ADDRESS (0.0.0.0 for IPv4).</p> <p>Once the value entered, verification of the syntax or address resolution is made and the field becomes red if the value is invalid.</p>
Protocol	TCP, UDP or ICMP protocol (default = TCP protocol).
Port*	<p>The port number is limited to 65,535.</p> <p>By default, the port number is 2009.</p>

* Not available with ICMP connections

◆ Summary of connection parameters

When you move the mouse over the black arrow, a popup window - called a **tooltip** – is displayed.

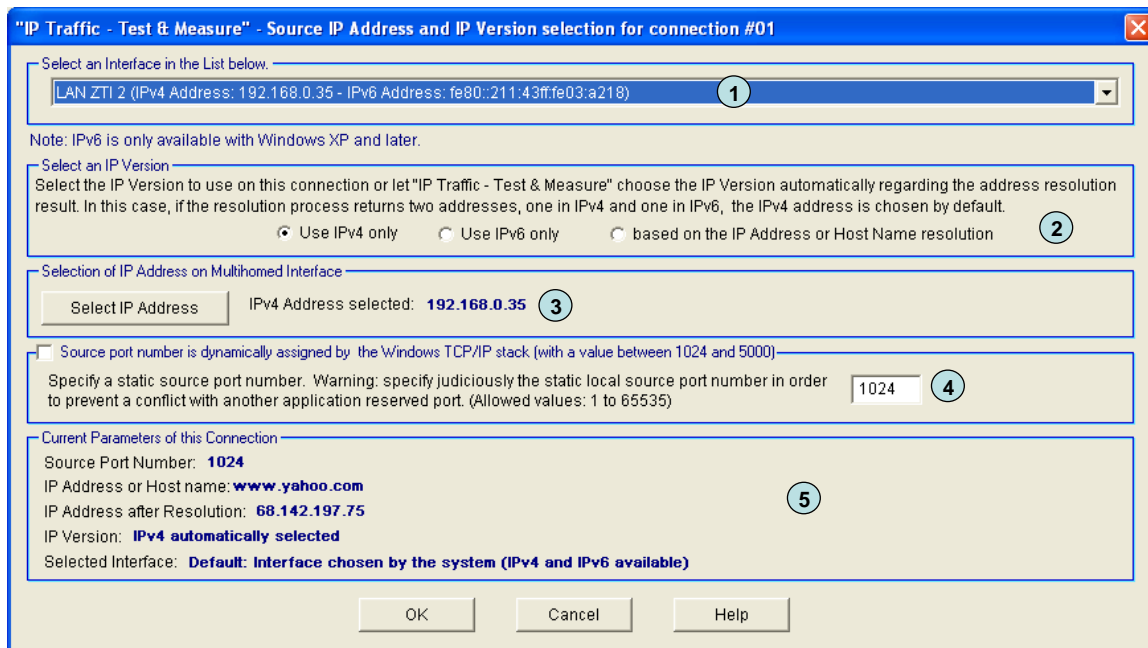


The tooltip for the IP Generator connection includes 5 items:

- The first item is the connection number the tooltip refers to.
- The next item is the IP address or host name defined by the user.
- The next item is the IP address translated when IP Translation address has succeeded (e.g. the address is neither NO_ADDRESS nor 0.0.0.0).
- The next item is the IP version currently selected.
- The last item is the interface's name selected. The name displayed is the name of the connection presented in the "Settings/Network and Dial-up Connections" Start menu of the operating system (Default is "Interface chosen by the system").

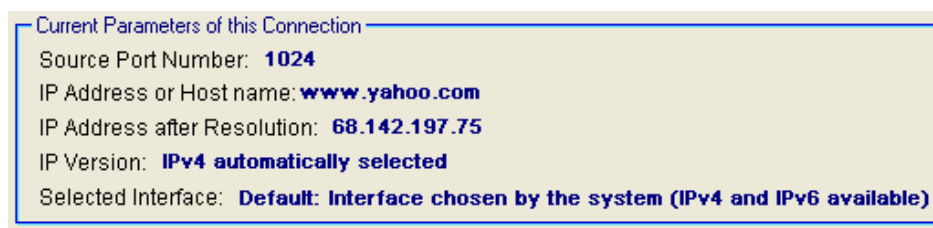
◆ Select the network interface, source IP address and source port number

When you click on the black triangle, a window is displayed:



Network interface, IP version and IP source address for a Sender connection

- (1) The **network interface** selection is optional with IPv4. It is used to constrain connections to be established using a specific interface.
- By default:
 - The IP version is automatically selected by **IP Traffic - Test & Measure** regarding the destination address or host name specified on the "IP Generator - Parameters" tab (see below).
 - The IP stack resolves the interface selection to send packets to the remote. The IP stack uses the destination IP address to select the correct interface. The IP address and the netmask related to each interface are checked against the remote IP address to reach. When an interface that matches the remote IP address is found, it is used. To understand how the IP stack selects the interface, you may enter 'route print' console command to list the interface order, the IP address and the network address mask.
 - You can select one interface from the list of the connected interfaces. **IP Traffic - Test & Measure** will only use the selected interface to translate IP address and to make a connection. You must select the interface compatible with the remote IP address you want to reach. When the IP address translation failed, the current connection parameters area is updated as follows:




- Interface types are restricted: only Ethernet and PPP are listed.
A PPP interface should be in a 'connected' state to belong to the interface list.



We have noticed that some operating systems may choose automatically the best network interface to use when several NICs are plugged on the same network when it comes to network interface selection. In that case, data can be sent on one interface and received on another one.

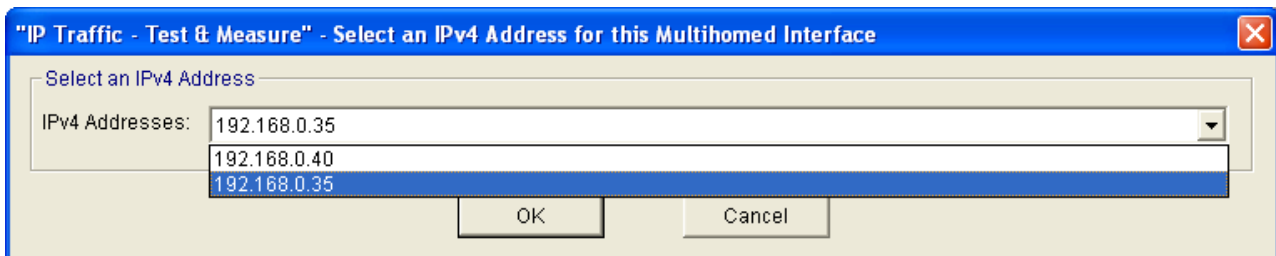
(2) The IP version selection is available:

- with Windows XP (or later)
- If IPv6 features are installed on the target machine. Please refer to the Windows XP or Server 2003 documentation to install the IPv6 stack. On Windows Vista, the IPv6 stack is installed by default.
- You can allow **IP Traffic - Test & Measure** to choose automatically the good IP version regarding the address or host name resolution result. If a canonical name corresponds at the same time to an IPv4 and IPv6 address, **IP Traffic - Test & Measure** chooses the IPv4 address. In that case, to use the IPv6 address, you should leave the automatic selection mode and specify the use of IPv6.

If you have selected an IP version, the IP address translation (see ) uses the current selected IP version to get the IP address numerical form.

(3) Select IP address is available when multiple IP addresses are attached to the network interface. This interface configuration is also known as 'multihomed' interface. The selection of a Source IP address is generally not required: **IP Traffic - Test & Measure** uses the default IP address of the interface to establish connections. It may be useful when routing priority or policy is defined.

Example of an IP address selection for a multihomed interface:



Select IP address is not available if the default interface 'Interface chosen by the system' is selected.

- (4) Specification of the local source port number** is disabled by default. In this case, the system automatically chooses the source port number for any connection generating traffic. In order to respect the rules of a firewall for example, the source port number can be user defined.
- (5) Current parameters of this connection** area are an abstract for the connection. It summarizes the IP address, the numerical IP address format, the IP version and the interface selection.
- The source port used is dynamically updated with the user selection.
 - IP addresses are static. The IP address translation process occurs after you click on OK.

- IP version field is dynamically updated with the user selection.
- Current interface is dynamically updated with the user selection.



When you click on the OK button if the interface selected or IP version has changed, the IP address translation is automatically started. *It may be time consuming.*

♦ **IP Address translation mechanism**

IP Traffic - Test & Measure tries to translate – e.g. to resolve - the IP address from a canonical to a numerical format. This operation is called the *IP address translation mechanism*. When the 'IP Address or Host Name' field or Interface parameters changes, when you move from 'IP Address or Host Name' field to another field, or to another tab, when the Enter key is pressed or when the Interface parameters change, all of these actions start the IP address translation function.

Because the IP address translation mechanism is time consuming, you should be carefully when using IP canonical addresses. The time consumption depends on the DNS answer speed, the number of DNS configured and the network load when the DNS request is sent.

If network environment changes – e.g. a new DNS has been defined - you should press the Enter key in the 'IP Address or Host Name' field to force **IP Traffic - Test & Measure** to restart the translation mechanism for this connection.



When the IP address translation failed, the IP address is written in **red** on a white background. This connection cannot be started: the "Run" button in the 'IP Generator – Traffic + Statistics' tab is grayed.



To summarize, the **IP address translation** mechanism is activated when:

- the focus leaves the 'IP Address or Host Name' field,
- another tab is selected,
- you change the Interface parameters,
- a context file is loaded.



If no IP version has been selected, the IP address translation mechanism chooses the good IP version regarding the IP version returned by the resolution process. If for example, a canonical name represents at the same time an IPv4 and an IPv6 addresses, the IP Address Translation mechanism chooses the IPv4 address. If you want to use the IPv6 address, you should select IPv6 version (see ☐ Select the network interface, source IP address and source port number).

◆ Duplicate parameters of a connection onto others

In order to facilitate the input of these parameters, a *copy/paste mechanism* for all parameters of a connection is available. This mechanism is not available when the canonical IP address cannot be translated into numerical format.

Duplication of connection's parameters doesn't copy the interface information. When you copy a connection to another one, the IP address translation mechanism is started.

Step 1: first, input parameters for a connection (for example, connection #01)

Destination Parameters			
	IP Address or Host Name	Protocol	Port
Connection #1	192.168.0.13	TCP	2009
Connection #2	NO_ADDRESS	TCP	2009
Connection #3	NO_ADDRESS	TCP	2009

Step 2: move the mouse cursor on the 'Connection #1' label (source). The mouse cursor appears as shown beside.

	IP Address or Host Name	Protocol	Port
Connection #1	192.168.0.13	TCP	2009

Step 3: mouse click left. Then the 'Connection #1' label is blue colored.

	IP Address or Host Name	Protocol	Port
Connection #01	192.168.0.13	TCP	2010
Connection #02	NO_ADDRESS	TCP	2009

Step 4: when you move the mouse cursor on one another 'Connection #02' label for example, the mouse cursor changes.

	IP Address or Host Name	Protocol	Port
Connection #01	192.168.0.13	TCP	2010
Connection #02	NO_ADDRESS	TCP	2009



(Copy mode)

Step 5: then you can paste all parameters of connection #01 to the desired connection (#02 for example as target). Put the mouse cursor on the 'Connection #02' label and then use the left mouse button.

	IP Address or Host Name	Protocol	Port
Connection #01	192.168.0.13	TCP	2010
Connection #02	192.168.0.13	TCP	2010

Note: this copy/paste function allows copying parameters from one connection (source) to another one (target). Repeat this process for others connections if needed.

◆ *Description of the floating menu mechanism*

In the Destination Parameters object, the labels 'IP address', 'Port' and 'Protocol' are mouse sensitive.



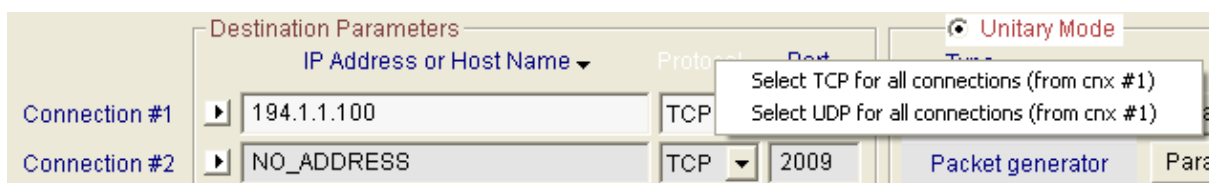
When the mouse is located on the 'IP Address or Host Name' text area for example, the text color changes to white. Then click left your mouse to display the associated menu.

Floating menu for the 'IP Address or Host Name' label



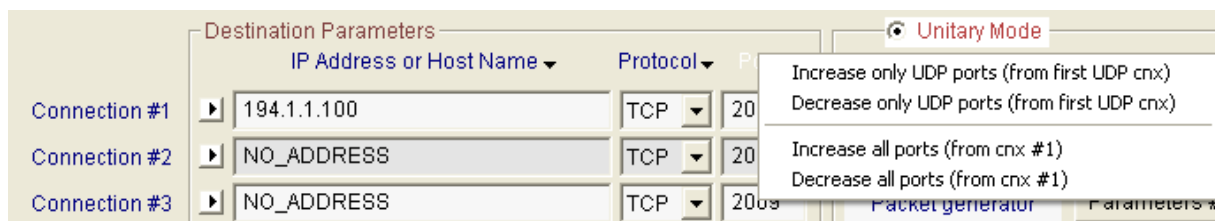
With this function, you can duplicate the IP address or the Host name from the first connection to the others fifteen connections.

Floating menu for the 'Protocol' label



This menu helps to set the same protocol to every connection.

Floating menu for the 'Port' label



With this menu you can:

- Set the port number increasingly or decreasingly for every UDP connection, based on the port number of the first UDP connection,
- Set the port number increasingly or decreasingly for every connection, based on the port number of the first connection without taking account the protocol in use.

10.6.2 Configure the Unitary Mode for TCP and/or UDP connections

Unitary Mode	
Type	
Mathematical law	Parameters #01
Packet generator	Parameters #02
File to send	Parameters #03
User file	Parameters #04
User DLL	Parameters #05
Packet generator	Parameters #06
Packet generator	Parameters #07
Packet generator	Parameters #08
File to send	Parameters #09
Mathematical law	Parameters #10
Packet generator	Parameters #11
User DLL	Parameters #12
User file	Parameters #13
Packet generator	Parameters #14
Packet generator	Parameters #15
Packet generator	Parameters #16

The unitary mode is one of the three testing modes offered by the 'IP Generator' module. Note that each testing mode is exclusive, i.e. it is impossible to mix connections in unitary testing mode and connections in another mode.

Unitary mode is configured in Tab 1 "IP Generator - Parameters" and launched from Tab 2 "IP Generator - Traffic + Statistics".

To run or configure unitary testing session, you must first select 'Unitary mode'.

By pressing "Parameter #n" buttons, a parameters window is displayed and the parameters for this connection can be configured.

The main selected unitary testing parameter of connection #n is reminded beside the "Parameters #n" button: Mathematical law, Packet generator, File to send, User file or User DLL.

When the "Parameters #n" button is pressed, the following window is displayed.

"IP Traffic - Test & Measure" - Parameters in unitary testing mode

Mode 1: Using the Internal Data Generator

Step1: Select the traffic generator type
First of all, select the traffic generator which is going to be used on this connection.

Packets generator Parameters
Packets number (0 to 99,999,999) (0 = infinite value)

Packet Contents (00 to FF hexa byte)

☒ Fix
☐ Random min max
☐ Alternate value-1 value-2
☐ Increasing / Decreasing min max step

Law : data volume to send

☐ Mathematical law
 Uniform law
 Range : [9.77 KB , 2.38 MB]

☐ File to send

 Loop counter (1 to 99) Idle time between each loop (0 to 99 s)

Step2: Specify Data Size and packets parameters
 In this step, define Data Size and packets parameters as well as the delay between each sent packet.

TCP Data Size (1 to 65535 bytes)

☒ Fix
☐ Random min max
☐ Alternate size-1 size-2
☐ Increasing / Decreasing min max step

Inter Packet Delay (0 to 9.999 ms)

☒ Fix (See Forewarnings menu please)
☐ Random min max
☐ Alternate value-1 value-2
☐ Increasing / Decreasing min max step
☐ Mathematical law

Step 3 (Optional): Activate a throughput limit
 When one of these two options is selected, "IP Traffic - Test & Measure" generates the traffic in best effort to respect the throughput chosen.

☐ Use value Mean Throughput (8 to 999,999 Kb/s)
☒ Inter Packet Delay automatically adjusted by IP Traffic
☐ TCP or UDP Data Size automatically adjusted by IP Traffic
☐ Use value (except for TCP connection) Mean Packet Throughput (1 to 99,999 Pkts/s)

Mode 2: Using the External Data Source Generator ☒ User file or ☐ User DLL

Loop counter Idle time between each loop (sec.)

Options

Timecode (RTT) option
 If enabled, IP Traffic adds 14 bytes to the "Data Size" defined by the Mode 1 or Mode 2 settings. ☐ Yes ☒ No

DSCP (1 hexa byte)
 Value (0x00 to 0x3F)

Time To Live (TTL)
 Value

Save incoming data traffic (needs remote in echo mode)

Save generated traffic into file (only data are saved)

Unitary testing parameters window

This window is divided into three main areas:

- Mode 1: Using the Internal data generator
- Mode 2: Using the External data source generator (allowing to use an user file or an user DLL)
- Options:
 - Time code option (used to calculate the RTT – Round Trip Time and Jitter, if the remote is operating in the echoer mode)
 - DSCP value byte (hex value)
 - TTL (Time To Live) byte (hex value)
 - Save incoming data traffic in a file for this connection (if the remote is operating with the echoer mode)
 - Save generated traffic into a file for this connection

The “OK” button validates new entered parameters for this connection and closes the window.

Note: The first parameter to configure a unitary testing session is to select the mode between the internal data generator and the external data source generator.

◆ Mode 1: Using the Internal data generator

Mode 1: Using the Internal Data Generator

Step 1: Select the traffic generator type
First of all, select the traffic generator which is going to be used on this connection.

Packets generator Parameters

Packets number (0 to 99,999,999) (0 = infinite value)

Packet Contents (00 to FF hexa byte)

☒ Fix min max

☐ Random

☐ Alternate value-1 value-2

☐ Increasing / Decreasing min max step

Mathematical law

Law : data volume to send

Uniform law
Range : [9.77 KB , 2.38 MB]

File to send

Filename

Loop counter (1 to 99) Idle time between each loop (0 to 99 s)

Step 2: Specify Data Size and packets parameters
In this step, define Data Size and packets parameters as well as the delay between each sent packet.

TCP Data Size (1 to 65535 bytes)

☒ Fix min max

☐ Random

☐ Alternate size-1 size-2

☐ Increasing / Decreasing min max step

Inter Packet Delay (0 to 9,999 ms)

☒ Fix (See Forewarnings menu please)

☐ Random min max

☐ Alternate value-1 value-2

☐ Increasing / Decreasing min max step

☐ Mathematical law

Step 3 (Optional): Activate a throughput limit
When one of these two options is selected, "IP Traffic - Test & Measure" generates the traffic in best effort to respect the throughput chosen.

☐ Use value Mean Throughput (8 to 999,999 Kb/s)

☐ Inter Packet Delay automatically adjusted by IP Traffic

☐ TCP or UDP Data Size automatically adjusted by IP Traffic

☐ Use value (except for TCP connection) Mean Packet Throughput (1 to 99,999 Pkts/s)

This area is divided into three parts:

- Step 1: Select the traffic generator type
- Step 2: Specify Data Size and packets parameters
 - Data Size (in bytes)
 - Inter Packet Delay (in milliseconds)
- Step 3 (Optional): Activate a throughput limit
 - Mean Throughput (in Kb/s)
 - Mean Packet Throughput (in Pkts/s, only for UDP connection)

Step 1: Select the traffic generator type

This area is divided into three parts corresponding to the three types of data source; beside each data source selection is a sub-area that displays data source parameters:

- ⇒ Mathematical law (Law: data volume to send)
- ⇒ Packets generator (Packets generator parameters)
- ⇒ File to send (Filename)

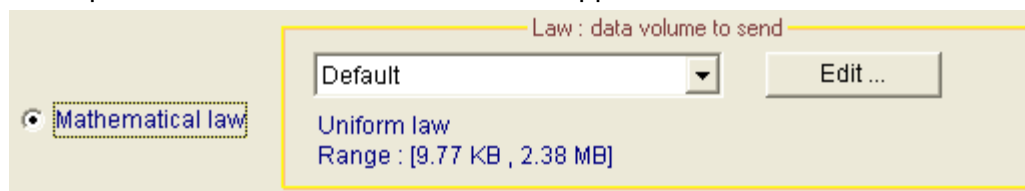
◆ *Mathematical law*

In the unitary mode, the offered mathematical law is a data volume to send law. Volume will modify on the duration of the connection.

IP Traffic - Test & Measure unitary mode offers four mathematical laws related to data volume:

- Uniform law
- Exponential law
- Pareto's law
- Gauss law

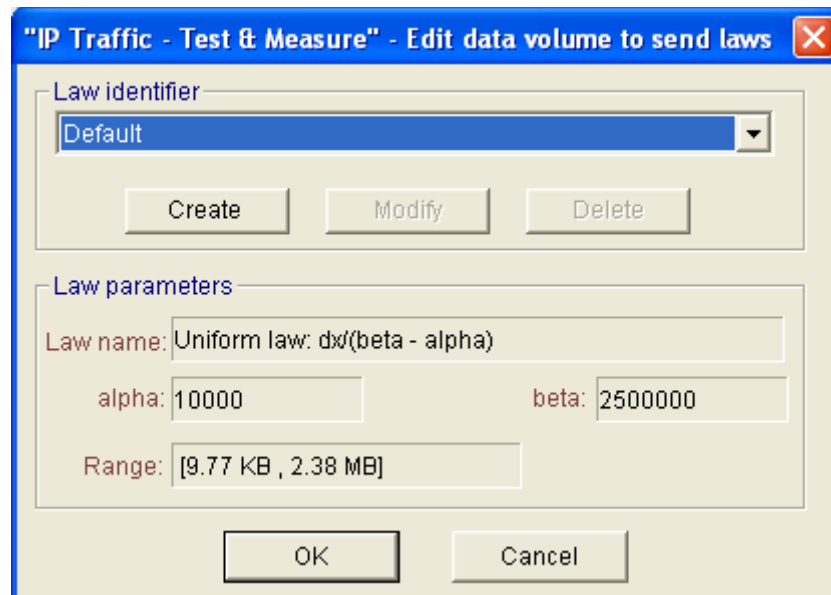
These laws are presented in details in the PART 13 Appendix.



Mathematical law for the unitary testing selection

In the “Law: data volume to send” sub-area, a list box allows selecting an existing law. The main features (type of mathematical law and values range) of the selected law are reminded below the list box.

You can add, modify or delete laws by pressing the “Edit” button. Then a new window is displayed:



Edit data volume to send laws

To add a new data volume to send law:

1. Press “Create” button, then a new window is displayed:

Edit data volume to send laws window

2. Select one mathematical law: Uniform, Exponential, Pareto or Gauss.
3. Enter parameters value for the selected mathematical law (1 or 2 parameters are required depending on the selected law),
4. Save and close the window by pressing the “OK” button.
5. Your new law is selected in the parent window
6. Repeat operations 1 to 5 to create other laws.

Note: Range is computed automatically each time you modify the parameters of the law.

Note: Laws created from this window will also be available for the Automatic mode.

◆ **Packets Generator**

When the Packet Generator data source is selected, **IP Traffic - Test & Measure** generates **n** IP packets for this connection. Packet contents can also be configured.

⇒ Packets number

You specify the number of packets to send in the “Packets generator” sub-area. The number of packets to send is limited to 99,999,999. Zero value means infinite (Zero is the default value).

⇒ Packet contents

A content is one hex byte. Accepted values are all combinations from 00 to FF. If a no valid value is entered, it will be automatically replaced by FF.

You can configure packet contents as follows:

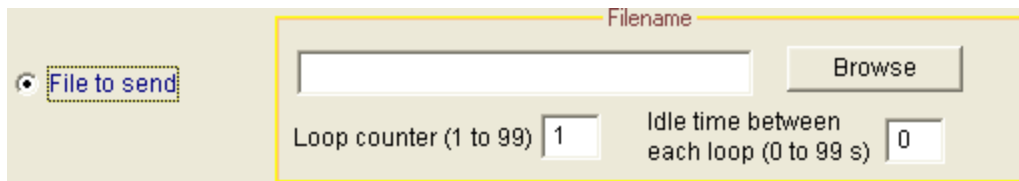
- **Fix:** each packet has the same content.
- **Random:** **IP Traffic - Test & Measure** computes random packet content included in a range (min to max).
- **Alternate:** you define two values. **IP Traffic - Test & Measure** uses the first value (value #1) for odd packets and the second value (value #2) for even packets.
- **Increasing/Decreasing:** the content of each packet varies in a range from the minimal to the maximal value; each packet content following is incremented by the step value (0 is an invalid value). When the maximal value is reached, the packet content decreases by the step value, until the minimal value is reached.

Note:

When ‘Packets generator’ data source is selected, the ‘Volume to send’ and the ‘Remaining volume’ statistics cannot be computed. In the statistics fields of the tab 2 “IP Generator - Traffic + Statistics”, “N/A” will be displayed in “Sent” and “Remain” columns.

◆ File to send

With this selection, **IP Traffic - Test & Measure** sends the content of the file defined in “Filename” sub-area. The “Browse” button is made to ease the “file to send” selection.



Note: it is not allowed to send an empty file.

With the two input fields “**Loop counter**” and “**Idle time between each loop (sec.)**”, you can specify how many times this file must be sent and the idle time (expressed in seconds) before sending the file again. Notice that the remote IP Answering should be configured accordingly to accept an idle time greater than the ‘Idle time between each loop value’.

Step 2: Specify Data Size and packets parameters

◆ Data Size

This parameter defines the size of transmitted packets.

UDP Data Size (1 to 65507 bytes)

☒ Fix 1460

☐ Random 128 min 1460 max

☐ Alternate 128 size-1 1460 size-2

☐ Increasing / Decreasing 1 min 1460 max 1 step

The maximum accepted value is 65 535 for TCP connections and 65507 for UDP connections. 0 (null) is not a valid value. By default, the entered value is 1460.

Data size can be configured as follows:

- **Fix:** each packet has the same size. The last packet may have an inferior size to fit the data volume to send when a mathematical law or file to send data source is selected.
- **Random:** **IP Traffic - Test & Measure** computes a random data size included in a range for each packet to send.
- **Alternate:** **IP Traffic - Test & Measure** uses the first value for odd packets and the second value for even packets.
- **Increasing/Decreasing:** the size of each packet varies in a range from the minimal to the maximal value, each size is incremented by step value (0 is an invalid value). When the maximal value is reached, the data size decreases step by step until the minimal value.

Note:

The TCP or UDP Data Size is the data payload, not including headers (MAC, IP and protocol headers). It is not the frame size e.g. Ethernet frame size.

When UDP is used, the Data Size, greater than the MTU, generates IP fragmentation.

If TCP is used, the TCP protocol can aggregate packets with a size smaller than the MTU. To avoid aggregation, you should configure IP Traffic – Test & Measure with a TCP No Delay option set (see 13.3 Configuration parameters saved in the Registry database for more details).

In addition, if the time code option is selected, the real TCP or UDP Data Size adds the size of the time code option. (see 0 Time code option).

◆ Inter Packet Delay

This parameter allows defining the time interval between two packets to send. Values are limited to 9999 milliseconds i.e. 10 seconds. A value of zero means no inter packet delay.

The Inter Packet Delay can be configured as follows:

- **Fix:** Inter Packet Delay is the same for all transmitted packets.
- **Random:** **IP Traffic - Test & Measure** computes a random Inter Packet Delay included in a range you have specified for each packet to send.
- **Alternate:** **IP Traffic - Test & Measure** uses the first value for odd packets and the second value for even packets.
- **Increasing/Decreasing:** Inter Packet Delay varies in a range from the minimal to the maximal value; each Inter Packet Delay is incremented by the step (0 is not an accepted value for step). When the maximal value is reached, Inter Packet Delay decreases by step value until the minimal value is reached.
- **Mathematical law:** you can choose between one of the fourth available laws: Uniform, Exponential, Pareto and Gauss.

Step 3 (optional): Activate a throughput limit

For the TCP connection, the average throughput limit is expressed in Kb/s (or Kbps).

With this feature, you can define a throughput limit for this connection (in Kilo bits per second) with the check box 'Use value'. You specify the average throughput in Kbps in the edit box and select one of the two parameters (Data Size or inter packet delay). IP Traffic - Test & Measure automatically adapts data traffic generation with adjustment of Data Size or Inter Packet Delay (user choice) up to the throughput requested by the user.

For the UDP connection, the average throughput is expressed in Kb/s or can also be expressed in number of packets per second (p/s):

Note: The throughput value must be greater than or equal to 8 Kbps.

◆ **Mode 2: Using the External data source generator (allowing to use an user file or DLL)**

If you select the external data source generator, the following area is active:

Two external data sources (file or DLL) are selectable, and you specify which filename to use:

- ⇒ **User file**: this external data file is provided by the user (see 13.5 External File for the 'IP Generator' module). It contains different parameters: data, Data Size, Inter Packet Delay...
- ⇒ **User DLL: IP Traffic - Test & Measure** invokes the user DLL each time data is needed to send (see 13.6 External DLL for the 'IP Generator' module for more information)

Note: when the 'User file' parameter is selected two parameters can be defined allowing sending the same file many times:

- *Loop counter,*
- *Idle time (expressed in seconds) between each loop.*

◆ **Options**

Time code option

When this option is selected, **IP Traffic - Test & Measure** will add RTT (Round Trip Time) information to packets. The RTT header format (in the little endian notation) is:

- 4 bytes magic number
- 4 bytes sequence number
- 4 bytes time when sent
- 2 bytes length (without the RTT header)

This information is used in conjunction with connections running in the echoer mode on the Remote IP Answering module. The Local 'IP Generator' module analyzes each echoed packet. When the RTT header is found, the RTT and the 'sequencing errors' values are computed and displayed in statistics.

For the remote IP Answering module, the RTT information is checked to update 'sequencing errors' statistics only.

The DSCP field (with IPv4 only)

This field is available only if IPv4 is selected for the corresponding connection. Under Windows Vista, the DSCP field is not available for ICMP connections.

You can input a DSCP value (by default, DSCP = 00) used for each packet sent on the IP connection.

The Differentiated Services Code Point is a selector for router's per-hop behaviors. Because it is a selector, there is no implication that a numerically greater DSCP implies a better network service. The RFC 2474 redefined the Type of Service Byte to be:

7	6	5	4	3	2	1	0
Differentiated Services Code Point						ECT	CE

The ECT and CE fields don't refer to the DiffServ quality of service. They are spare bits in the IP Header used by the Explicit Congestion Notification (see RFC 3168 for more details).

This leads the notion of "class", each class being a group of the DSCPs with the same *Precedence* value. Values within a class offer similar network services but with slight differences (different levels of service such as "gold", "silver" and "bronze").

From the initial definition of the RFC 2474, RFC 2697 added the "assured forwarding" service and RFC 2598 defined the "expedited forwarding" service. The DSCP values are defined as following:

DSCP (Hexa value)	Service	IP header TOS field value in hexadecimal (if ECT = 0 and CE = 0)
0 (0x00)	Best effort	0x00
8 (0x08)	Class 1	0x20
10 (0x0A)	Class 1, gold (AF11)	0x28
12 (0x0C)	Class 1, silver (AF12)	0x30
14 (0x0E)	Class 1, bronze (AF13)	0x38
16 (0x10)	Class 2	0x40
18 (0x12)	Class 2, gold (AF21)	0x48
20 (0x14)	Class 2, silver (AF22)	0x50
22 (0x16)	Class 2, bronze (AF23)	0x58
24 (0x18)	Class 3	0x60
26 (0x1A)	Class 3, gold (AF31)	0x68
28 (0x1C)	Class 3, silver (AF32)	0x70
30 (0x1E)	Class 3, bronze (AF33)	0x78
32 (0x20)	Class 4	0x80
34 (0x22)	Class 4, gold (AF41)	0x88
36 (0x24)	Class 4, silver (AF42)	0x90
38 (0x26)	Class 4, bronze (AF43)	0x98
40 (0x28)	Express forwarding	0xA0
46 (0x2E)	Expedited forwarding (EF)	0xB8
48 (0x30)	Control	0xC0
56 (0x38)	Control	0xE0

◆ *How to allow the use of the DSCP field on Windows XP and Server 2003*



Using Registry Editor inaccurately can cause serious problems that may require you to reinstall your operating system. Microsoft cannot guarantee that problems resulting from the incorrect use of Registry Editor can be solved. Note that you should back up the registry before editing it. If you are running Windows XP or Server 2003 you should also update your Emergency Repair Disk (ERD). For information about how to edit the registry, view the "Changing Keys and Values" Help topic in Registry Editor (regedit.exe) or the "Add and Delete Information in the Registry" and "Edit Registry Data" Help topics in regedit.exe.

Step1: Start Registry Editor (regedit.exe). Go to the following key on Local Machine:

`HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\Tcpip\Parameters\`

Step 2: On the Edit menu, click Add Value, and then type DisableUserTOSSetting. Click REG_DWORD in the Data Type box, and then click OK. Enter 0 in the prompt box. Quit Registry Editor, and then restart the computer.

◆ *How to allow the use of the DSCP field on Windows Vista*

Under Windows Vista, you must have the administrator rights to be able to use the DSCP field. To launch IP Traffic with the administrator rights, right-click on the IP Traffic - Test & Measure shortcut in "Start > All Programs > IP Traffic – Test & Measure>" and choose "Run as administrator".

The TTL field

	<p>The user can input the TTL/Hop Limit value (hexadecimal) used for each packet sent on the connection.</p> <p>Default value = 00</p>
--	--

The TTL field is only considering with the UDP connections.

Save incoming data traffic or generated traffic into a file

With this feature, you save in a file all incoming data traffic on the considered connection. The remote 'IP Answering' module must be set before in "Echoer" or "Echoer file" mode.

If the internal traffic generator is used and a file has been specified:

then it would be possible to compare the two files: sent data and received data on this connection.

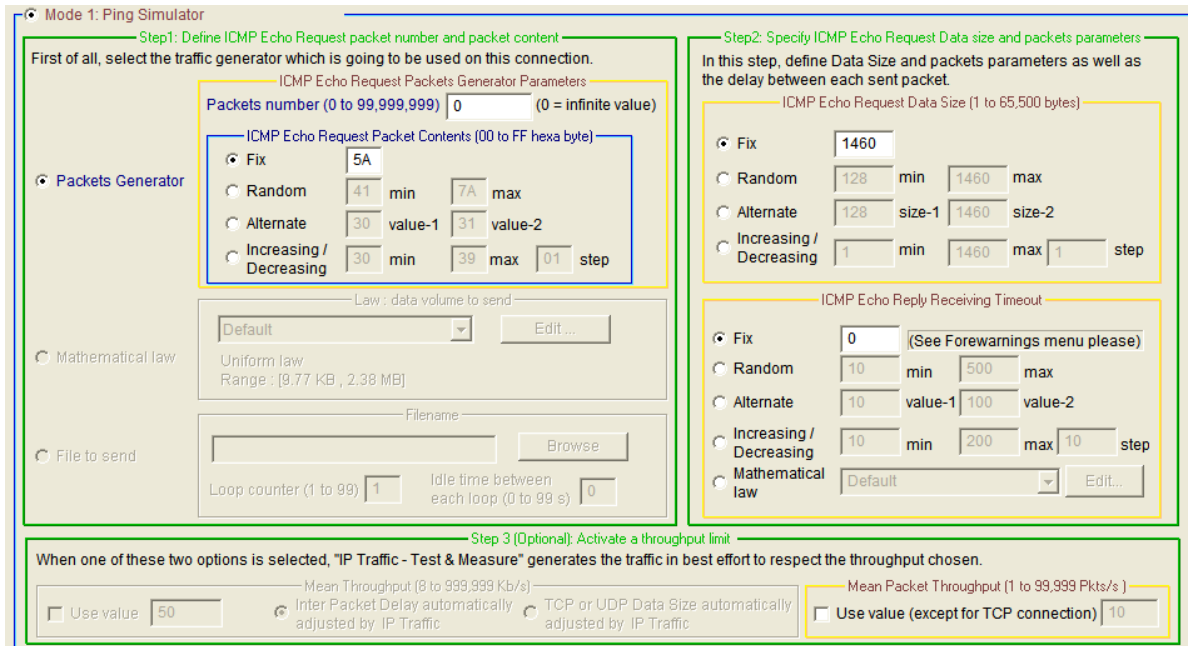
10.6.3 Configure the Unitary Mode for ICMP connections

IP Traffic - Test & Measure offers the possibility to generate ICMP Echo Request traffic. (the protocol used by Ping) which can use IPv4 or IPv6 IP version.



By using the ICMP protocol, only the unitary mode can be used. You are still allowed to use TCP and/or UDP on other connections.

By pressing the “Parameters #n” button, the window below is displayed:



Three areas are proposed to configure the Ping Simulator:

- In the Step 1, the packets number and the packet content can be specified.
- In the upper part of the Step 2, the ICMP Echo Request Data Size can be defined (up to 65 500 bytes).
- The lower part of Step 2 allows the definition of the replies timeout.
- In Step 3 you can define the mean packet throughput.

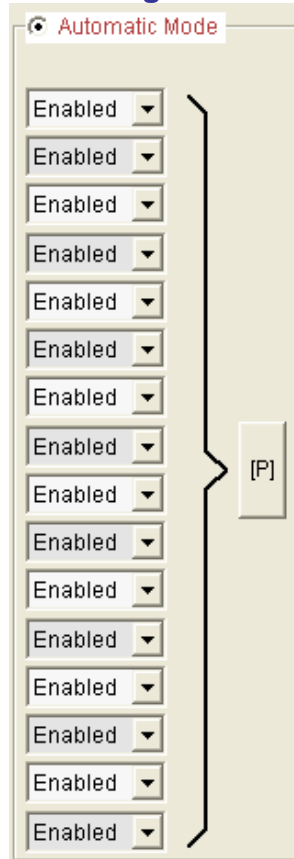
Note: more information about these three areas is available in paragraph [Mode 1: Using the Internal data generator](#).

Destination Parameters			Statistics (based on application data)						Unitary Mode	
Connection #	IP Address or Host Name	Port	Seq. Num. Errors	Tx Packets	Rx Packets	Max RTT	Mean RTT	Min RTT		
Connection #01	192.168.0.120	N/A	0	2025 p	2024 p	16 ms	2 ms	0 ms	Stop #01	

For the “IP Generator – Traffic + Statistics” tab, six statistics are available when using ICMP Echo Request:

- Tx packets: this value represents the number of ICMP Echo Request packets sent.
- Rx packets: this value is the number of ICMP Echo Reply packets received.
- Mean RTT: this value shows the average Round Trip Time.
- Min RTT: this value is the minimum Round Trip Time calculated
- Max RTT: this value is the maximum Round Trip Time calculated
- Seq. Num. Errors: this value represents the number of replies that **IP Traffic - Test & Measure** does not receive.

10.6.4 Configure the automatic mode for TCP or UDP connections

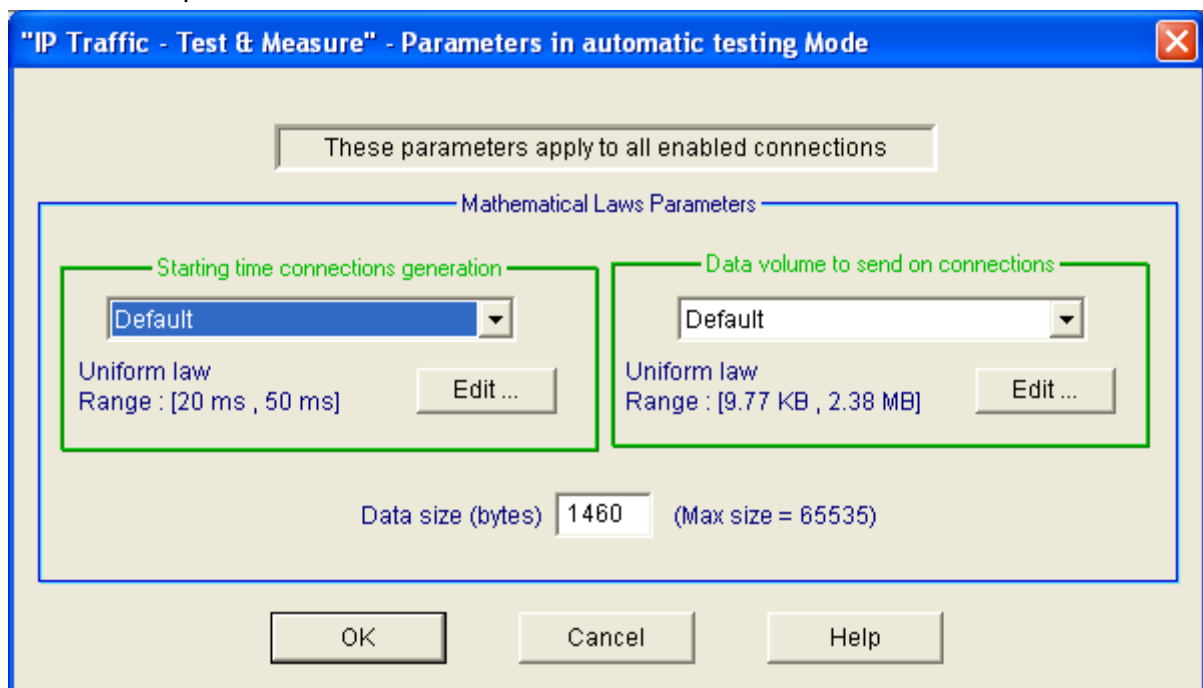


The Automatic Mode is a mode in which all enabled connections are generated in loop, according to a “Starting time connections generation” law and a “Data volume to send” law.

As the unitary mode, the automatic mode is configured in Tab 1 “IP Generator – Parameters” and is run in Tab 2 “IP Generator – Traffic +Statistics”.

Once the automatic mode is selected in Tab 1, the user can choose to enable or disable each connection by using the combo-box.

By clicking on the “[P]” button, the following window is displayed, allowing configuring the automatic mode parameters:



Automatic testing parameters window

Note: the Automatic Testing Mode can not be used if ICMP connections are selected

♦ *Starting time connections generation laws*

Starting time connection laws regulates the timing between the beginnings of two connections. The available mathematical laws for starting time connection are Uniform and Exponential laws. (Mathematical laws are presented in details in PART 13 Appendix).

To modify, delete or add a law, click on the “Edit” button. Then the following window is displayed:

The screenshot shows a dialog box titled "IP Traffic - Test & Measure" - Edit starting time connectio... with a close button (X) in the top right corner. The dialog is divided into two main sections. The first section, "Law identifier", contains a dropdown menu with "Default" selected, and three buttons: "Create", "Modify", and "Delete". The second section, "Law parameters", contains a text field for "Law name" with the value "Uniform law: dx/(beta - alpha)", two input fields for "alpha" (20.00) and "beta" (50.00), and a text field for "Range" with the value "[20 ms , 50 ms]". At the bottom of the dialog are "OK" and "Cancel" buttons.

This window is composed of three areas:

- “Law identifier”
This area allows selecting, creating, modifying or deleting an existing law.
- “Law parameters”
This area displays the parameters associated to the selected law.
- Action buttons
“OK” button: to quit the law-editing window and accept all changes.
“Cancel” button: to ignore all modifications made since the window has been opened.

To add a new *Starting time connections generation law*:

1. Press the “Create” button, then a new window is displayed:

The dialog box titled "IP Traffic - Test & Measure" - Edit starting time connection... contains the following fields and controls:

- Law identifier:** A text input field.
- Mathematical law associated:** A section header.
- Law name:** A dropdown menu showing "Uniform law: $dx/(\beta - \alpha)$ ".
- alpha:** A text input field with the value "0.0".
- beta:** A text input field with the value "100.0".
- Range:** A text input field showing "[0 ms , 100 ms]".
- Buttons:** "OK" and "Cancel" buttons at the bottom.

Edit starting time connections generation law window

2. Select one mathematical law: Uniform or Exponential.
3. Enter parameters value for the selected mathematical law (1 or 2 parameters are required depending on the selected law).
4. Save and close the window by pressing the “OK” button.
5. The new law is selected in the parent window.
6. Repeat operations 1 to 5 to create other laws

◆ **Data volume to send laws**

Data volume laws define the data volume to send for a connection. The available mathematical laws for data volume to send are: Uniform, Exponential, Pareto and Gauss laws (Mathematical laws are presented in details in PART 13 Appendix).

You can add, modify or delete a law by pressing the “Edit” button. Then a new window is displayed:

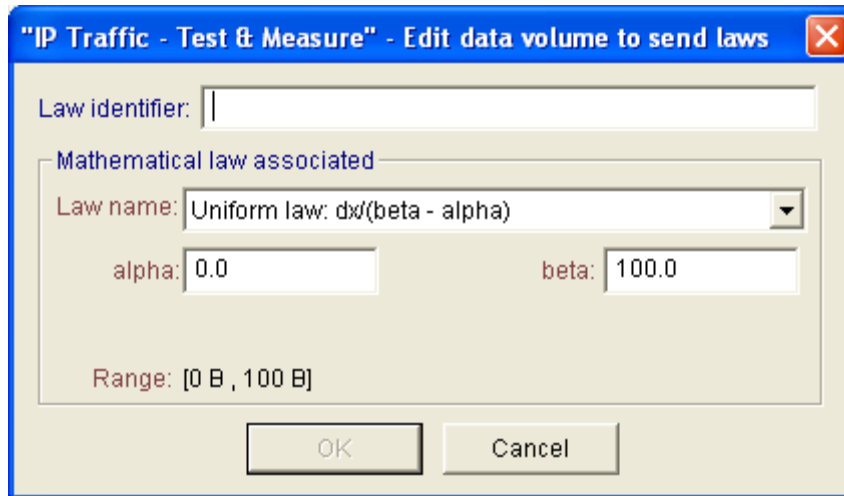
The dialog box titled "IP Traffic - Test & Measure" - Edit data volume to send laws contains the following fields and controls:

- Law identifier:** A dropdown menu showing "Default".
- Buttons:** "Create", "Modify", and "Delete" buttons below the Law identifier dropdown.
- Law parameters:** A section header.
- Law name:** A text input field showing "Uniform law: $dx/(\beta - \alpha)$ ".
- alpha:** A text input field with the value "10000".
- beta:** A text input field with the value "2500000".
- Range:** A text input field showing "[9.77 KB , 2.38 MB]".
- Buttons:** "OK" and "Cancel" buttons at the bottom.

Edit data volume to send laws

To add a new data volume to send law:

1. Press the “Create” button, then a new window is displayed:



The screenshot shows a dialog box titled "IP Traffic - Test & Measure" - Edit data volume to send laws. It contains the following fields and controls:

- Law identifier:** A text input field.
- Mathematical law associated:** A section containing:
 - Law name:** A dropdown menu showing "Uniform law: $dx/(beta - alpha)$ ".
 - alpha:** A text input field with the value "0.0".
 - beta:** A text input field with the value "100.0".
 - Range:** A text label showing "[0 B , 100 B]".
- Buttons:** "OK" and "Cancel" buttons at the bottom.

2. Select one mathematical law: Exponential, Uniform, Pareto or Gauss.
3. Enter parameters value for the selected mathematical law (1 or 2 parameters are required depending on the selected law),
4. Save and close the window by pressing the “OK” button.
5. Your new law is selected in the parent window
6. Repeat operations 1 to 5 to create other laws

Note:

*Up to the used OS (Windows XP, Server 2003 or Vista), WinSock 2 Interface could present number-limits of the incoming simultaneous calls. Consequence for **IP Traffic - Test & Measure** is the presence of “connection failed”, particularly when connections frequency is very near (inferior to 150 ms), and when the data volume to transmit is very small, which implies to make many connections. These connection failures do not disturb **IP Traffic - Test & Measure**. To reduce these failures, increase the frequency of connection or the data volume.*

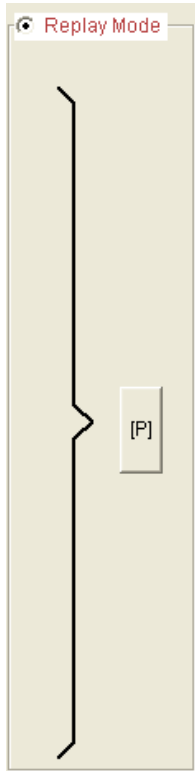
◆ Data size

In the automatic mode, entering a value (in bytes) in «Mathematical laws parameters» window configures the Data Size.

The Data Size is limited to 65,535 bytes for TCP connections and to 65507 bytes for UDP connections.

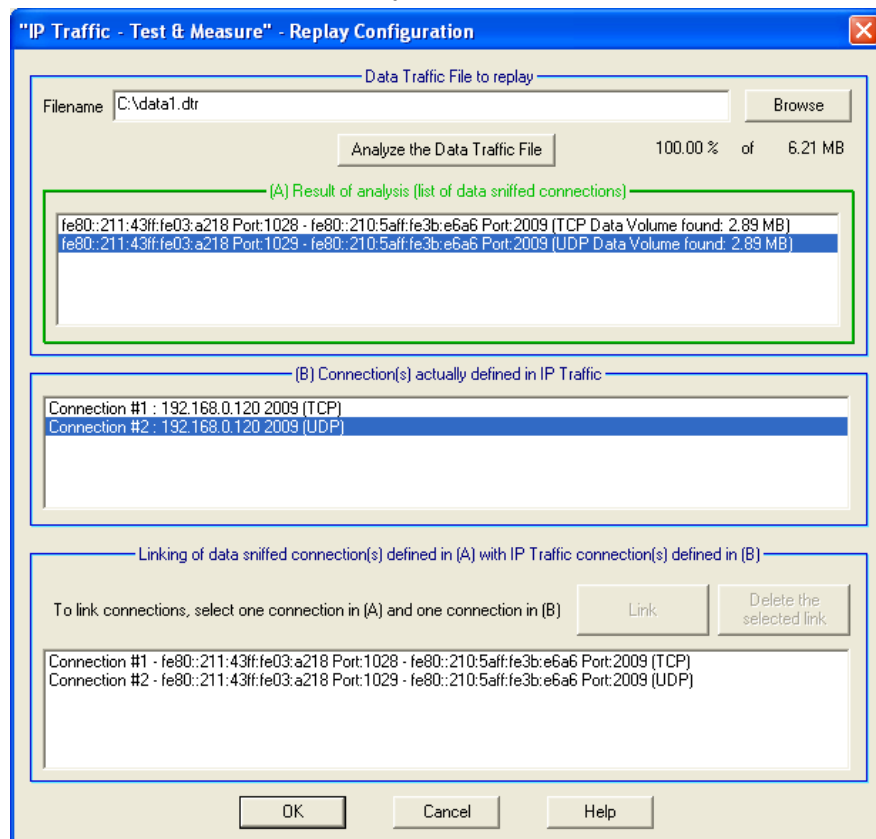
10.6.5 Configure the replay sniffed traffic mode

In this mode, **IP Traffic - Test & Measure** uses traffic files captured by the “Traffic Sniffer” (see 10.9 The ‘Traffic Sniffer’ tab).



When you click on the command button “[P]”, the following window is displayed.

First, select a ‘Data traffic file to replay’ and then press the “Analyze the data traffic file” button. At the end of the process, an indication is displayed: “100.00% of xxx MB” (where xxx is the file size).



Note: the Replay Sniffed Traffic Mode can not be used if ICMP connections are enabled.

After the analysis of the data traffic file, all IP connections found in the sniffed traffic file are then displayed in the “(A) Result of analysis (list of data sniffed connections)” object.

Connections that have already been defined in the current IP Generator module are displayed in the “(B) Connection(s) already defined in IP Traffic” object.

Then you must link one ‘data sniffed connection’ to one ‘defined connection’ by pressing the “Link” button. If needed, one association can be removed by pressing the “Delete the selected link” button.

Once the needed links have been defined, press OK. **IP Traffic - Test & Measure** is ready to replay traffic on actually defined connections of the ‘IP Generator’ by using data of connections from the ‘data traffic file to replay’ specified by the different links made by the user.

◆ **How does IP Traffic - Test & Measure replay the traffic?**

The first step, as explained before, is to link a connection #A from the « .dtr » file to a connection #B defined on the IP Generator.

When the replay is started, **IP Traffic - Test & Measure** reads the “.dtr” file to get the packets of the connection #A. Two data are necessary for the replay mode: the timestamp of the packet and the data payload. **IP Traffic - Test & Measure** is not concerned by the IP version (IPv4 or IPv6), the protocol or the IP addresses used by the connection #A. The replay process, in relation with the link done between the connection #A and the connection #B, reuses the data payload respecting the timestamp of each packet some is the protocol or the IP version used to replay the data. For example a UDP connection using IPv4 can be replayed on a TCP connection using IPv6.

Note: the “.dtr” file contains only one-way packets. More details about how creating “.dtr” files are available in the paragraph 10.9.3 Run analysis algorithm (Step 3).

10.7 The 'IP Generator – Traffic + Statistics' tab

This second tab related to the IP Generator module allows:

- To visualize destination parameters and traffic statistics for each connection,
- To save traffic statistics for all or a set of active connections of the IP Generator module in a CSV file,
- If unitary mode is selected in “IP Generator – Parameters” tab (please refer to “10.6 The 'IP Generator – Parameters' tab”), to control traffic generation in unitary mode, i.e. to start and to stop each connection,
- If automatic mode is selected in “IP Generator – Parameters” tab, to command traffic generation in automatic mode, i.e. to start and to stop all enabled connections,
- If replay sniffed traffic mode is selected in “IP Generator – Parameters” tab, to command replay traffic generation on connection(s).

The “IP Generator - Traffic + Statistics” tab is divided into five areas. Each area is presented in the following paragraphs.

Destination Parameters			Statistics (based on application data)								Unitary Mode	
	IP Address or Host Name	Port	Tx Throughput	Tx Packets	Tx Volume	Rx Throughput	Rx Volume	Rx Packets	RTT			
Connection #01	192.168.0.120	9	570 Kb/s	559 p	797 KB	0.00 b/s	0 B	0 p	N/A	Stop #01		
Connection #02	192.168.0.120	7	570 Kb/s	559 p	797 KB	570 Kb/s	797 KB	559 p	6 ms	Stop #02		
Connection #03	192.168.0.120	9	570 Kb/s	559 p	797 KB	0.00 b/s	0 B	0 p	N/A	Stop #03		
Connection #04	192.168.0.120	9	570 Kb/s	559 p	797 KB	0.00 b/s	0 B	0 p	N/A	Stop #04		
Connection #05	192.168.0.120	7	570 Kb/s	559 p	797 KB	570 Kb/s	797 KB	559 p	5 ms	Stop #05		
Connection #06	NO_ADDRESS	2009								Start #06		
Connection #07	NO_ADDRESS	2009								Start #07		
Connection #08	NO_ADDRESS	2009								Start #08	Start All Connections	
Connection #09	NO_ADDRESS	2009								Start #09		
Connection #10	NO_ADDRESS	2009								Start #10	Stop All Connections	
Connection #11	NO_ADDRESS	2009								Start #11		
Connection #12	NO_ADDRESS	2009								Start #12		
Connection #13	NO_ADDRESS	2009								Start #13		
Connection #14	NO_ADDRESS	2009								Start #14		
Connection #15	NO_ADDRESS	2009								Start #15		
Connection #16	NO_ADDRESS	2009								Start #16		

Export Statistics into a File
Parameters Export is running

RTT summary of all connections - Min: 0 ms - Max: 63 ms - Mean: 6 ms
Choose Columns Reset Display

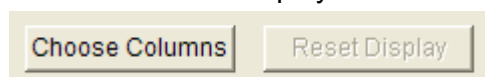
Tab 2: “IP Generator - Traffic + Statistics”

10.7.1 Destination Parameters area

In this area, the destination parameters (IP address and port number) of each connection are shown for information. These parameters can be modified in the “IP Generator –Parameters” tab, when all connections are stopped.

10.7.2 Statistics (Application Level)

The statistics are displayed for each connection in the "Statistics" area:



By using the "Choose Columns" button at the bottom, you can select the parameters to display.

Up to 7 parameters can be simultaneously displayed among the 15 parameters described later in this paragraph, and at least one parameter must be selected.

These statistics are computed at the application level (and based on application data sent or received). No MAC, IP and TCP/UDP headers and trailers are taken into account. Please refer to "PART 11 Calculation Mode for the Statistics" to get more details.

To reset the statistics displayed, two methods can be used:

- by clicking on the "Reset Display" button (this button is enabled when all connections are stopped).
- by checking the "Clear on Stop" option (when the connection stops, the statistics for this connection are automatically cleared).



The "**N/A**" (Not Applicable) mention can be displayed instead of a value in the cell of the statistics table if the parameter cannot be calculated.

Statistics (based on application data)						<input type="checkbox"/> Clear on Stop
Tx Packets	Tx Throughput	Rx Packets	Rx Throughput	Jitter	Seq. Num. Errors	
Connection failed: no response from the Remote. Please check your parameters.						
4817 p	2.23 Mb/s	0 p	0.00 b/s	N/A	N/A	

If a connection is in progress or cannot be activated (in case of invalid parameters or connection problem), a warning message is displayed. Examples of warning messages:

- Connection failed: no response from the Remote. Please check your parameters.
- Connection pending: **IP Traffic - Test & Measure** is waiting for the Remote response.
- Connection reset: the Remote has reset the connection.

Statistics (based on application data)						<input checked="" type="checkbox"/> Clear on Stop
Tx Packets	Tx Throughput	Tx Volume	Rx Packets	Rx Throughput	Jitter	Seq. Num. Errors
Connection failed: no response from the Remote. Please check your parameters.						
Connection reset: the Remote has reset this connection.						

Note: the warning message isn't erased if the "Clear on Stop" option is selected.

◆ Transmitting statistics

◆ Tx Packets ⁽²⁾	Tx Packets (Tx = Transmit) is the number of packets that IP Traffic - Test & Measure has sent since the connection started.
◆ Tx Pkts Throughput ^{(1) (2)}	Tx Pkts Throughput (Tx = Transmit) is the mean number of packets that IP Traffic - Test & Measure is sending per second. This value is only available with UDP connections. The calculation of this value is based on the sampling period defined by the throughput sampling period in the 'Configuration/General Parameters' menu.
◆ Tx Throughput ⁽¹⁾	Tx Throughput (Tx = Transmit) is the mean throughput of data sent. The calculation of this value is based on the sampling period defined by the throughput sampling period in the 'Configuration/General Parameters' menu.
◆ Tx Volume ⁽¹⁾	Tx Volume (Tx = Transmit) is the number of bytes that IP Traffic - Test & Measure has sent since the connection started.

◆ Receiving statistics

◆ Rx Packets ⁽²⁾	Rx Packets (Rx = Receive) is the number of packets that IP Traffic - Test & Measure has received since the connection is started.
◆ Rx Pkts Throughput ^{(1) (2)}	Rx Pkts Throughput (Rx = Receive) is the mean number of packets that IP Traffic - Test & Measure is receiving per second. This value is only available with UDP connections. The calculation of this value is based on the sampling period defined by the throughput sampling period in the 'Configuration/General Parameters' menu.
◆ Rx Throughput ⁽¹⁾	Rx Throughput (Rx = Receive) is the mean throughput of data received. The calculation of this value is based on the sampling period defined by the throughput sampling period in the 'Configuration/General Parameters' menu.
◆ Rx Volume ⁽¹⁾	Rx Volume (Rx = Receive) is the number of bytes that IP Traffic - Test & Measure has received since the connection is started.

◆ Other statistics

◆ Jitter ⁽¹⁾	Jitter is the mean variation of delays on packets received. This value is only available when Timecode option is selected (for the local 'IP Generator'). This value corresponds to either the mean one-way variation (remote 'IP Answering' = Generator mode) or the mean two-ways variation (remote 'IP Answering' = Echoer mode).
◆ Remaining Volume ⁽¹⁾	'Remaining Volume' is the number of bytes that IP Traffic - Test & Measure has still not sent. This information is only available for two Traffic Generator types: Mathematical Law and File to Send.
◆ Mean RTT	'Mean RTT' is the Round Trip Time of a packet that was sent by IP Traffic - Test & Measure . This value is calculated if the Timecode option is selected for the local 'IP Generator' and if the remote 'IP Answering' works in the Echoer mode.
◆ Min RTT	"Min RTT" is the minimum value of the Round Trip Time calculated by IP Traffic - Test & Measure . For more information, please see the "Mean RTT" column information.
◆ Max RTT	"Max RTT" is the maximum value of the Round Trip Time calculated by IP Traffic - Test & Measure . For more information, please see the "Mean RTT" column information.
◆ Seq. Numb. Errors ⁽²⁾	'Seq. Numb. Errors' (Sequence Number Errors) is the sum of the Out Of Sequence packets number (OOS) and the number of lost packets. This value is only available if the Timecode option is selected (for the local 'IP Generator') and if the working mode of the remote 'IP Answering' is Generator or Echoer.
◆ Volume To Send ⁽¹⁾	'Volume To Send' is the number of bytes that IP Traffic - Test & Measure should send. This information is only available for two Traffic Generator types: Mathematical law and File to Send.

⁽¹⁾ These statistics are not available with ICMP

⁽²⁾ These statistics are not available with TCP

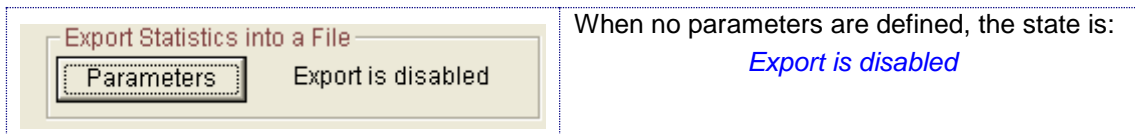
A RTT summary for all connections is also available. This summary displays the minimum, maximum and mean RTT values of all connections (for connections having RTT (Timecode) option selected (see 0 Time code option for more information)).

When you press the “Stop all connections” button, statistics remain displayed in black writing on gray background.

If a connection cannot be activated (in case of invalid parameters), the statistics fields are empty on gray background.

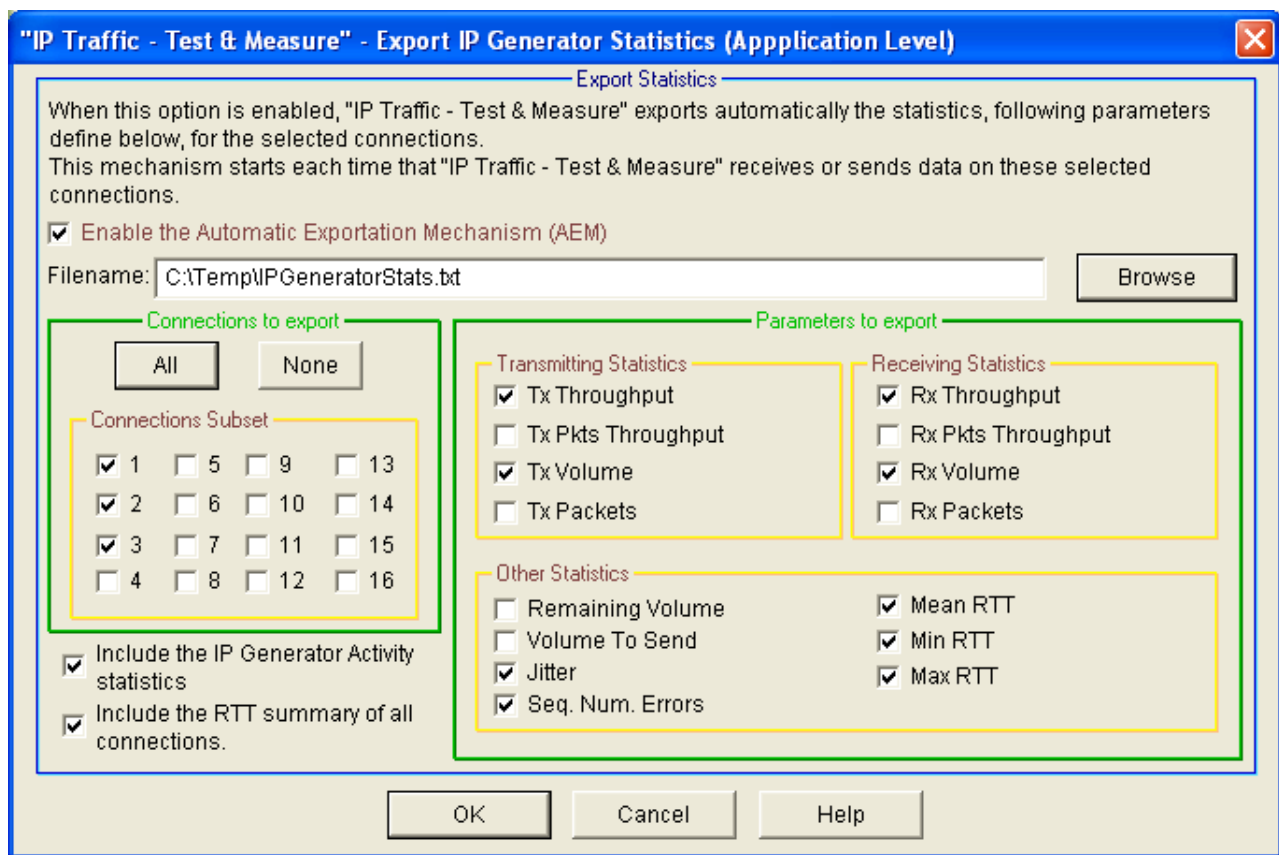
◆ Export statistics into a file

To export all or part of **statistics** into a CSV file, click on the 'Parameters' button when enabled (i.e. when no connection of the IP Generator is active):



Then a window allows defining parameters for the export process:

- Enable or disable the export process,
- The filename (.csv extension) of the export file,
- The identification of the needed connections,
- The parameters to export (up to 15).
- Include or not the RTT summary or the IP Generator activity into the statistics file.



"Export IP Answering Statistics"

Then press OK to validate, and a new state is displayed:



Note: do not specify the same filename to save statistics for the 'IP Generator' and the 'IP Answering' parts. If you do so, a warning message is displayed.

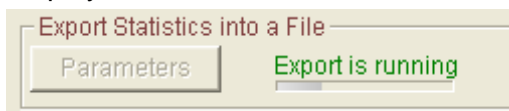
Note: The maximum number of columns handled by Excel is 255. If the number of statistics and connections you have selected exceeds this limit of Excel, you have to restrict to the most important statistics that you need, or to reduce the number of connections.

The statistics file is updated with the same refresh period than the statistics displayed.

A special mark is added to keep special TCP and UDP events e.g. Start and End of sending traffic.

When you reset statistics, the displayed values and the exported values are reset.

Statistics are saved into the CSV file as soon as one connection of the IP Generator is started and the 'Export is running' state is displayed:



When all the connections are stopped, then the export process is automatically suspended and the following idle state is displayed:



To export all or part of statistics displayed (in other words, there is the possibility of saving also the statistics which are not displayed) in a file, you can use the parameters connection and statistics dialog.

The RTT summary is exported even if the selected connections don't use the RTT option.

The IP Generator statistics CSV file format

The IP Generator statistics file is formatted line by line as follows (example):

First line: (All types of statistics are represented here. The general statistics (RTT summary, IP Generator activity, Date/Time, etc ...) and the statistics available for each connection. The statistics headers can be up to fifteen for each connection)

IP Generator Date/Time	RTT Summary: Mean RTT (ms)	RTT Summary: Min RTT (ms)	RTT Summary: Max RTT (ms)	State Connection #xx	Tx Throughput Connection #xx (Kb/s)	Tx Pkts Throughput Connection #xx (Pkts/s)	Tx Volume Connection #xx (KB)
Tx Packets Connection #xx (Pkts)	Rx Throughput Connection #xx (Kb/s)	Rx Pkts Throughput Connection #xx (Pkts/s)	Rx Volume Connection #xx (KB)	Rx Packets Connection #xx (Pkts)	Remaining Volume Connection #xx (KB)	Volume To Send Connection #xx (KB)	Mean RTT Connection #xx (ms)
Jitter Connection #xx (ms)	Seq. Num. Errors Connection #xx	Min RTT Connection #xx (ms)	Max RTT Connection #xx (ms)				

Next lines:

MM/DD/YYYY HH:MM:SS.mmm	mmm	mmm	mmm	TCP or UDP or ICMP	nnn.nn	nnn.nn	mmm
mmm	nnn.nn	nnn.nn	mmm	mmm	mmm	mmm	mmm
mmm	mmm	mmm	mmm				

Additional mark for TCP, UDP or ICMP connection events

TCP START	This mark indicates the connection starts. When this mark is included in the IP Generator traces, the numerical values are set to 0.
TCP END	This mark indicates the corresponding connection has stopped. The numerical values are the latest values computed by IP Traffic - Test & Measure . Moreover, for IP Generator part, the line containing the END flag shows a synthesis of all statistics. The averages are calculated from the START flag time to the END flag time.
TCP PENDING	This mark indicates the connection is launched but that no data packet has been sent for the moment (for example in TCP, time to realize the “Three-ways Handshake”).
TCP WAITING END	This mark indicates the connection has sent all of its packets but still waiting for the echoed packets until the timeout is reached (see <input type="checkbox"/> General parameters).
TCP FAILED	This mark indicates the connection could not be established.

Additional mark for TCP, UDP or ICMP disconnection events

TCP INFO	<p>This mark indicates the reason of the disconnection if this one is not produced by the click on the stop button or the scheduled end of the traffic generation (due to the generator parameters, for example: Number packets to send = 1000)</p> <p>When this mark is included in the IP Generator traces, the error message returned by IP Traffic - Test & Measure is placed after the “INFO” mark.</p>
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Idle connections

When the connection is idle, no numerical value is set into the file. The field is empty.

Conventions

“Volume to send” and “Remaining Volume” are filled with the “N/A” symbol when the generator is not configured with “File to send”.

“Seq. Num. Errors”, “Jitter”, “Mean RTT”, “Min RTT” and “Max RTT” are filled with the “N/A” symbol until one RTT header is found in the received data by the 'IP Generator' part.

“Tx Pkts Throughput” and “Rx Pkts Throughput” are filled with the “N/A” symbol when the protocol used for the concerned connection is not UDP.

In addition, when a connection is using ICMP protocol, all statistics are filled with the “N/A” symbol, except “Mean RTT”, “Min RTT” and “Max RTT”, “Seq. Num. Errors”, “Tx Packets” and “Rx Packets”.

Then for the RTT summary, “Mean RTT”, “Min RTT” and “Max RTT” are filled with the “N/A” symbol until one “RTT” header is found in the received data by the 'IP Generator' part (at least for one connection).

When “Mean RTT”, “Min RTT” or “Max RTT” is filled with the value 0, this means that the result is less than 1 millisecond.

How to open this CSV file with Excel?

To open this file with Microsoft Excel, the comma should be defined as “list separator” (this is the default value with English regional settings). In case of problem, click on “Start > Control Panel” and click on “Regional and Language Options”, select an item in the list or click Customize to define your own parameters.

How to change the date/time format?

To change the format of the date/time column, select the whole column and right click on the column. Choose “Format Cells ...”, then, in the Category list, choose “Custom”. In the “Type” area, enter the following string: mm/dd/yyyy hh:mm:ss.000. Using this string, the date/time format will be changed to : 03/20/2008 09:45:50.840.

Export an IP Generator file sample

In this example, 2 connections have been selected with all parameters exported. For each connection, the 'IP Answering' is operating with the echoer mode.

- Connection #01 is configured with the TCP protocol and uses the internal data generator (with RTT activated).
- Connection #02 is configured with the UDP protocol and uses the internal data generator (with RTT activated).

The "Refresh time" parameter is set to 2 seconds.

IP Generator Date/Time	State Connection #01	Tx Throughput Connection #01 (Kb/s)	Rx Throughput Connection #01 (Kb/s)	Mean RTT Connection #01 (ms)	State Connection #02	Tx Throughput Connection #02 (Kb/s)	Rx Throughput Connection #02 (Kb/s)	Mean RTT Connection #02 (ms)
03/20/2008 13:25:40.421					UDP PENDING	0	0	N/A
03/20/2008 13:25:40.421					UDP START	0	0	N/A
03/20/2008 13:25:40.437					UDP	0	0	N/A
03/20/2008 13:25:40.453	TCP START	0	0	N/A	UDP	0	0	N/A
03/20/2008 13:25:41.859	TCP	98.09	98.09	2	UDP	98.09	98.09	1
03/20/2008 13:25:43.843	TCP	326.22	326.22	1	UDP	326.22	326.22	1
03/20/2008 13:25:45.843	TCP	554.34	554.34	1	UDP	554.34	554.34	1
03/20/2008 13:25:47.843	TCP	570.31	570.31	1	UDP	570.31	570.31	1
03/20/2008 13:25:49.843	TCP	570.31	570.31	1	UDP	570.31	570.31	1
03/20/2008 13:25:51.843	TCP	570.31	570.31	1	UDP	570.31	570.31	1
03/20/2008 13:25:53.843	TCP	570.31	574.88	1	UDP	570.31	572.59	2
03/20/2008 13:25:55.843	TCP	570.31	570.31	1	UDP	570.31	570.31	1
03/20/2008 13:25:57.843	TCP	570.31	570.31	1	UDP	570.31	570.31	1
03/20/2008 13:25:59.843	TCP	570.31	570.31	1	UDP	570.31	570.31	1
03/20/2008 13:26:01.843	TCP	570.31	570.31	1	UDP	570.31	570.31	1
03/20/2008 13:26:03.843	TCP	570.31	574.88	1	UDP	570.31	574.88	2
03/20/2008 13:26:05.843	TCP	570.31	570.31	1	UDP	570.31	570.31	1
03/20/2008 13:26:07.843	TCP	570.31	570.31	0	UDP	570.31	570.31	1
03/20/2008 13:26:09.843	TCP	570.31	570.31	1	UDP	570.31	570.31	1
03/20/2008 13:26:11.859	TCP	570.31	570.31	1	UDP	570.31	570.31	1
03/20/2008 13:26:13.843	TCP	570.31	570.31	1	UDP	570.31	570.31	1
03/20/2008 13:26:15.843	TCP	570.31	570.31	1	UDP	570.31	570.31	1
03/20/2008 13:26:17.843	TCP	570.31	570.31	1	UDP	570.31	570.31	1
03/20/2008 13:26:19.843	TCP	570.31	570.31	1	UDP	570.31	570.31	1
03/20/2008 13:26:20.453	TCP WAITING END	570.31	570.31	1	UDP WAITING END	570.31	570.31	1
03/20/2008 13:26:20.453	TCP WAITING END	570.31	570.31	1	UDP WAITING END	570.31	570.31	1
03/20/2008 13:26:20.968	TCP END	563.1	563.1	1	UDP WAITING END	570.31	570.31	1
03/20/2008 13:26:21.046					UDP WAITING END	570.31	570.31	1
03/20/2008 13:26:21.156					UDP END	559.93	559.93	1

The delimiter mark used between each field is the comma character (in conformance with the CSV file format). In this example, the lines containing the END flag have a synthesis of all statistics exported. The throughputs showed are the mean throughputs calculated from the START flag time to the END flag time.

10.7.3 Run an unitary testing session

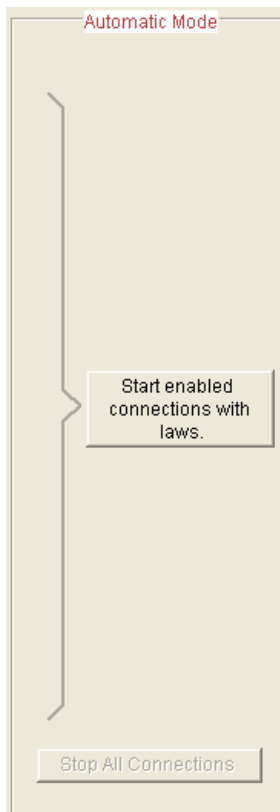


The unitary testing session can be started from the “Unitary mode” area in Tab 2 “IP Generator - Traffic + Statistics”. From this area, you can start or stop connections in unitary testing separately or all together.

To run an unitary mode session:

1. *In Tab 2 “IP Generator - Traffic + Statistics”:*
 - If the IP Generator connections are active, stop all running connections by pressing the “Stop All connections” button.
2. *In Tab 1 “IP Generator - Parameters”:*
 - Select the unitary testing mode.
3. *In Tab 1 “IP Generator - Parameters”:*
 - If necessary configure the unitary parameters for each connection by pressing the “Parameters #n” button.
4. *In Tab 2 “IP Generator - Traffic + Statistics”:*
 - Press the “Start All Connection” button to start all connections together or press the “Start #n” buttons to start connections one by one.

10.7.4 Run an automatic testing session

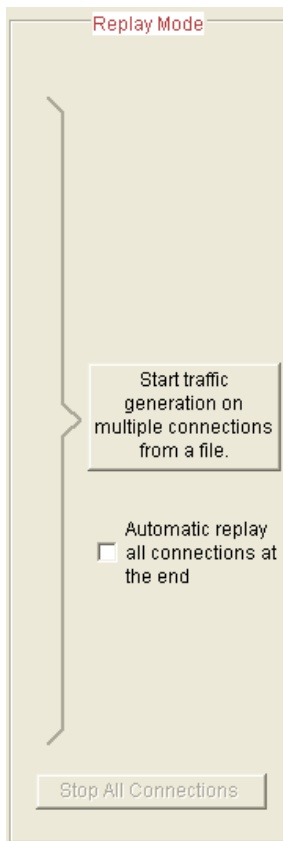


An automatic testing session is launched from the “Automatic Mode” area in Tab 2 “IP Generator - Traffic + Statistics”. In this area, there is only one button to start and to stop all enabled connections in the automatic mode.

To carry out the automatic mode session:

- 1 *In Tab 2 “IP Generator - Traffic + Statistics”:*
 - If the IP Generator connections are active, stop all running connections by pressing the “Stop All connections” button.
- 2 *In Tab 1 “IP Generator - Parameters”:*
 - Select the automatic testing mode.
- 3 *In Tab 1 “IP Generator - Parameters”:*
 - If necessary, configure the automatic parameters by pressing the “[P]” button and enable or disable connections by using the combo boxes.
- 4 *In Tab 2 “IP Generator - Traffic + Statistics”:*
 - Press the “Start enabled connections with laws” button to start all enabled connections.

10.7.5 Run a replay traffic session



A replay traffic testing session is launched from the “Replay Mode” area in Tab 2 “IP Generator - Traffic + Statistics”. In this area, there is only one button to start replay traffic from a traffic file on connections.

To run a replay traffic session:

1. *In Tab 2 “IP Generator - Traffic + Statistics”:*
 - If the IP Generator connections are active, stop all running connections by pressing the “Stop All Connections” button.
2. *In Tab 1 “IP Generator - Parameters”:*
 - Select the “Replay sniffed traffic” mode.
3. *In Tab 1 “IP Generator - Parameters”:*
 - If necessary, configure and select the traffic file by pressing the “[P]” button.
4. *In Tab 2 “IP Generator - Traffic + Statistics”:*
 - Press the “Start traffic generation on multiple connections from a file” button to start replay traffic generation.
5. *The option “Automatic replay at the end of all connections” restarts the replay of traffic generation when all connections are stopped.*

10.8 The 'IP Answering' tab

The 'IP Answering' part allows receiving UDP and TCP traffic in accordance with five different working modes: 'Absorber', 'Absorber file', 'Echoer', 'Echoer file' or 'Generator'.

IP Answering - Parameter + Statistics tab

This third tab is related to the 'IP Answering' part activity to:

- Configure the “**Listening to**” parameters: network interface, port number and protocol of the listening port,
- Configure IP connected remote “**Coming From ...**”: source IP address or host name from which connection is received,
- Configure “**Receiving Working Mode**” for each connection,
- Visualize the statistics for each connection,
- Save traffic statistics for all active connections of the IP Answering module in a file.

The tab is divided into four areas: Listening To..., Coming From..., Receiving Working Mode and Statistics (calculated at the application level).

The screenshot shows the 'IP Answering - Parameters + Statistics' tab. It features a table with 16 connections. Each connection has a 'Listening To' section with 'Port' (2009) and 'Protocol' (TCP) dropdowns, and a 'Coming From' section with a 'Remote IP Address or Host Name' (ANY_ADDRESS) dropdown. The 'Receiving Working Mode' section has a 'Replay Mode' checkbox and a 'Replay Mode Parameters' dropdown. The 'Statistics' section shows a table with columns for Rx Throughput, Rx Volume, Tx Throughput, Tx Volume, and Jitter. The table has 16 rows, each corresponding to a connection. The 'Receiving Working Mode' section also has a 'Replay Mode' checkbox and a 'Replay Mode Parameters' dropdown. The 'Statistics' section shows a table with columns for Rx Throughput, Rx Volume, Tx Throughput, Tx Volume, and Jitter. The table has 16 rows, each corresponding to a connection.

Tab 3: "IP Answering - Parameters + Statistics"


10.8.1 Duplicate parameters of a connection onto others

In order to facilitate input of the parameters for a connection, a *copy/paste mechanism* for all parameters of a connection is available (identical to the *copy/paste mechanism* for the IP Generator part – see “[□ Duplicate parameters of a connection onto others](#)”).

This function is not available when the canonical IP address cannot be translated in numerical format.

10.8.2 Listening To ...

In this area, you configure each receiving connection with the following parameters corresponding to the connected sender from which connections are received. You configure the parameters IP Traffic - Test & Measure uses to listen to incoming connections. These parameters are:

Network interface selection 	The black arrow has two purposes: <ul style="list-style-type: none"> To display a summary of the connection's parameters To select the network interface and the IP version for a connection.
Port	The port number is limited to 65,535. By default, the port number is 2009.
Protocol	TCP or UDP protocol (default = TCP protocol).

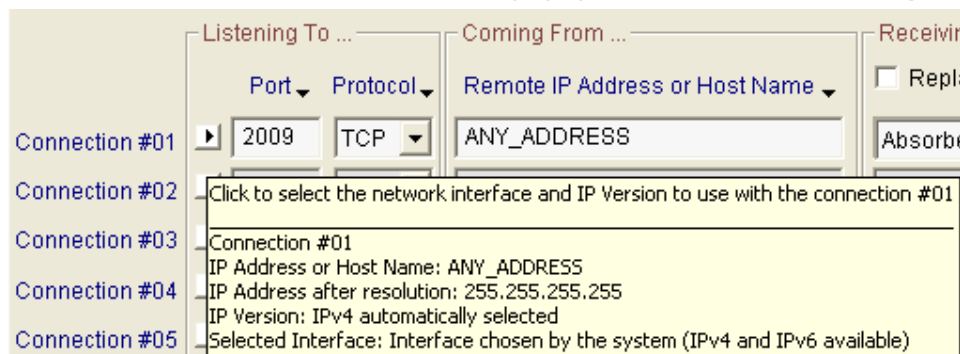
♦ Specific Rules to receive TCP or UDP traffic

Rules	TCP	UDP
The same port number can be used by several IPv4 or IPv6 connections	YES	NO
The same port number can be used by two connections using either IPv4 or IPv6	YES	YES
The same port number can be used by connections using different NICs	YES	YES*
The same port number can be used by connections using the same multihomed NIC but by selecting different IP Addresses	YES	YES*

* If a UDP connection uses the "default interface", this connection is used in favor of the connection using an interface.

♦ Summary of connection parameters

When you move the mouse over the black arrow, a popup window - called a **tooltip** – is displayed.



IP Answering connection tooltip

The tooltip for the IP Answering connection includes five items:

- The first item is the connection number the tooltip refers to.
- The next item is the IP address defined by the user.
- The next item is the IP address translated when IP Translation address has succeeded (e.g. the address is not NO_ADDRESS or 0.0.0.0).
- The next item is the IP version currently selected.
- The last item is the interface name selected. The name displayed is the name of the connection presented in the "Settings/Network and Dial-up Connections" Start menu of the operating system (Default is "Interface chosen by the system").

◆ Select the network interface, IP version and local IP address

When you click on the black triangle, a window is displayed:

"IP Traffic - Test & Measure" - Local IP Address and IP Version selection for connection #01

Select an Interface in the List below.
 LAN ZTI 2 (IPv4 Address: 192.168.0.35 - IPv6 Address: fe80::211:43ff:fe03:a218) **1**

Note: IPv6 is only available with Windows XP and later.

Select an IP Version
 Select the IP Version to use on this connection or let "IP Traffic - Test & Measure" choose the IP Version automatically regarding the address resolution result. In this case, if the resolution process returns two addresses, one in IPv4 and one in IPv6, the IPv4 address is chosen by default. **2**

☒ Use IPv4 only ☐ Use IPv6 only ☐ based on the IP Address or Host Name resolution

Selection of IP Address on Multihomed Interface
 Select IP Address IPv4 Address selected: **192.168.0.35** **3**

☒ Source port number is dynamically assigned by the Windows TCP/IP stack (with a value between 1024 and 5000)
 Specify a static source port number. Warning: specify judiciously the static local source port number in order to prevent a conflict with another application reserved port. (Allowed values: 1 to 65535) **4**

Current Parameters of this Connection
 Source Port Number:
 IP Address or Host name: **ANY_ADDRESS** **5**
 IP Address after Resolution: **255.255.255.255 (IPv4)**
 IP Version: **IPv4 automatically selected**
 Selected Interface: **Default: Interface chosen by the system (IPv4 and IPv6 available)**

OK Cancel Help

Network interface, IP version and IP local address for an IP Answering connection

(1) The **network interface** selection is optional. It is used to constrain connections to be established using a specific interface.

- By default:
 - The IP version is automatically selected by **IP Traffic - Test & Measure** regarding the destination address or host name specified on the "IP Answering –Traffic + Statistics" tab (see below). By default, NO_ADDRESS is an IPv4 address.
 - The IP stack resolves the interface selection to send packets to the remote. The IP stack uses the destination IP address to select the correct interface. The IP address and the netmask related to each interface are checked against the remote IP address to reach. When an interface that matches the remote IP address is found, it is used. To understand how the IP stack selects the interface, you may enter 'route print' console command to list the interface order, the IP address and the network address mask.
- You can select one interface from the list of connected interfaces. **IP Traffic - Test & Measure** will only use the selected interface to translate the IP address and to make a connection. You must select the interface compatible with the remote IP address you want to reach. When the IP address translation failed, current connection parameters area is updated as follows:

Current Parameters of this Connection

Source Port Number:
 IP Address or Host name: **ANY_ADDRESS**
 IP Address after Resolution: **255.255.255.255 (IPv4)**
 IP Version: **IPv4 automatically selected**
 Selected Interface: **Default: Interface chosen by the system (IPv4 and IPv6 available)**


- Network interface types are restricted: only Ethernet and PPP are listed. A PPP interface should be in 'connected' state to belong to the interface list.



We have noticed that some operating systems may choose automatically the best network interface to use when several NICs are plugged on the same network when it comes to network interface selection. In that case, data can be sent on one interface and received on another one.

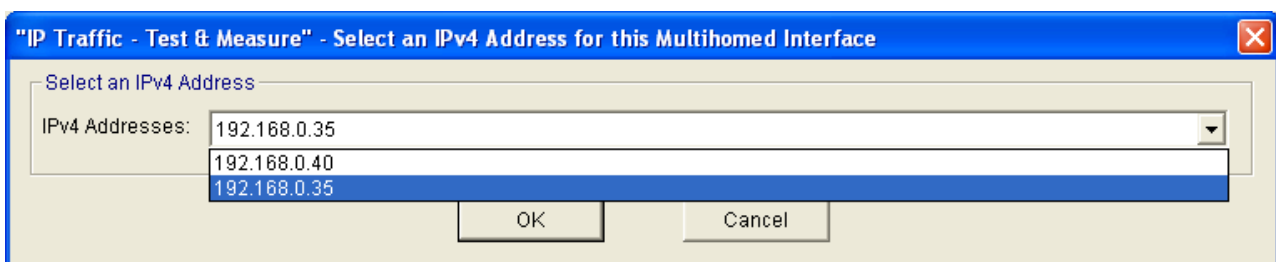
(2) The **IP version** selection is available:

- with Windows XP (or later)
- If IPv6 features are installed on the target machine. Please refer to the Windows XP or Windows Server 2003 documentation to install the IPv6 stack. On Windows Vista, the IPv6 stack is installed by default.
- You can allow **IP Traffic - Test & Measure** to choose automatically the good IP version regarding the address or host name resolution result. If a canonical name corresponds at the same time to an IPv4 and IPv6 addresses, **IP Traffic - Test & Measure** chooses the IPv4 address. In that case, to use the IPv6 address, you should select the use of IPv6 only (Use IPv6 only).

If you have selected an IP version, the IP address translation (see ) uses the current selected IP version to get the IP address numerical form.

(3) **Select IP address** is available when multiple IP addresses are attached to the network interface. This interface configuration is also known as 'multihomed' interface. The selection of a Source IP address is generally not required: **IP Traffic - Test & Measure** uses the default IP address of the interface to establish connections.

It may be useful when routing priority or policy is defined. Example of an IP address selection for a multihomed interface:



Select IP address is not available if the default interface 'Interface chosen by the system' is selected.

(4) **Specification of the local source port number** is disabled in the receiver Interface configuration because the source port number and the destination port number are generated by the remote as the originator of the connection.

(5) **Current parameters of this connection** area are an abstract for the connection. It summarizes the IP address, the numerical IP address format, the IP version and the interface selection.

- The source port used is dynamically updated with the user selection.
- The IP addresses are static. The IP address translation process occurs **after** you click on OK.
- The IP version field is dynamically updated with the user selection.
- The current interface is dynamically updated with the user selection.



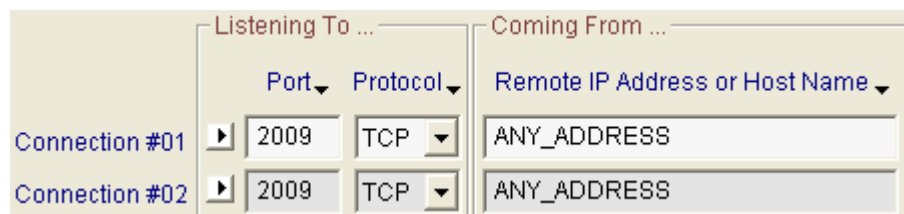
When you click on the OK button, if the interface selected or IP version has changed, the IP address translation is automatically started. It may be time consuming.

So, you can configure various incoming connection criteria:

- **Interface:** you limit a connection to a specific Interface or let the Operating System to return connections from any interfaces.
- **IP version:** when an Interface offers the two IP versions, you can select the IP version expected or not. By default, the automatic selection is activated.
- **When multiple IP addresses are attached to one interface,** you should select the destination IP address the incoming connection should refer to. By default, the first IP address returned by the system is selected.

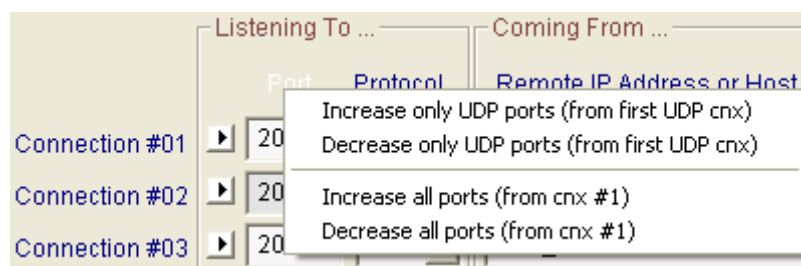
◆ *Description of the floating menu mechanism*

In the 'Listening To' object, the labels 'Port' and 'Protocol' are mouse-sensitive.



When the mouse is located on the 'Port' text area for example, the text color changes to white. Then click left your mouse to display the associated menu.

Floating menu for the 'Port' label



With this menu you can:

- Set the port number increasingly or decreasingly for every UDP connection, based on the port number of the first UDP connection.
- Set the port number increasingly or decreasingly for every connection, based on the port number of the first connection without taking account the protocol in use.

Floating menu for the 'Protocol' label



This menu helps to set the same protocol to every connection.

10.8.3 Coming From ...

Remote IP address or Host Name:

Enter the IP address (numerical format) or Host Name (canonical format), with the help of AutoComplete when active. The IP address is not a mask.

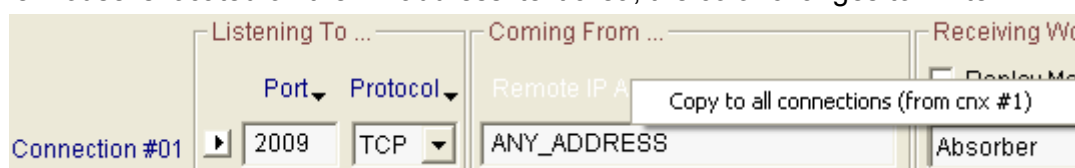
By default, the value is ANY_ADDRESS (This address is used to accept connection from any source address).

With a TCP connection, the incoming connection is rejected if **IP Traffic - Test & Measure** can't correlate this IP Address or host name with the source IP Address of the incoming packet.

With a UDP connection, the incoming packets are received but if **IP Traffic - Test & Measure** can't correlate this IP Address or host name with the source IP Address of the incoming packets, **IP Traffic - Test & Measure** doesn't take them into account in the statistics.

◆ IP address floating menu

When the mouse is located on the 'IP address' text area, the color changes to white.



Click on the left mouse button to display the short menu as above. With this function, the IP Address field from connection #01 is copied out to all connections from #02 to #16.

◆ IP Address translation mechanism

IP Traffic - Test & Measure tries to translate – e.g. to resolve – the IP address from a canonical to a numerical format. This operation is called the *IP address translation mechanism*. When the 'IP Address or Host Name' field or Interface parameters changes, when you move from 'IP Address or Host Name' field to another field, to another tab, when the Enter key is pressed or when the Interface parameters change, all of these actions start the IP address translation function.

Because the IP address translation mechanism is CPU consuming, you should be carefully when using IP canonical addresses. CPU consumption depends on the DNS answer speed, the number of DNS configured and the network load when the DNS request is sent.

If the network environment changes – e.g. a new DNS has been defined – you should press the Enter key in the 'IP Address or Host Name' field to force **IP Traffic - Test & Measure** to restart the translation mechanism for this connection.



When the IP address translation failed, the IP address is written in red on a white background. This connection cannot be started.



*To summarize, the **IP address translation** mechanism is activated when:*

- *the focus leaves the 'IP Address or Host Name' field,*
- *another tab is selected,*
- *you change the Interface parameters,*
- *a context file is loaded.*

10.8.4 Receiving working mode

IP Traffic - Test & Measure offers five different active working modes for the IP Answering part: '**Absorber**', '**Absorber File**', '**Echoer**', '**Echoer file**' or **Generator**'. A '**Disable**' (or inactive) mode is also available.

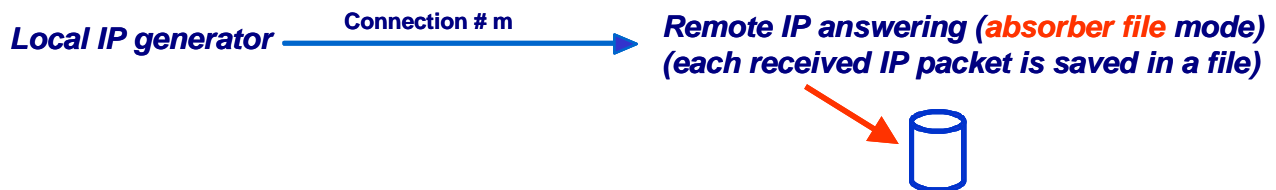
◆ **Absorber mode**

With this working mode, **IP Traffic - Test & Measure** absorbs data on this connection.



◆ **Absorber File mode**

When a receiving connection is operating in the 'Absorber File' mode, the 'IP Answering' module will save the received data in a file. The name of the file must be entered in the Filename field. A "Browse" button allows selecting the file easily.



◆ **Echoer mode**

When a receiving connection is operating in echoer mode, the received data are sent back to the 'IP Generator' module.



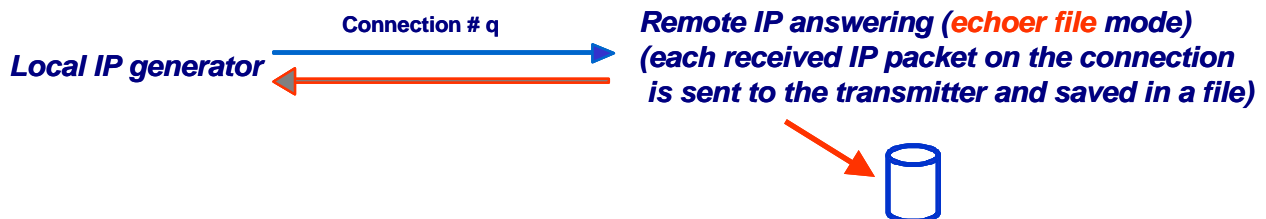
With UDP protocol, the 'Echoer' mode is available if a connected 'IP Generator' address is specified only.

Remind:

Echoed data can be saved in a file by the local 'IP Generator' module via the tab 1 "IP Generator - Parameters".

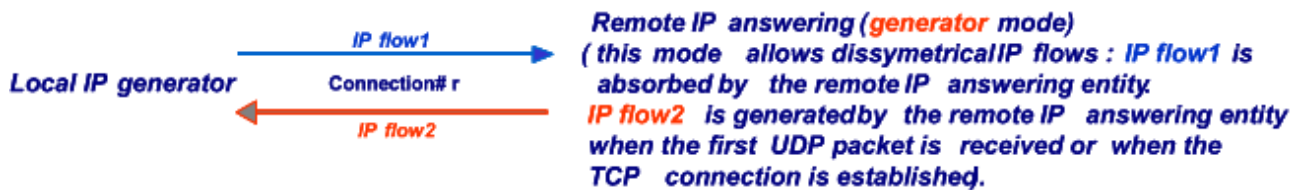
◆ **Echoer File mode**

When a receiving connection is operating in this mode, the received data are sent back to the 'IP Generator' module and are saved in a file. The name of the file must be entered in the Filename field. A "Browse" button allows selecting the file easily.

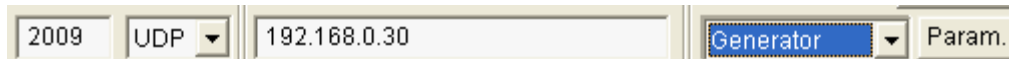


◆ Generator mode

This mode is displayed as “Generator” in the combo-box mode.



Properties of the *IP flow 1* are defined at the local ‘IP Generator’ level and each IP packet received by the remote ‘IP Answering’ module is used to compute statistics only.



When you select the “Generator” mode for a connection (#1 in the example above), a “Param.” Button is displayed in order to specify the traffic parameters generated by the remote ‘IP Answering’ module (i.e. *IP flow 2*). When you press the “Param.” button, an “IP Traffic – Parameters in unitary mode” window is displayed (the same as IP Generator – configure unitary testing mode). So you can input parameters for this *IP flow 2* as you like (for example, generate 10000 packets with an average throughput of 250 Kb/s).

For a TCP connection, *IP flow 2* is generated as soon as the TCP connection will be established between the local ‘IP Generator’ and the remote ‘IP Answering’ modules. The IP flow 2 is stopped when the FIN or RESET flag is received or when the user stops the IP Answering. The IP flow 2 is also stopped when no data are received during *TCPINACTIVITY* seconds. (see 13.3 Configuration parameters saved in the Registry database)

For an UDP connection, *IP flow 2* is generated as soon as the remote ‘IP Answering’ module will receive the first UDP packet. The IP flow 2 is stopped when the RESET flag is received or when the user stops the IP Answering. The IP flow 2 is also stopped when no data are received during *UDPINACTIVITY* seconds. (see 13.3 Configuration parameters saved in the Registry database)

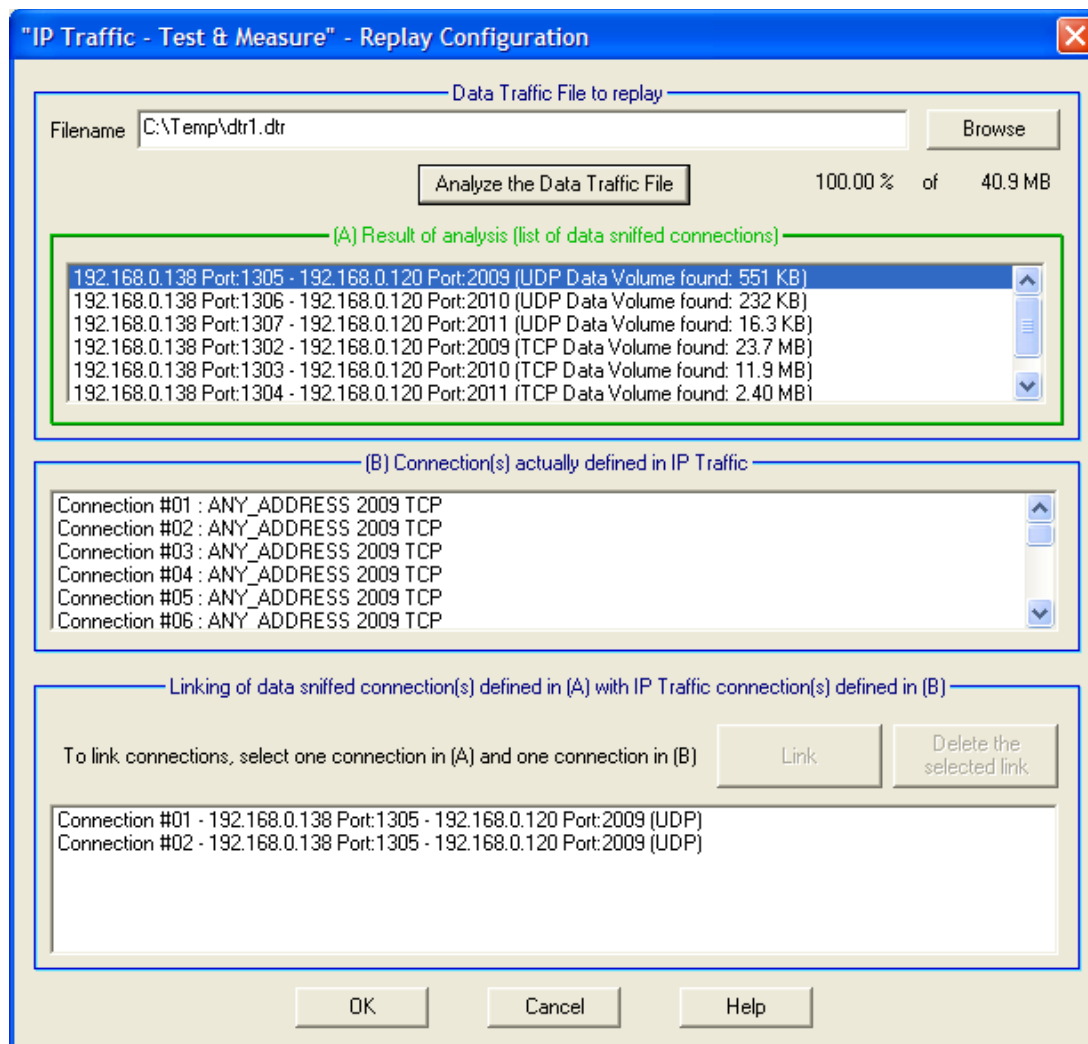
◆ Disable mode

When this mode is selected for a connection, **IP Traffic - Test & Measure** does not use this connection. The disabled connections are grayed when you start receiving traffic. Statistics fields of disabled connections are filled in with the following message: “Connection disabled”. There is no statistics in the file for these connections.

◆ **The command button: “Replay mode parameters”**



The check box ‘Replay mode’ must be checked in order to access to the replay mode. By clicking on the “Replay Mode Parameters” button, the following window is displayed.



First, select a ‘Data traffic file to replay’ and then press the “Analyze the data traffic file” button. At the end of the process, an indication is displayed: “100.00% of xxx Kb” (where xxx is the file size).

After the analysis of the data traffic file, all IP connections found in the sniffed traffic file are then displayed in the “(A) Result of analysis (list of data sniffed connections)” object.

Connections that have already been defined by the user in the current IP Answering module are displayed in the “(B) Connection(s) already defined in IP Traffic” object.

You must then link one ‘data sniffed connection’ to one ‘defined connection’ by pressing the “Link” button. If needed, one association can be removed by pressing the “Delete the selected link” button.

Once that the needed links have been defined, then press OK. **IP Traffic - Test & Measure** will replay traffic on actually defined connections of the ‘IP Answering’ module by using data of connections from the ‘data traffic file to replay’ specified by the different links you have made.

The connections that are not used to replay the traffic can be used but with the absorber Receiving Working Mode only.

10.8.5 'IP Answering' Statistics

By using the "Choose Columns" button at the bottom, you can select the parameters to display.

Up to 5 parameters can be simultaneously displayed among 13 parameters described later in this paragraph, and at least one parameter must be selected.

These statistics are computed at the application level (and based on application data sent or received). No MAC, IP and TCP/UDP headers and trailers are taken into account. Please refer to "PART 11 Calculation Mode for the Statistics".

To reset the statistics displayed, you can use the 'Reset Display' button at any time.

The "N/A" (Not Applicable) mention can be displayed instead of a value in the cell of the statistics table if the parameter cannot be calculated.

Statistics (based on application data)				
Rx Packets	Rx Pkts Throughput	Rx Throughput	Jitter	Seq. Num. Errors
2769 p	47 p/s	536 Kb/s	N/A	N/A
1044 p	N/A	1.03 Mb/s	0 ms	0

If a problem is detected for a connection, a warning message is displayed.

Example:

- Problem: disconnection due to TCP inactivity (see registry).
The IP Answering has ended the TCP connection because no data has been received (timeout defined with the TCPINACTIVITY parameter of IP Traffic - Test & Measure in the Registry).

Statistics (based on application data)				
Rx Packets	Rx Pkts Throughput	Rx Throughput	Jitter	Seq. Num. Errors
524 p	46 p/s	525 Kb/s	N/A	N/A
Problem: disconnection due to TCP inactivity (cf registry).				

◆ Transmitting statistics

◆ Tx Packets ⁽¹⁾	Tx Packets (Tx = Transmit) is the number of packets that IP Traffic - Test & Measure has sent since the connection is started.
◆ Tx Pkts Throughput ⁽¹⁾	Tx Pkts Throughput (Tx = Transmit) is the mean number of packets that IP Traffic - Test & Measure is sending per second. This value is only available with UDP connections. The calculation of this value is based on the sampling period defined by the throughput sampling period in the 'Configuration/General Parameters' menu.
◆ Tx Throughput	Tx Throughput (Tx = Transmit) is the mean throughput of data sent. The calculation of this value is based on the sampling period defined by the throughput sampling period in the 'Configuration/General Parameters' menu.
◆ Tx Volume	Tx Volume (Tx = Transmit) is the number of bytes that IP Traffic - Test & Measure has sent since the connection is started.

◆ *Receiving statistics*

◆ Rx Packets ⁽¹⁾	Rx Packets (Rx = Receive) is the number of packets that IP Traffic - Test & Measure has received since the connection is started.
◆ Rx Pkts Throughput ⁽¹⁾	Rx Pkts Throughput (Rx = Receive) is the mean number of packets that IP Traffic - Test & Measure is receiving per second. This value is only available with UDP connections. The calculation of this value is based on the sampling period defined by the throughput sampling period in the 'Configuration/General Parameters' menu.
◆ Rx Throughput	Rx Throughput (Rx = Receive) is the mean throughput of data received. The calculation of this value is based on the sampling period defined by the throughput sampling period in the 'Configuration/General Parameters' menu.
◆ Rx Volume	Rx Volume (Rx = Receive) is the number of bytes that IP Traffic - Test & Measure has received since the connection is started.

◆ *Other statistics*

◆ Data Not Echoed	'Data Not Echoed' is the number of bytes that the 'IP Answering' part couldn't echo. This value is only available if the 'IP Answering' part works in the Echoer mode.
◆ Jitter	Jitter is the mean variation of delays on packets received. This value is only available when Timecode option is selected (on the remote IP Generator). This value corresponds to the mean one-way variation only.
◆ Remaining Volume	'Remaining Volume' is the number of bytes that IP Traffic - Test & Measure has still not sent. This information is only available for two Traffic Generator types: Mathematical Law and File to Send.
◆ Seq. Numb. Errors ⁽¹⁾	'Seq. Numb. Errors' (Sequence Number Errors) is the sum of the Out Of Sequence packets number (OOS) and the number of lost packets. This value is only available if the Timecode option is selected (for the remote 'IP Generator') and if the working mode of the local 'IP Answering' is Generator or Echoer.
◆ Volume To Send	'Volume To Send' is the number of bytes that IP Traffic - Test & Measure should send. This information is only available for two Traffic Generator types: Mathematical law and File to Send.

⁽¹⁾ These statistics are not available with TCP

When pressing the “Start receiving traffic” button:

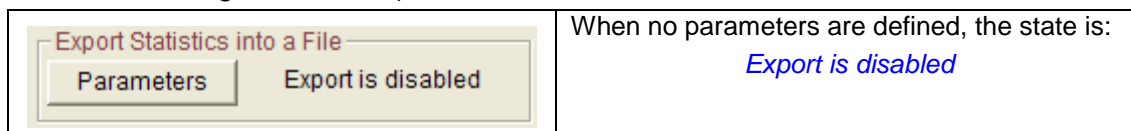
- All connected IP Answering information and working mode information are grayed,
- For disabled connections statistics, the message “Connection has been disabled” is displayed
- UDP enabled connections statistics fields are filled in with “N/A” or “00” value,
- TCP connections statistics fields are empty on white background (they will be filled in only when connection will be established).
- Statistics are exported into the file (see bellow)

When pressing the “Stop receiving traffic” button:

- Statistics fields are cleared up,
- ‘Listening to ...’, ‘Coming From ...’ and ‘Receiving Working Mode’ areas become available.

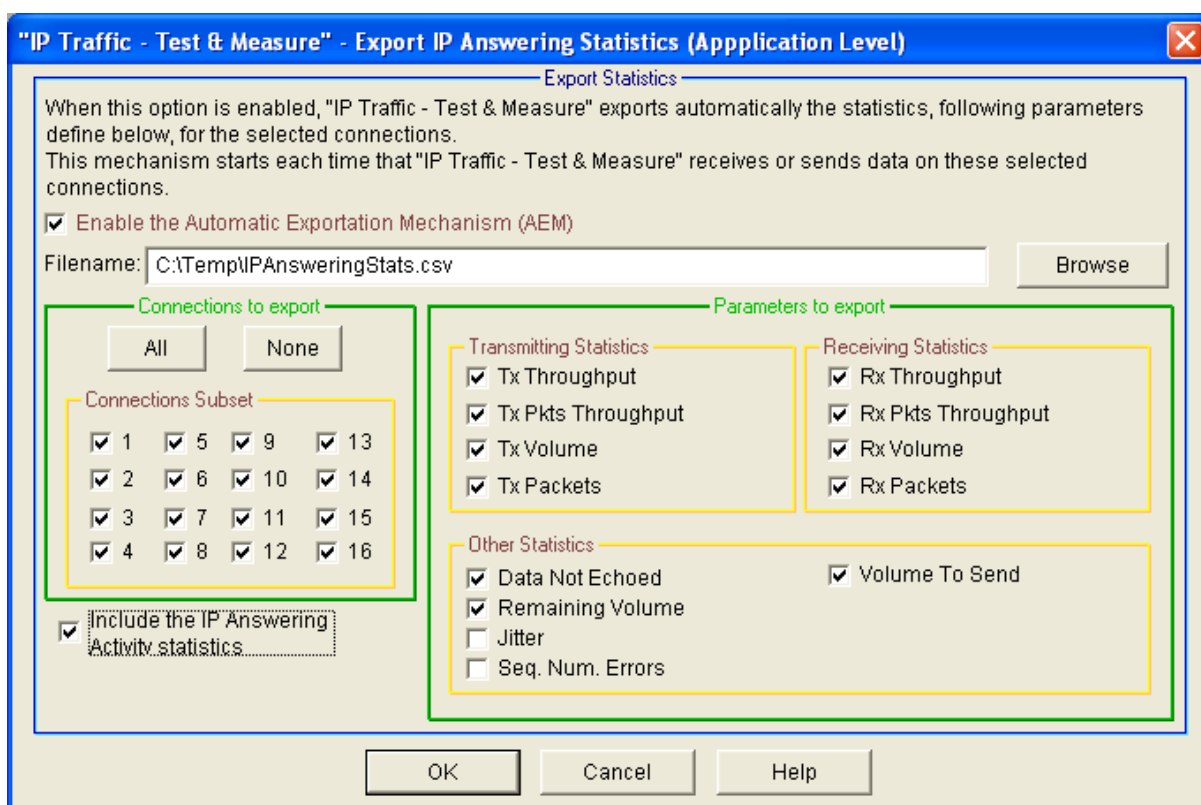
10.8.6 “Export IP Answering statistics into a file” parameters

To export all or part of **statistics** into a CSV file, click on the 'Parameters' button when enabled (i.e. if the IP Answering is not active):

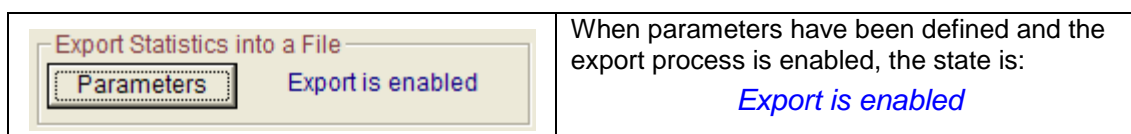


Then a new window allows defining parameters for the export process:

- Enable or disable the export process,
- The filename (.csv extension) of the export file,
- The identification of the needed connections,
- The parameters to export (up to 13).



Then press OK to validate, and a new state is displayed:



Note:

Do not specify the same filename to save statistics for the 'IP Generator' and the 'IP Answering' parts. If you do so, a warning message is displayed.

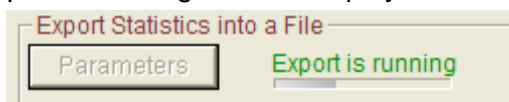
Note: The maximum number of columns handled by Excel is 255. If the number of statistics and connections you have selected exceeds this limit of Excel, you have to restrict to the most important statistics that you need, or to reduce the number of connections.

The statistics file is updated at the same rate than the statistics are displayed.

A special mark is added to keep special TCP and UDP events e.g. Begin and End of sending traffic.

When you reset statistics, the displayed values and the exported values are reset.

Statistics are saved into the file as soon as the 'Start Receiving Traffic' button of the IP Answering has been pressed and the 'Export is running' state is displayed:



When the 'Stop Receiving Traffic' button of the IP Answering has been pressed, then the export process is automatically suspended and the following idle state is displayed:



♦ The 'IP Answering' statistics file format

The IP Answering statistics file is formatted line by line as follows (example):

First line: (All types of statistics available for each connection are represented here. The statistics headers can be up to fifteen for each connection)

IP Answering Date/Time	State Connection #xx	Tx Throughput Connection #xx (Kb/s)	Tx Pkts Throughput Connection #xx (Pkts/s)	Tx Volume Connection #xx (KB)	Tx Packets Connection #xx (Pkts)	Rx Throughput Connection #xx (Kb/s)	Rx Pkts Throughput Connection #xx (Pkts/s)
---------------------------	----------------------------	---	---	-------------------------------------	--	---	---

Rx Volume Connection #xx (KB)	Rx Packets Connection #xx (Pkts)	Remaining Volume Connection #xx (KB)	Volume To Send Connection #xx (KB)	Data Not Echoed Connection #xx (KB)	Jitter Connection #xx (ms)	Seq. Num. Errors Connection #xx
-------------------------------------	--	---	---	--	----------------------------------	--

Next lines:

MM/DD/YYYY HH:MM:SS.mmm	TCP or UDP or ICMP	nnn.nn	nnn.nn	mmm	mmm	nnn.nn	nnn.nn
mmm	mmm	mmm	mmm	mmm	mmm	mmm	

Additional mark for TCP or UDP connection events

TCP START It indicates the corresponding connection starts. When this mark is included in the IP Answering traces, the numerical values are set to 0.

TCP END It indicates the corresponding connection has stopped. The numerical values are the latest values computed by **IP Traffic - Test & Measure**.

Additional mark for TCP or UDP disconnection events**TCP INFO**

This mark indicates the reason of the disconnection if this one is not produced by the click on “Stop receiving” button or the normal shutdown of the traffic generation i.e. when the number of packets to send has been reached.

When this mark is included in the IP Answering traces, the error message returned by **IP Traffic - Test & Measure** is placed after the “INFO” mark.

Idle connections

When the connection is idle, no numerical values are set. The fields are empty.

Conventions

“Volume to send” and “Remaining Volume” are filled with the “N/A” symbol when the generator is not configured with “File to send”.

“Seq. Num. Errors” and “Jitter” are filled with the “N/A” symbol until one “RTT” header is found in the received data by the 'IP Generator' part.

“Tx Pkts Throughput” and “Rx Pkts Throughput” are filled with the “N/A” symbol when the protocol used for the concerned connection is not UDP.

How to open this CSV file with Excel?

To open this file with Microsoft Excel, the comma should be defined as list separator (this is the default value with English regional settings). In case of problem, click on “Start > Control Panel” and click on “Regional and Language Options”, select an item in the list or click Customize to define your own parameters.

How to change the date/time format?

To change the format of the date/time column, select the whole column and right click on the column. Choose “Format Cells ...”, then, in the Category list, choose “Custom”. In the “Type” area, enter the following string: mm/dd/yyyy hh:mm:ss.000. Using this string, the date/time format will be changed to: *03/20/2008 09:45:50.840*.

Export an IP Answering file sample

In this example, 2 connections have been selected with all parameters exported.

For each connection, the 'IP Answering' is operating with the echoer mode.

- Connection #01 is configured with the TCP protocol
- Connection #02 is configured with the UDP protocol.

The “Refresh time” parameter is set to 2 seconds.

IP Answering Date/Time	State Connection #01	Tx Throughput Connection #01 (Kb/s)	Rx Throughput Connection #01 (Kb/s)	Rx Pkts Throughput Connection #01 (Pkts/s)	State Connection #02	Tx Throughput Connection #02 (Kb/s)	Rx Throughput Connection #02 (Kb/s)	Rx Pkts Throughput Connection #02 (Pkts/s)
03/20/2008 15:12:15.850					UDP START	0	0	0
03/20/2008 15:12:15.850					UDP	0	0	0
03/20/2008 15:12:17.084	TCP START	0	0	N/A	UDP	0	0	0
03/20/2008 15:12:17.787	TCP	75.28	75.28	N/A	UDP	77.56	77.56	6
03/20/2008 15:12:19.787	TCP	303.41	303.41	N/A	UDP	305.69	305.69	26
03/20/2008 15:12:21.787	TCP	531.53	531.53	N/A	UDP	533.81	533.81	46
03/20/2008 15:12:23.787	TCP	568.03	568.03	N/A	UDP	568.03	568.03	49
03/20/2008 15:12:25.787	TCP	568.03	568.03	N/A	UDP	570.31	570.31	50
03/20/2008 15:12:27.787	TCP	570.31	570.31	N/A	UDP	570.31	570.31	50
03/20/2008 15:12:29.787	TCP	568.03	568.03	N/A	UDP	570.31	570.31	50
03/20/2008 15:12:31.787	TCP	570.31	570.31	N/A	UDP	568.03	568.03	49
03/20/2008 15:12:33.787	TCP	568.03	568.03	N/A	UDP	568.03	568.03	49
03/20/2008 15:12:35.787	TCP	570.31	570.31	N/A	UDP	568.03	568.03	49
03/20/2008 15:12:37.787	TCP	570.31	570.31	N/A	UDP	572.59	572.59	50
03/20/2008 15:12:39.787	TCP	572.59	572.59	N/A	UDP	572.59	572.59	50
03/20/2008 15:12:41.787	TCP	572.59	572.59	N/A	UDP	572.59	572.59	50
03/20/2008 15:12:43.787	TCP	572.59	572.59	N/A	UDP	570.31	570.31	50
03/20/2008 15:12:45.787	TCP	570.31	570.31	N/A	UDP	570.31	570.31	50
03/20/2008 15:12:47.787	TCP	568.03	568.03	N/A	UDP	568.03	568.03	49
03/20/2008 15:12:49.787	TCP	568.03	568.03	N/A	UDP	570.31	570.31	50
03/20/2008 15:12:51.787	TCP	572.59	572.59	N/A	UDP	572.59	572.59	50
03/20/2008 15:12:53.787	TCP	570.31	570.31	N/A	UDP	570.31	570.31	50
03/20/2008 15:12:55.787	TCP	570.31	570.31	N/A	UDP	570.31	570.31	50
03/20/2008 15:12:57.787	TCP	568.03	568.03	N/A	UDP	568.03	568.03	49
03/20/2008 15:12:59.787	TCP	572.59	572.59	N/A	UDP	570.31	570.31	50
03/20/2008 15:13:00.850	TCP	572.59	572.59	N/A	UDP	570.31	570.31	50
03/20/2008 15:13:00.850	TCP END	572.59	572.59	N/A	UDP	570.31	570.31	50
03/20/2008 15:13:00.912					UDP END	570.31	570.31	50

The delimiter mark used between each field is the comma character (respecting the CSV format).

10.9 The ‘Traffic Sniffer’ tab

This tab is composed of three numbered areas:

1. **Step 1: Capture parameters:** traffic can be captured by **IP Traffic - Test & Measure** with 2 options: all IP traffic or IP traffic on connections specified by the user.
2. **Step 2: Capture sniffed traffic in a file:** once that capture parameters have been defined, captured traffic may be saved in a file.
3. **Step 3 (optional): Run analysis algorithm on a sniffed traffic file to generate data traffic files:** from an IP capture file, **IP Traffic - Test & Measure** uses an internal algorithm to produce two traffic files used by the Replay mode of the IP Generator and of IP Answering.

Note: IP Traffic - Test & Measure allows capturing traffic in a file.

This is used in two cases:

- For off-line statistics (see tab 5: ‘Traffic Observer’): in this case, step 3 is not necessary.
- In order to replay traffic via the ‘IP Generator’: in this case, step 3 must be done.

Tab 4: “Traffic Sniffer”

Note: IP Traffic - Test & Measure allows configuring the mode to capture the data. Please refer the DriverFilterMode entry in the registry presented in Appendix paragraph “13.3.1 General configuration parameters”.

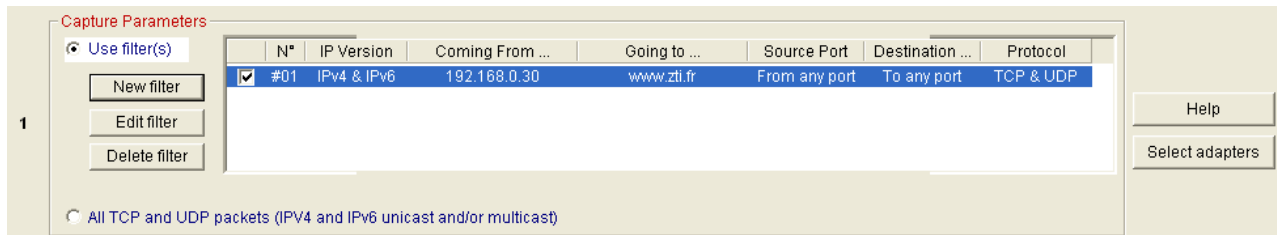
10.9.1 Capture Parameters (Step 1)

Two options are available:

- ⇒ **All TCP and UDP unicast and/or multicast packets: IP Traffic - Test & Measure** will capture all TCP and UDP unicast packets seen by the 'Traffic Sniffer'. This option is selected by default.
- ⇒ **Use filter(s):** Traffic capture is made according to user defined filters as explained below. Up to 20 filters can be specified.

Note:

With "Use filter(s)" option selected, at least one user defined filter should be selected in the list box to be allowed to start the traffic capture.

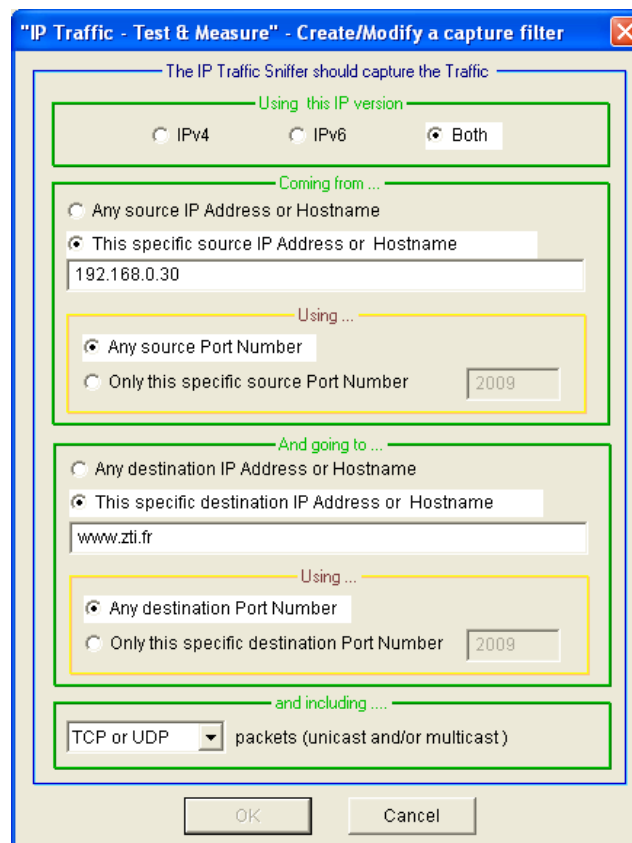


Step 1: Capture Parameters Specification

◆ Create/Modify/Delete user defined filters

You can define up to 20 'filters' composed of five parameters: Source IP address, Destination IP address, Source Port number, Destination Port number and Protocol.

The command buttons "Add filter", "Edit filter" and "Delete filter" allow adding, editing and removing the user-defined filters. By clicking on "Add filter", the window below appears:



Filter edition window

Four main areas compose this window.

1. Specification of the IP version: Only IPv4, Only IPv6 or both IPv4 and IPv6
2. Specification of the “Coming ...” information
 - a. Specification of the source IP Address or Host Name of the traffic (IPv4 or IPv6)
 - b. Specification of a particular source port number
3. Specification of the “And going ...” information.
 - a. Specification of the destination IP Address or Host Name of the traffic (IPv4 or IPv6)
 - b. Specification of a particular destination port number
4. Specification of the protocol(s) :
 - a. Capture only TCP packets
 - b. Capture only UDP packets (including multicast traffic)
 - c. Capture TCP and UDP packets

Note:

Each parameter is optional. It is not necessary to specify a value. In this case, this parameter is not used to filter packets.

Warning:

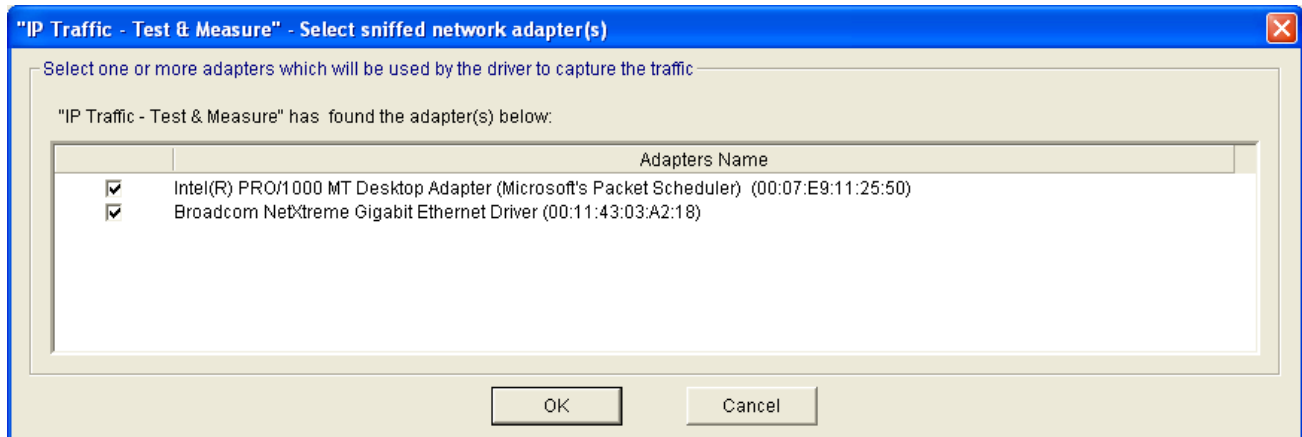
*You can input different filters, but **IP Traffic - Test & Measure** doesn't control the functional coherence between the filters.*

To edit a filter, select it in the list box and then press the 'Edit filter' button.

To delete a filter, select it in the list box and then press the 'Delete filter' button.

◆ **Select Adapters (optional)**

By clicking on the “Select Adapters” button, the window below opens. By default, if your machine contains more than one network card, IP Traffic Sniffer driver pools all of the network cards and captures all packets. This polling capacity can be greedy for resource. If it is not necessary, up to one network card could be specified.



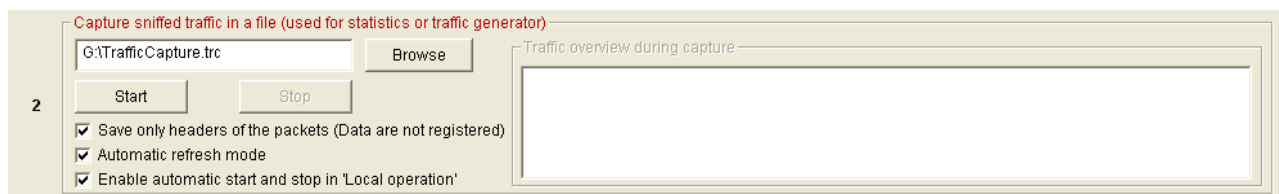
Adapter's selection window

Note:

When loading a context, if the interface in this context saved can not be found, **IP Traffic - Test & Measure** selects the first interface available to replace the one saved.

10.9.2 Capture sniffed traffic into a file (Step 2)

Once that capture parameters have been defined in the previous area, you must define a capture file. The command buttons “**Start**” and “**Stop**” allow starting and stopping the traffic capture.



Step 2: Capture traffic control panel

During the capture process, information is displayed in the “Traffic overview during capture” object (statistics if available).

“Save only the headers of the captured packets (Data are not saved)” check box: if checked, only the packet headers are saved (thus significantly reducing the size of the capture file) but you will be not able to use this file for the step 3.

“Automatic refresh mode” check box: allows refreshing display in the “Traffic overview during capture” object.

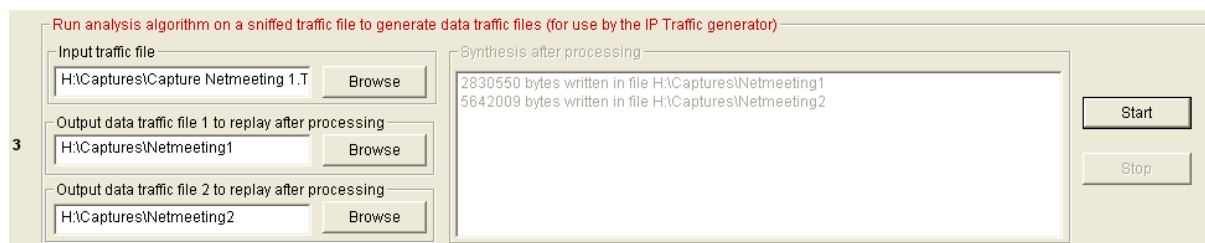
“Enable automatic start and stop in ‘Local operation’ check box: if checked, the “Start all processes” button of the “Local operation” will launch automatically the ‘Traffic Sniffer’.

10.9.3 Run analysis algorithm (Step 3)

In step 2, the capture process has generated a capture traffic file.

Warning:

The aim of step 3 is to split the captured data into two files. These two files are ONLY used by the IP Traffic Replay Mode available on the IP Generator and IP Answering parts. If you don't need to replay the traffic captured you keep time by avoiding reading this paragraph.



You specify a capture traffic file name in the “**Input traffic file**” object and two output files.

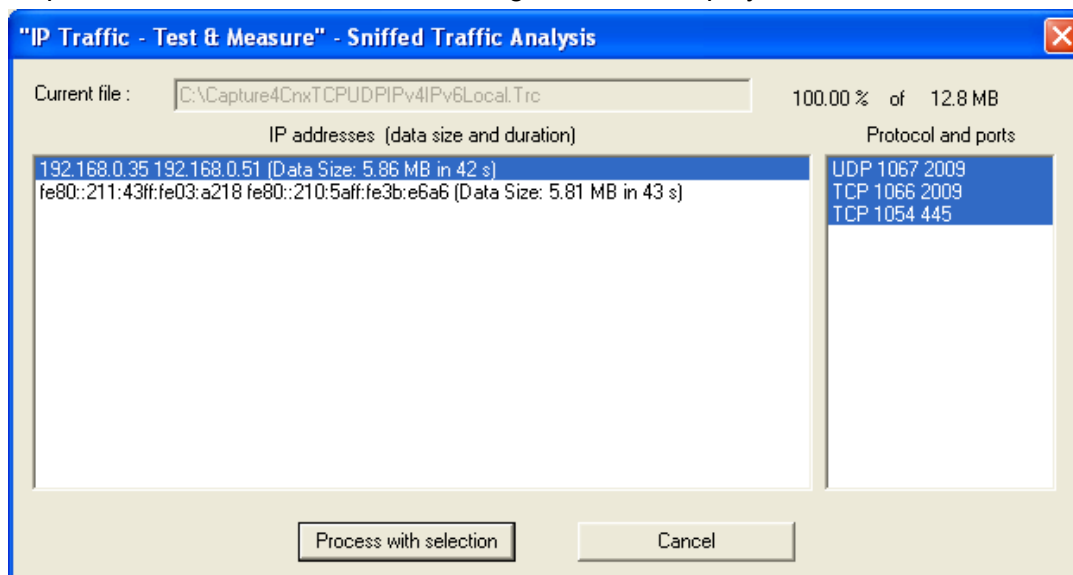
Note:

*The “**Input traffic file**” must contain data (see Step 2). The Step 3 can't use the files containing only headers.*

This file contains IP frames with different IP source addresses and IP source destinations.

The goal is to find in the input traffic file the communication entities (IP Generator and IP Answering) and to produce two traffic files to replay. An internal **IP Traffic - Test & Measure** algorithm analyzes IP frames from the Input traffic file and produces the two traffic files named “**Output data traffic file1 to replay after processing**” and “**Output data traffic file2 to replay after processing**”. The extension of these files must be “.dtr” (data to replay). This is an owner format used only by the IP Generator and IP Answering parts. This algorithm reassembles the fragmented packets before dispatching them in the two files. It is able to handle up to 50 fragments to reassemble a packet.

When you press the “Start” button, the following window is displayed:



You should select connections to consider (addresses + protocol and ports) and then press the “Process with selection” button.

After processing, the object “**Synthesis after processing**” displays statistics information about generated files and connections.

10.10 The ‘Traffic Observer’ tab

This fifth tab allows:

- Visualizing statistics and graphs for different parameters: IP throughput, Inter packet delay, Packet Erasure Rate quality (PER quality) and Packet transit delay,
- Downloading remote statistics traffic files,
- Analyzing off-line traffic,
- Exporting the statistics into a file.

The tab is divided into three main areas:

- The central area displays graphs and values,
- The right area contains objects and command buttons to select parameters to display,
- The bottom area is composed of four blocks:
 - **Remote (statistics) traffic files:** to download statistics traffic files from the remote, in order to do off-line statistic analysis.
 - **Off-line traffic analysis:** to do off-line analysis. It is necessary to have a local statistic traffic file and a remote statistic traffic file (downloaded via the previous area).
 - **Index (on-line or off-line):** one index is a marker set by the user that is used during off-line analysis for graphics display.
 - **Export statistics:** you can define statistic parameters to export in a CSV file and Start / Stop the export process.

The screenshot displays the 'Traffic Observer' tab with the following components:

- Statistical Values (based on Driver Statistics):** A table with columns for Connection #, IP Address/Host Name, Port, Prot., IP Throughput Snapshot (Tx, Rx), IP Throughput Average (Tx, Rx), UDP or TCP Throughput (Tx, Rx), Inter Packet Delay (Tx, Rx), Packet Transit Delay (Tx, Rx), and Packet Erasure Rate (PER) (Tx, Rx). All values are currently 0.00 b/s or 0 ms.
- Statistics Display:** A panel on the right with radio buttons for 'Values' and 'Graphics'. Under 'Graphics', there are checkboxes for 'IP Throughput', 'Inter Packet Delay', 'Packet Transit Delay', and 'PER Quality'.
- Remote Traffic Files:** A section at the bottom left with a 'Download...' button.
- Off-Line Traffic Analysis:** A section at the bottom center with radio buttons for 'Yes' and 'No', and buttons for 'Process Files...', 'Play >', 'Play >>', 'Pause', and 'Stop'.
- Index (On-Line or Off-Line):** A section at the bottom center with buttons for 'Next >', 'Add', '00 / 00', 'Remove', and 'Remove all'.
- Export Statistics:** A section at the bottom right with buttons for 'Parameters', 'Start', and 'Stop'.

Tab 5: Traffic Observer (on-line mode)

Note:

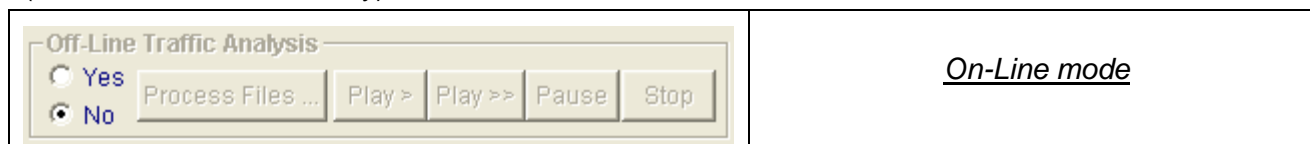
Values and statistics displayed in this tab are calculated at the ‘time’ point of reference (see **IP Traffic - Test & Measure** architecture in paragraph “11.2.1 Reference points to compute the statistics”) i.e. under the TCP/IP protocol stack.

10.10.1 IP Traffic - Test & Measure: On-line and Off-line modes for statistics

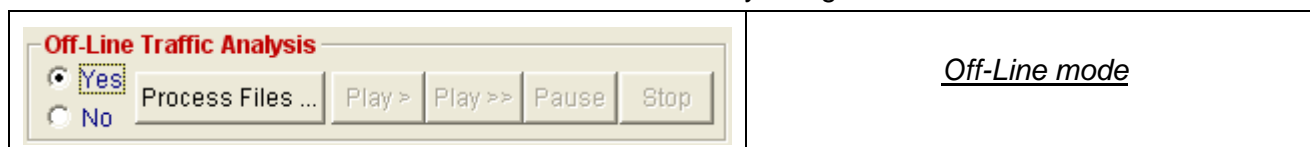
When **IP Traffic - Test & Measure** is operating ('IP Generator' is active and/or 'IP Answering' is active), this mode is named on-line. On-line statistics are displayed in the following tabs:

- 'IP Generator – Traffic + statistics': statistics area,
- 'IP Answering – Parameters + statistics': statistics area,
- 'Traffic Observer': statistics area, but all parameters are not displayed: PER (Packet Erasure Rate) and Packet transit delay need remote information to be computed.

By using the "Traffic Sniffer" tab, a capture traffic file can be defined (see "10.9.2 Capture sniffed traffic into a file (Step 2)") to save traffic that would be used in the off-line mode. Both file formats (With Data or Headers only) can be used for Off-line calculation.



You can switch between the off-line and on-line mode by using the Yes / No radio button.



Off-line mode is defined as a state where all **IP Traffic - Test & Measure** activity is stopped ('IP Generator', 'IP Answering' and 'Traffic Sniffer' are stopped). In this mode, only the "Traffic Observer" tab is available. All other tabs are inhibited.

In order to analyze traffic files and obtain all statistics, the user must first download a traffic file from the remote. **IP Traffic - Test & Measure** uses two traffic files to do off-line statistics analysis: a 'local' traffic file (generated by the 'Traffic Sniffer') and a downloaded 'remote' traffic file (generated by the remote 'Traffic Sniffer').

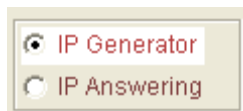
Note:

A red color for objects or command buttons in the 'Traffic Observer' tab means that these items are only available in the off-line mode.

10.10.2 Objects and command buttons

All objects and command buttons on the right and at the bottom of the 'Traffic Observer' tab are explained here.

♦ On the right of the 'Traffic Observer' tab



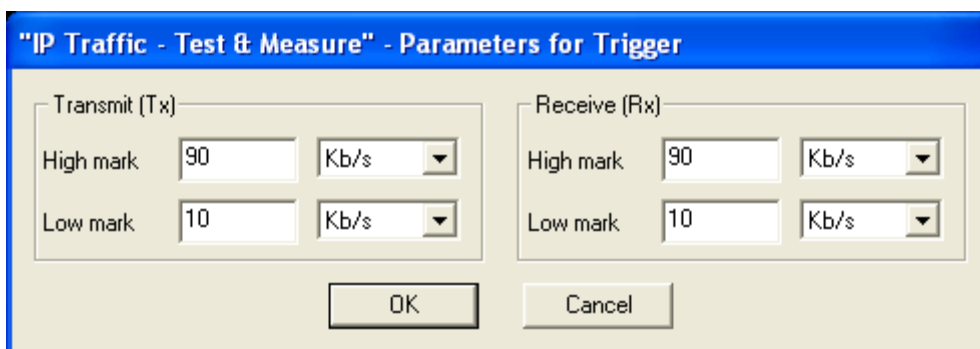
This choice allows selecting display connections for the 'IP Generator' or the "IP Answering" module. So, the user can switch simply to see statistics for the 16 'IP Generator' connections and the 16 'IP Answering' connections.

You can define different scale factors for the Transmit (Tx) and the Receive (Rx) graphs, and one value for the time scale.



Triggers are used for graphics displays (see statistics display below). The command button "**Triggers Parameters**" opens a dialog window where user defines 2 triggers (low and high) according to the parameters: IP throughput, Inter packet delay, PER and Packet transit delay. The command buttons "**Start Triggers**" and "**Stop Triggers**" allow enabling or disabling the defined triggers.

When a parameter is lower or upper than the threshold defined, counters are incremented in the graphic area. Triggers are displayed in red color.

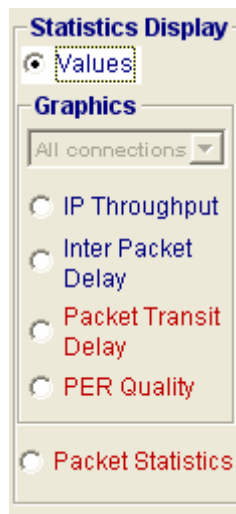


Parameters for the triggers

The statistics display area allows choosing a display item:

On-line mode

Off-line mode



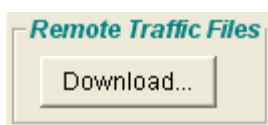
- **Values:** a values table (6 parameters for each connection with Tx and Rx values) is displayed (on-line and off-line),
- **Graphics:** select first 1 or all connections and then the parameter to display:
 - **IP Throughput** (on-line and off-line),
 - **Inter Packet Delay** (on-line and off-line),
 - **Packet Transit Delay** (off-line only),
 - **PER (Packet Erasure Rate) quality** (off-line only)
- **Packet Statistics:** off-line only and when traffic files have been previously loaded and processed.



The command button “**Reset statistics**” resets all statistics values displayed whatever the statistics display item is selected (see above).

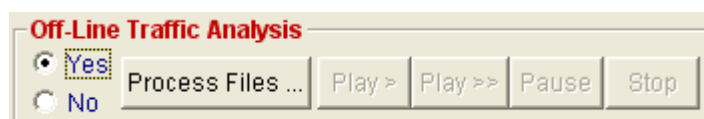
The command button “**Help**” displays a help window explaining all functionalities and commands for the 'Traffic Observer' tab.

♦ *In the lower part of the 'Traffic Observer' tab*



The command button “**Download...**” is used to download remote traffic files generated by **IP Traffic - Test & Measure** (via the 'Traffic Sniffer').

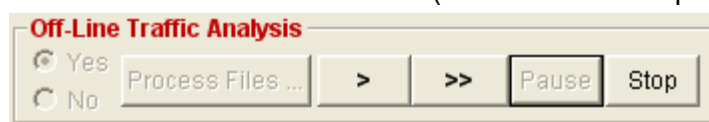
To calculate off-line statistics for all parameters, **IP Traffic - Test & Measure** uses 2 traffic files generated by the 'Traffic Sniffer' (see step 2 in the 'Traffic Sniffer' tab): a local traffic file and a remote traffic file.



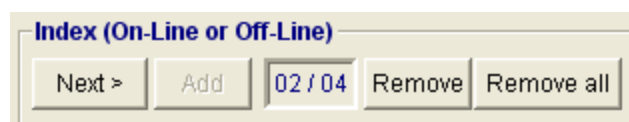
The command buttons of the “Off-line traffic analysis” area are used in off-line mode to display values and statistics from traffic files.

- “**Process files...**”: to select two traffic files (a local traffic file and a remote traffic file downloaded via the previous “**Download...**” command button by example).
- “**Play >**”: **IP Traffic - Test & Measure** replays the local traffic file at the beginning (selected via the previous “**Process Files...**” command) according to timing contained in the file.
- “**Play >>**”: idem “**Play >**” with a quick replay speed.
- “**Pause**”: traffic replay is halted. You can continue replay traffic with “**Play >**” or “**Play >>**”.
- “**Stop**”: ends traffic replay.

The “**Play >**”, “**Play >>**” and “**Stop**” buttons are enabled once that traffic files have been analyzed via the “**Process files...**” button (see further in this paragraph).



The “**Play >**” or “**Play >>**” buttons are replaced by “>” and “>>” after the user has pressed “**Pause**” for the first time.



The command buttons of the “Index (On-line or Off-line)” area are used to manage display index (or markers) in graphic displays for the off-line mode. These buttons are used:

- To add and remove index,
- To help the user to navigate when displaying off-line traffic analysis.

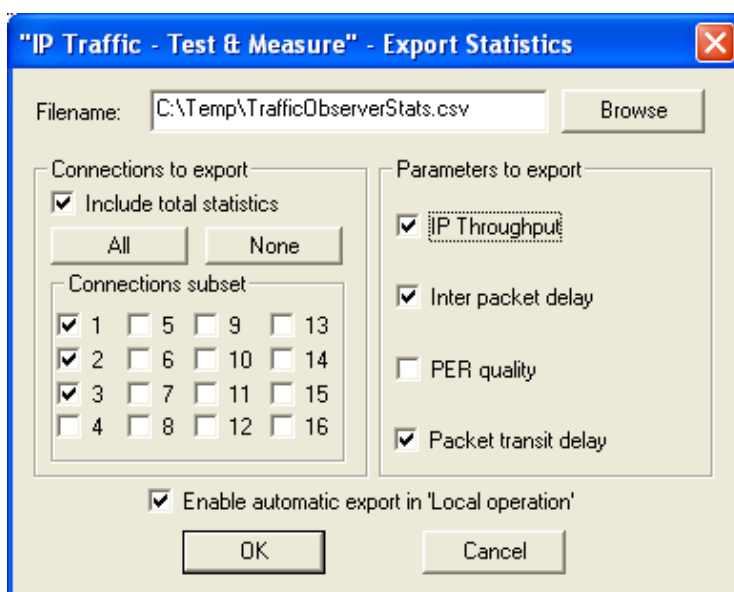
- “**Next >**”: the current position in the traffic file to analyze is set to the next display index set by the user.
- “**Add**”: adds a display index at the current position.
- “**XX/YY**”: displays the actual XX index number (YY is the total number of indexes set by the user).
- “**Remove**”: removes the current displayed index.
- “**Remove all**”: removes all displayed indexes.

The “**Export statistics**” area allows exporting in a CSV file the statistics values calculated by **IP Traffic - Test & Measure** with the filter parameters defined by the user.



You define first the export filters and filename by using the command button “**Parameters**”. The export filters allow selecting: connection(s) and parameter(s). The statistics export file is a CSV file.

The command buttons “**Start**” and “**Stop**” allow starting and stopping the export statistics process in the user-defined file.



Parameters to export statistics

Filename

The statistics are saved in the specified CSV file accordingly to parameters described below.

Connections to export:**Include total statistics**

If checked, the following parameters are saved in the file for the 'IP Generator' and the 'IP Answering' modules (see the file format explained in the next paragraph).

[Total Throughput Tx] [Total Throughput Rx] [Total Inter packet delay Tx] [Total Inter packet delay Rx] [Total PER Tx] [Total PER Rx] [Total Transit delay Tx] [Total Transit delay Rx]

where the term total is used as the sum of values for connections selected by user. Tx is used as Transmit and Rx as Receive.

'All' or 'None'

These buttons select all the connections or none.

Connections subset

Select the needed connections in order to save statistics for these connections.

Parameters to export:

Select the parameter you want to save as statistics.

Enable automatic export in 'Local operation' check box

If checked, the "Run all processes" button of the "Local operation" will launch automatically the export of statistics in the file according to parameters defined in the above window.

Note: Only up to 255 columns can be exported in the statistics file. It's impossible to select all statistics for all connections. A warning message is display if this limit is reached.

Format of the statistics file

The general format is defined for one line in the file (with the comma character as delimiter) as:

<Location (if GPS operational)> <Date/Time> [< Total statistics for the IP Generator>
<Connections Statistics for the IP Generator> [< Total statistics for the IP Answering>
<Connections Statistics for the IP Answering>

[< Total statistics for the IP Generator>] and [< Total statistics for the IP Answering>] are included if the 'Include total statistics' check box has been checked.

<Total statistics for the ...> is structured as follows:

[Total Throughput Tx] [Total Throughput Rx] [Total Inter packet delay Tx] [Total Inter packet delay Rx] [Total PER Tx] [Total PER Rx] [Total Transit delay Tx] [Total Transit delay Rx]

where the term total is used for the sum or the total of connections saved in the file, and Tx = Transmit, Rx= Receive.

<Connections Statistics for the IP Generator> or <Connections Statistics for the IP Answering> are structured as follows for a connection:

[#nn Throughput Tx] [#nn Throughput Rx] [#nn Inter packet delay Tx] [#nn Inter packet delay Rx]
[#nn PER Tx] [#nn PER Rx] [#nn Transit delay Tx] [#nn Transit delay Rx]

These fields are present depending of the parameter(s) selected:

- IP Throughput
- Inter packet delay
- PER quality
- Packet transit delay

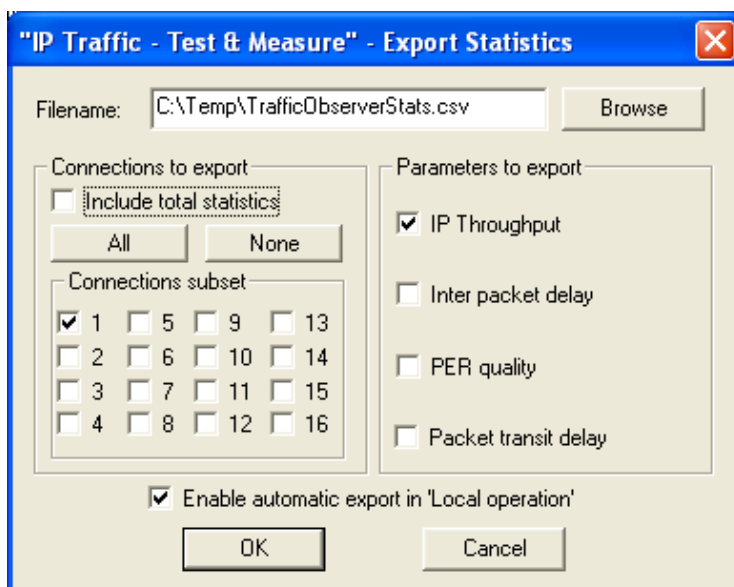
Note:

It is recommended to define carefully the parameters to use; otherwise, the number of columns in the file can be high (and an application like Excel may have problems to import this file).

The 'Include total statistics' generate 16 columns per line (8 columns for the 'IP Generator' and '8 columns' for the IP Answering)

When you select the 4 parameters to export (IP Throughput, Inter packet delay, PER quality and packet transit delay), that generates 16 columns to export for each connection (2 columns Rx and Tx per parameter = 8 columns for the 'IP Generator' and 8 columns for the 'IP Answering'). When 16 connections are selected, that generates 16 x 16 = 256 columns.

The following example has been generated for connection # 1 by using:



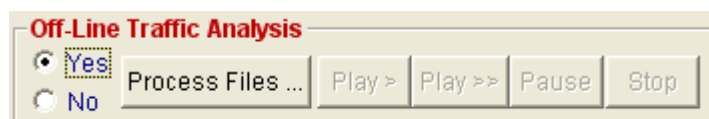
View of the generated file (by Excel):

Location	Date / Time	IP Generator - #01 Throughput Tx (Kb/s)	IP Generator - #01 Throughput Rx (Kb/s)	IP Answering - #01 Throughput Tx (Kb/s)	IP Answering - #01 Throughput Rx (Kb/s)
	03/20/2008 10:05:32	585.37	7.80	7150.11	6724.68
	03/20/2008 10:05:33	585.37	7.80	34786.69	35534.52
	03/20/2008 10:05:34	575.34	7.83	47907.98	48467.63
	03/20/2008 10:05:35	585.94	7.50	38407.81	39074.06
	03/20/2008 10:05:36	573.66	7.80	47592.21	48103.96
	03/20/2008 10:05:37	585.94	7.81	38394.09	39121.09
	03/20/2008 10:05:38	573.66	7.80	43840.07	44810.15
	03/20/2008 10:05:39	575.34	7.51	38888.61	39524.54
	03/20/2008 10:05:40	574.22	7.81	45008.19	45548.91
	03/20/2008 10:05:41	585.94	7.81	39250.31	39998.91
	03/20/2008 10:05:42	573.66	7.80	47448.26	48630.01
	03/20/2008 10:05:43	574.78	7.51	40484.63	41211.65
	03/20/2008 10:05:44	585.37	7.80	46030.45	46680.51
	03/20/2008 10:05:45	574.78	7.82	38802.36	39085.05
	03/20/2008 10:05:46	585.94	7.81	43434.16	44418.28
	03/20/2008 10:05:47	562.50	7.81	45220.88	46275.47
	03/20/2008 10:05:48	562.50	7.50	47115.25	48163.28
	03/20/2008 10:05:49	561.95	7.80	47547.44	48164.68
	03/20/2008 10:05:50	585.94	7.81	44028.91	44662.66
	03/20/2008 10:05:51	574.78	7.51	40255.09	40881.64
	03/20/2008 10:05:52	573.66	7.80	46573.20	47739.16
	03/20/2008 10:05:53	574.22	7.50	37604.41	37977.81
	03/20/2008 10:05:54	586.51	7.82	49914.37	50371.54
	03/20/2008 10:05:55	573.66	7.80	37785.75	38784.15
	03/20/2008 10:05:56	574.22	7.81	46445.88	47119.38
	03/20/2008 10:05:57	574.22	7.50	44737.72	45502.97
	03/20/2008 10:05:58	574.78	7.82	46436.63	47073.00
	03/20/2008 10:05:59	539.06	7.19	42642.66	43495.94

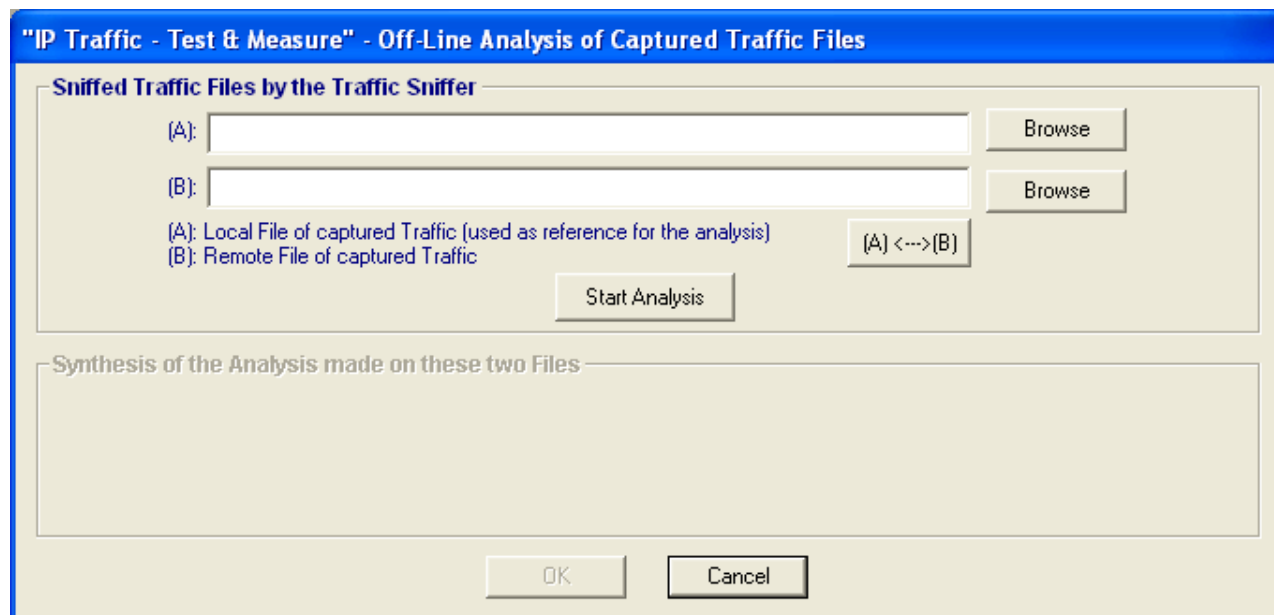
		Column 3	Column 4	Column 5	Column 6

The columns 3 and 4 refer to the 'IP Generator' part and columns 5 and 6 to the 'IP Answering' part.

◆ **The “Process Files ...” command button**



This button is enabled only with the Off-line mode. It allows sniffed traffic files to replay. Once pressed, the following window is displayed:

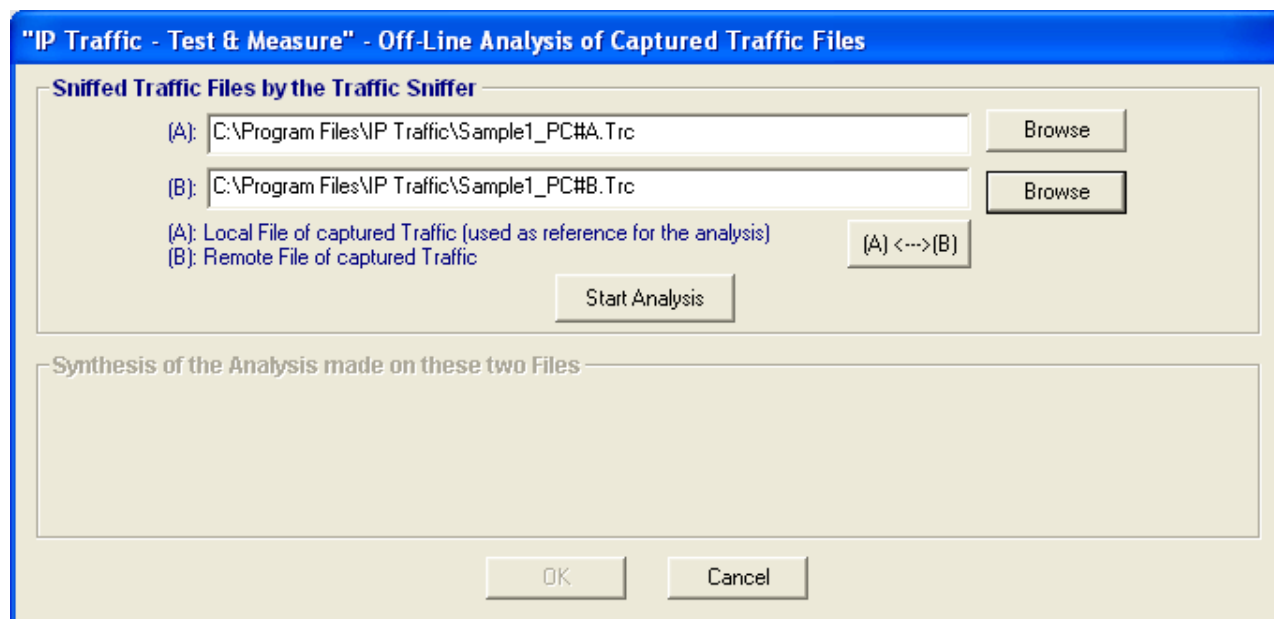


In order to proceed, you must input a local sniffed traffic file in (A) and a remote sniffed traffic file in (B).

The “(A) < --- > (B)” button inverts the (A) and (B) filenames.

Note:

(A) will be used as reference to find the packet synchronization between these two files and to compute the statistics (for example, lost packets and the transit delay).



Once files have been selected, then you can press the “Start Analysis” button and a new window is displayed:

"IP Traffic - Test & Measure" - Processing of the Captured Traffic Files

Step 1: Files Overview

(A): C:\Program Files\IP Traffic\Sample1_PC#A.Trc (B): C:\Program Files\IP Traffic\Sample1_PC#B.Trc

(A) is used as reference for the analysis

Collapse Expand

Not Scanned Start Scan Stop Scan Not Scanned

When the scan is complete, please select in (A) a couple of IP addresses or connections for a couple of IP addresses. Then go to Step 2.
Note: If you expect to replay connections, please select up to 16 connections.

Step 2: Criteria to search the Synchronization between these two files

Source: ☒ IP Address ☒ Port Number Destination: ☒ IP Address ☒ Port Number Others ...: ☒ Identification (IP header field)

Status: Start Scan Stop Scan

You can now do the Step 3

Step 3: Analysis to compute "Packets Statistics"

Number of packets analysed: Start Analysis Stop Analysis

Synthesis of the Analysis made on these two Files:

Processing of the sniffed traffic files is ended, you can now press "OK"

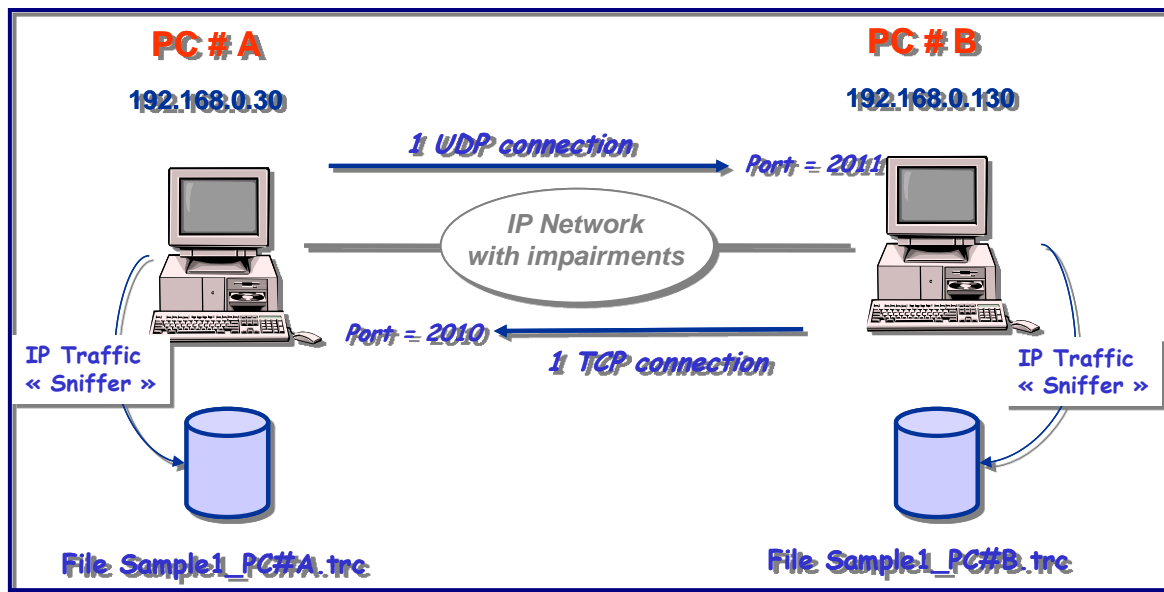
OK Cancel

Three steps are defined in this window:

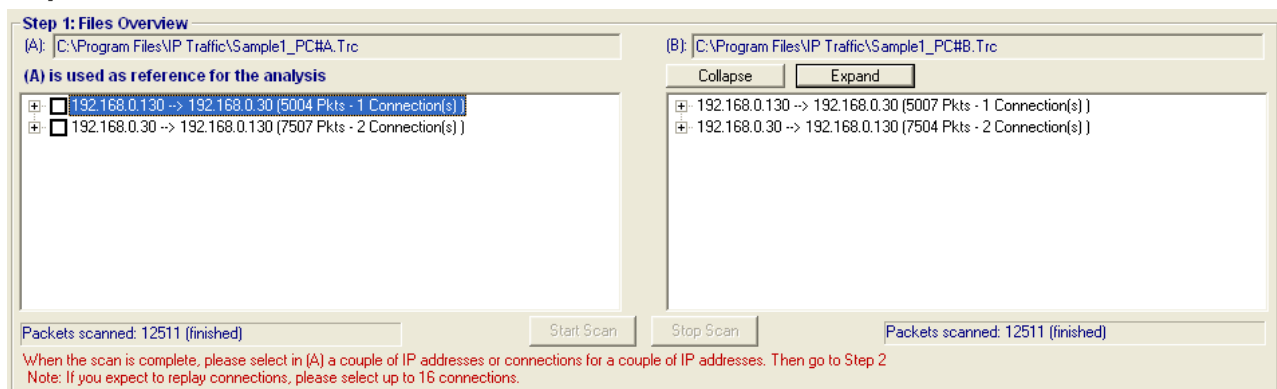
- **Step 1:** scanning of the selected files in order to display the TCP and UDP connections found.
- **Step 2:** once a couple of IP addresses or connections for a couple of IP addresses have been selected by using the step 1, you can specify one or more criteria in order to search the synchronization between these two files.
- **Step 3:** once the synchronization has been found in the step 2, you can now start the analysis in order to play these traffic files via the Traffic Observer off-line mode and compute the "Packet Statistics".

To proceed, you must first do the **Step 1** by pressing the "Start Scan" button. This scan allows display of couples of IP addresses found in these files and for each couple the number of connections and packets.

An example is given below by using two traffic files provided with the **IP Traffic - Test & Measure** software: These sniffed traffic files have been generated with the following configuration:



Step 1



For each file, a descriptive is given with the following description when the scan is complete:

<Couple of IP addresses> (<Number of packets> – <Number of connections>)

where:

<Couple of IP addresses> = Source IP address → Destination IP address

<Number of packets> = number of packets found in the file for this couple of addresses

<Number of connections> = number of connections found in the file for this couple of addresses

So, you can examine easily the (A) and (B) file overviews in order to choose for analysis a specific couple of IP addresses or connection(s) for a couple of IP addresses.

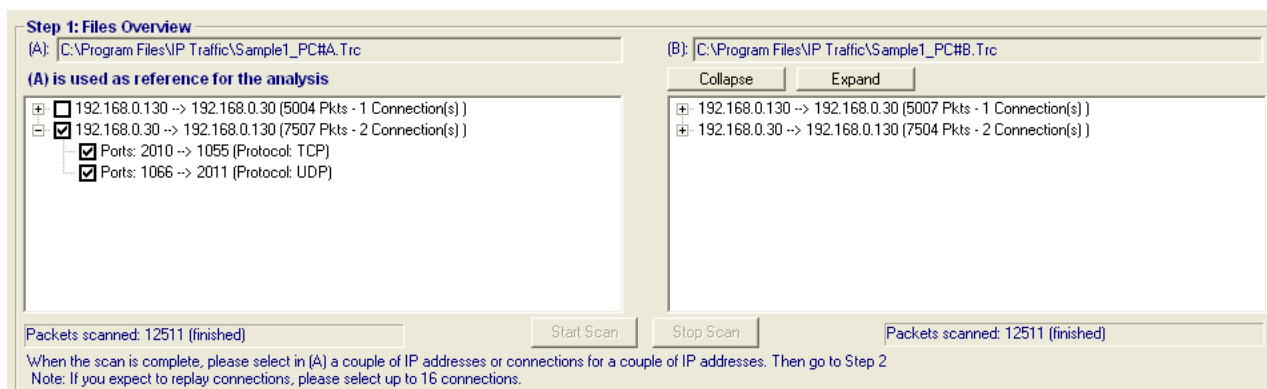
For (B), two additional buttons are available 'Collapse' and 'Expand'.

As a sniffed traffic file may content a huge number of connections with for example IP address translation between the two files, you can examine the overview of these two files and decide

which couple of IP addresses to consider or select one or more connections for a couple of IP addresses.

The selection can only be made on (A) which is used as reference.

Once selection is made, then the Step 2 is enabled.



Step 2

The **Step 2** is aimed to find the synchronization between the two files by using up to 6 criteria:

- Source IP address
- Source Port Number
- Destination IP address
- Destination Port Number
- Identification number (corresponding to the Identification field of the IP header)
- Hash Code (MD5 Algorithm), available on the captured traffic files generated since the version 2.4.0 of **IP Traffic - Test & Measure**. This Hash Code is based on the IP data payload.

The Hash Code is very useful to identify the packets captured for example on mobile or satellite networks. In this case, packets can go through a NAT. So the IP addresses and the IP Identifier may be replaced. If the port numbers are changed too, the Hash Code can't be used anymore to identify the packets.

Note: at least one criterion must be selected.

Once you have defined one or more criteria, press the "Start Scan" button to run the search for synchronization.

During this process, the 'Status' field indicates statistics on the number of combinations analyzed. At the end, this field is updated with the result of the search synchronization (see examples below).

Synchronization found:	Status Synchro Found (File A: Packet #1 <-> File B: Packet #1)
Synchronization not found:	Status No synchronization found. Please check the criteria and check also if you have specified both good files.

If the synchronization is not found, you should modify the search criteria and then retry.

Remark: for example, if the receiving IP traffic system is behind a gateway that translates the source IP addresses, don't use the 'Source IP address' criterion.

In this example, we obtain the following results:

Step 1: Files Overview

(A): [C:\Program Files\IP Traffic\Sample1_PC#A.Trc] (B): [C:\Program Files\IP Traffic\Sample1_PC#B.Trc]

(A) is used as reference for the analysis

192.168.0.130 -> 192.168.0.30 (5004 Pkts - 1 Connection(s))
☒ 192.168.0.30 -> 192.168.0.130 (7507 Pkts - 2 Connection(s))
☒ Ports: 2010 -> 1055 (Protocol: TCP)
☒ Ports: 1066 -> 2011 (Protocol: UDP)

Packets scanned: 12511 (finished) Start Scan Stop Scan Packets scanned: 12511 (finished)

When the scan is complete, please select in (A) a couple of IP addresses or connections for a couple of IP addresses. Then go to Step 2
 Note: If you expect to replay connections, please select up to 16 connections.

Step 2: Criteria to search the Synchronization between these two files

Source: ☒ IP Address ☒ Port Number
 Destination: ☒ IP Address ☒ Port Number
 Others ...: ☒ Identification (IP header field) ☐ Hash Code (MD5)

Status: Synchro Found (File A: Packet #1 <-> File B: Packet #1)

Start Scan Stop Scan

You can now do the Step 3

When the synchronization is found (for example the packet #2 of the file (A) has been found in the file (B) as packet #2 for the search criteria defined), the Step 3 is enabled.

Note:

if needed you can modify the search criteria or change the selection made in step 1. In this case, you have to re-start the synchronization process

How does it work?

For packet #i in the file (A), a search is made in the file (B) by applying the user defined criteria defined. The search uses a depth parameter (**DEPTHFORPACKETANALYSIS**) in order to limit the processing time. If success, the synchronization is found and computing is stopped, else the following packet #i+1 is considered for the next search up to the end of file (A) if necessary. If no synchronization is found, the search is restarted but made, for each packet #i, in the whole file (B).

Step 3

You can now run the **Step 3** by pressing the “Start Analysis” button in order to calculate the packet statistics (number of lost packets, transit delay for each packet and total statistics).

Step 3: Analysis to compute "Packets Statistics"

Number of packets analysed: []

Start Analysis Stop Analysis

Synthesis of the Analysis made on these two files

Processing of the sniffed traffic files is ended, you can now press "OK"

As soon as processing is started, the number of packets analyzed is displayed with the percentage already done.

How does it work?

For packet #i in the file (A), the search is made in the file (B) by applying the user defined criteria defined in the Step 2. As the packet #i can be received fragmented or desequenced, the search uses a depth parameter (**DEPTHFORPACKETANALYSIS**) in order to limit the processing time.

This process is applied to all packets contained in the two files in order to find the lost packets and to calculate the transit delay between the two endpoints (A) and (B).

A packet is considered LOST in a source file if the search in the target file has failed on a depth relative to the previous packet found in the target file.

The depth is defined by the **DEPTHFORPACKETANALYSIS** parameter located in the Registry and valued by default to 500. To modify the DEPTHFORPACKETANALYSIS parameter located in the Registry, you must use the Registry Editor (run 'regedit').

The based key to access this parameter is: [\HKEY_CURRENT_USER\Software\ZTI\IPTraffic\Settings](#).

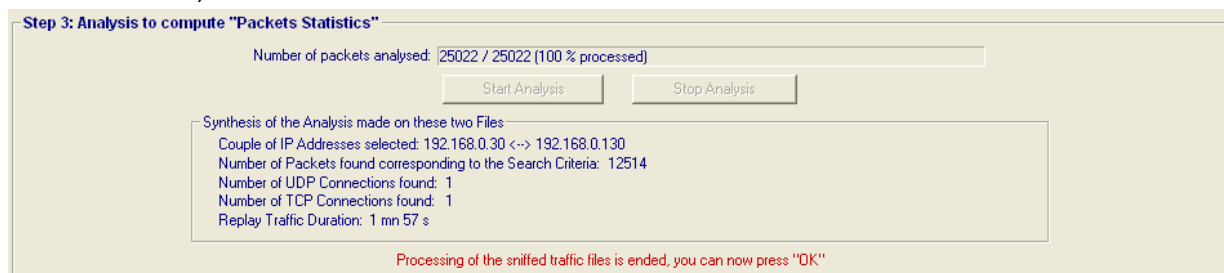
Moreover, this algorithm reassembles the fragmented packets before dispatching them in the two files. It is able to handle up to 50 fragments to reassemble a packet.

Warning:

Once you have changed the value, you have to quit and re-start the IP Traffic - Test & Measure software in order IP Traffic - Test & Measure takes into account the new value.

At the end of process, the number of packets analyzed is given and a synthesis is displayed:

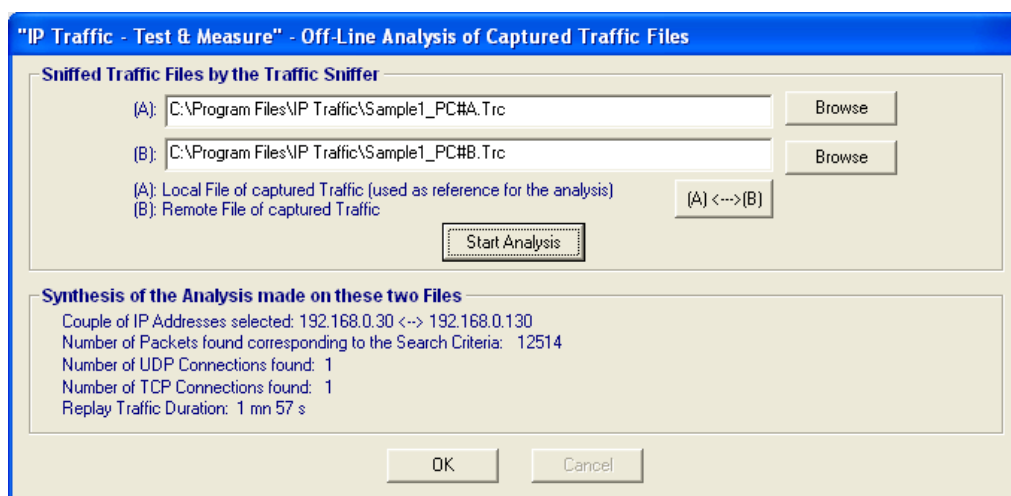
- Couple of IP addresses selected
- Number of packets found corresponding to the search criteria defined in the Step 2
- Number of UDP connections found
- Number of TDP connections found
- Replay traffic duration (useful if you want to play these sniffed traffic files via the Traffic Observer)



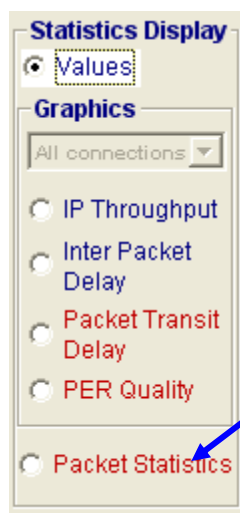
Note:

In this example, 25,022 packets have been analyzed (in fact 12,514 for file (A) and 12,514 for file (B)) and 12,514 packets match the search criteria.

You can then press OK to quit this window and come back to the previous window as shown below:



In this window, the synthesis is reminded. You can now press OK to quit the Off-line analysis.



The packet statistics can be viewed directly by using the Packet Statistics option of the Statistics display object.

With our example, we obtain the following results:

Offline Packet Statistics

Computer A ==> Computer B

Save ...

Computer B ==> Computer A

IP address of A: 192.168.0.30

IP address of B: 192.168.0.130

Time (UTC)	Sta...	Tra...	Port -> ...	IP size (pro...	Identi...
22:00:43.428	Sent	...	2010->1...	48 (TCP)	xD013
PC 22:00:43.451	Sent	0 (?)	2010->1...	40 (TCP)	xD014
PC 22:00:43.490	Sent	0 (?)	2010->1...	40 (TCP)	xD015
PC 22:00:43.530	Sent	0 (?)	2010->1...	40 (TCP)	xD016
PC 22:00:43.570	Sent	0 (?)	2010->1...	40 (TCP)	xD017
PC 22:00:43.611	Sent	0 (?)	2010->1...	40 (TCP)	xD018
PC 22:00:43.651	Sent	0 (?)	2010->1...	40 (TCP)	xD019
PC 22:00:43.691	Sent	0 (?)	2010->1...	40 (TCP)	xD01A
PC 22:00:43.731	Sent	0 (?)	2010->1...	40 (TCP)	xD01B
PC 22:00:43.771	Sent	0 (?)	2010->1...	40 (TCP)	xD01C
PC 22:00:43.810	Sent	0 (?)	2010->1...	40 (TCP)	xD01D
PC 22:00:43.850	Sent	0 (?)	2010->1...	40 (TCP)	xD01E
PC 22:00:43.890	Sent	0 (?)	2010->1...	40 (TCP)	xD01F

Time (UTC)	Sta...	Tra...	Port -> ...	IP size (pro...	Identi...
22:00:43.420	Sent	...	1055->2...	48 (TCP)	x6441
PC 22:00:43.420	Sent	0 (?)	1055->2...	40 (TCP)	x6442
PC 22:00:43.423	Sent	1 (?)	1055->2...	1500 (TCP)	x6443
PC 22:00:43.442	Sent	1 (?)	1055->2...	1500 (TCP)	x6444
PC 22:00:43.462	Sent	1 (?)	1055->2...	1500 (TCP)	x6445
PC 22:00:43.481	Sent	1 (?)	1055->2...	1500 (TCP)	x6446
PC 22:00:43.501	Sent	1 (?)	1055->2...	1500 (TCP)	x6447
PC 22:00:43.521	Sent	1 (?)	1055->2...	1500 (TCP)	x6448
PC 22:00:43.541	Sent	1 (?)	1055->2...	1500 (TCP)	x6449
PC 22:00:43.561	Sent	1 (?)	1055->2...	1500 (TCP)	x644A
PC 22:00:43.582	Sent	1 (?)	1055->2...	1500 (TCP)	x644B
PC 22:00:43.602	Sent	2 (?)	1055->2...	1500 (TCP)	x644C
PC 22:00:43.622	Sent	1 (?)	1055->2...	1500 (TCP)	x644D

Port -> Port(Pro...	Packets	Lost	% ...	Delay	Jitter	TCP...
Total Computer A	7507	3	0%	120 ...	1 ms	0
1066 -> 2011 (U...	5000	3	0%	178 ...	1 ms	N/A
2010 -> 1055 (T...	2507	0	0%	6 ms	0 ms	0

Port -> Port(Pro...	Packets	Lost	% ...	Delay	Jitter	TCP...
Total Computer B	5007	3	0%	8 ms	0 ms	3
1055 -> 2010 (T...	5007	3	0%	8 ms	0 ms	3

More information on the 'Packet Statistics' object is explained further in this chapter.

Note:

If the captures have been realized without Time Device and zClock system, the values showed in the "delay" column are close to the definition of the jitter. Why? The first packet found in the both files allows realizing the synchronization. **IP Traffic - Test & Measure** compares the two timestamps to calculate the delta time between the transmitting and the receiving of the packet. Then, this delta time is added or suppressed to each transit delay calculated for each packet. That is why the result is close to a variation of the transit delay and so close to the jitter notion.

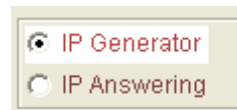
10.10.3 Values and statistics display



You can select six statistics displays via the “Statistics Display” object:

- Values
- 4 graphs:
 - IP Throughput
 - Inter Packet Delay
 - PER (Packet Erasure Rate) quality
 - Packet Transit Delay
- Packet Statistics

Before, you must select the 'IP Generator' or the 'IP Answering' part via:



Note: switching between “IP Generator” and “IP Answering” can be done at any time.

◆ Statistics display = Values

A value table is displayed as below (on-line example):

Statistical Values (based on Driver Statistics)															
	IP Address/Host Name	Port	Prot.	IP Throughput Snapshot		IP Throughput Average		UDP or TCP Throughput		Inter Packet Delay		Packet Transit Delay		Packet Erasure Rate (PER)	
				Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx
Connection #1	NO_ADDRESS	2009	UDP	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0 ms	0 ms	N/A	N/A	N/A	N/A
Connection #2	NO_ADDRESS	2009	UDP	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0 ms	0 ms	N/A	N/A	N/A	N/A
Connection #3	NO_ADDRESS	2009	UDP	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0 ms	0 ms	N/A	N/A	N/A	N/A
Connection #4	NO_ADDRESS	2009	UDP	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0 ms	0 ms	N/A	N/A	N/A	N/A
Connection #5	NO_ADDRESS	2009	UDP	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0 ms	0 ms	N/A	N/A	N/A	N/A
Connection #6	NO_ADDRESS	2009	UDP	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0 ms	0 ms	N/A	N/A	N/A	N/A
Connection #7	NO_ADDRESS	2009	UDP	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0 ms	0 ms	N/A	N/A	N/A	N/A
Connection #8	NO_ADDRESS	2009	UDP	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0 ms	0 ms	N/A	N/A	N/A	N/A
Connection #9	NO_ADDRESS	2009	UDP	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0 ms	0 ms	N/A	N/A	N/A	N/A
Connection #10	NO_ADDRESS	2009	UDP	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0 ms	0 ms	N/A	N/A	N/A	N/A
Connection #11	NO_ADDRESS	2009	UDP	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0 ms	0 ms	N/A	N/A	N/A	N/A
Connection #12	NO_ADDRESS	2009	UDP	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0 ms	0 ms	N/A	N/A	N/A	N/A
Connection #13	NO_ADDRESS	2009	UDP	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0 ms	0 ms	N/A	N/A	N/A	N/A
Connection #14	NO_ADDRESS	2009	UDP	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0 ms	0 ms	N/A	N/A	N/A	N/A
Connection #15	NO_ADDRESS	2009	UDP	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0 ms	0 ms	N/A	N/A	N/A	N/A
Connection #16	NO_ADDRESS	2009	UDP	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0.00 b/s	0 ms	0 ms	N/A	N/A	N/A	N/A

For each connection (from 1 to 16), the following 6 parameters (and for each parameter, Tx = Transmit and Rx = Receive) are displayed in 3 distinct areas:

Area 1 - IP address, Port number and protocol

Area 2 - Four parameters (available on-line and off-line):

- ⇒ IP throughput snapshot (immediate value),
- ⇒ IP throughput average,
- ⇒ UDP or TCP throughput,

⇒ Inter packet delay.

Area 3 - Two parameters (only available off-line):

⇒ **PER quality** (Packet Erasure Rate),

⇒ **Packet transit delay**.

In the Off-line mode, we have the following display, where a new object is defined: “Off-line duration information”. This object is used to indicate time of playing traffic files.

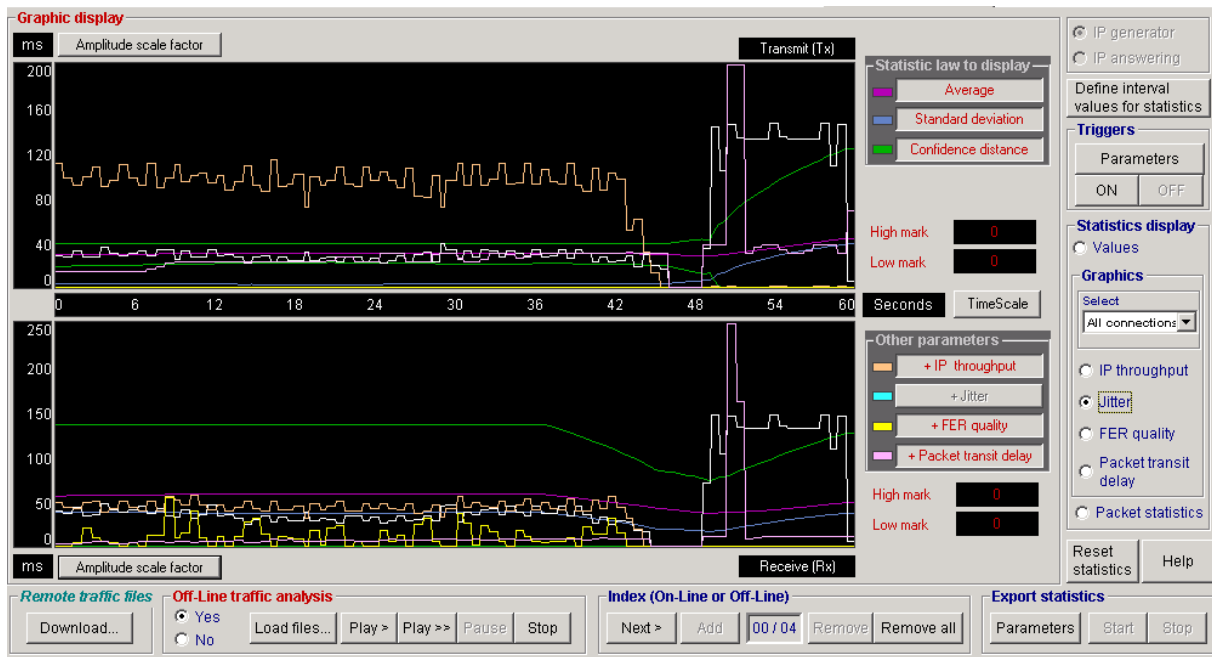
Statistical Values (based on Driver Statistics)																
	IP Address/Host Name	Port	Prot.	IP Throughput Snapshot		IP Throughput Average		UDP or TCP Throughput		Inter Packet Delay		Packet Transit Delay		Packet Erasure Rate (PER)		
				Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	
Connection #1																
Connection #2																
Connection #3																
Connection #4																
Connection #5																
Connection #6																
Connection #7																
Connection #8																
Connection #9																
Connection #10																
Connection #11																
Connection #12																
Connection #13																
Connection #14																
Connection #15																
Connection #16																
Off-Line duration information <input type="text"/>																

◆ **Statistics display = Graphics**

IP Traffic - Test & Measure allows displaying four graphics for the following parameters:

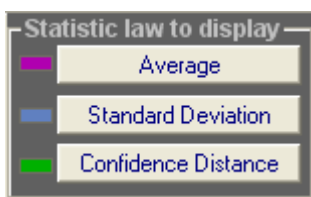
- ⇒ IP throughput (immediate value): on-line and off-line,
- ⇒ Inter packet delay: on-line and off-line,
- ⇒ PER quality: only off-line,
- ⇒ Packet Transit Delay: only off-line.

When you select a graphic, the following view is displayed:



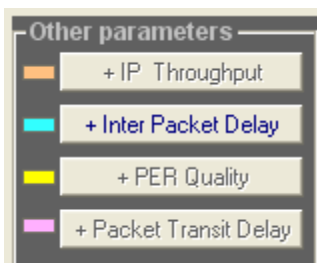
Example where all curves are displayed for all parameters

On the right area of the graphic display: 'Statistical law to display' and 'Other parameters'



Select one or many statistic laws to display. The mechanism is based on an ON/OFF button command (the red color indicates that the curve is displayed):

- ⇒ Average (1 curve)
- ⇒ Standard deviation (1 curve)
- ⇒ Confidence distance (2 curves)



Select the other parameter(s) to display on the same graphic by pressing one or more buttons as shown on left.

These ON/OFF command buttons allow adding graphical display for the other parameters not currently displayed. Up to 3 parameters may be added to the current parameter. So, you can see on the same graphic simultaneous displays of the 4 parameters.

Notes:

PER (Packet Erasure Rate) quality and Packet Transit Delay are only available with the off-line mode.

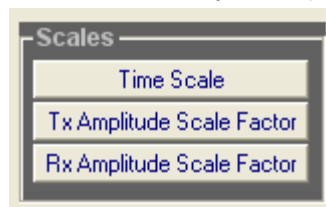
Time base scale for additional parameter to display is identical to the time base scale of the current parameter.

Formulas used for the statistical laws:

- Average m : $m = \frac{\sum_{i=1}^n x_i}{n}$
- Standard deviation σ : $\sigma = \sqrt{v}$ (with variance v defined as: $v = \frac{\sum_{i=1}^n x_i^2}{n} - m^2$)
- Confidence distance: 95.45 % of the values are between $(m - 2\sigma)$ and $(m + 2\sigma)$.

In the graphic display area: amplitude and time scales

The following buttons allow entering values for the “Amplitude scale factor” and the “Time base scale” necessary to display the different curve(s).

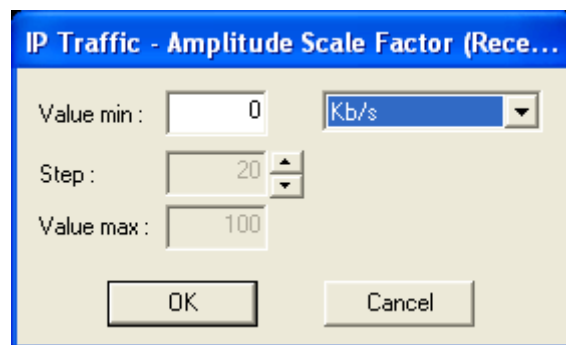
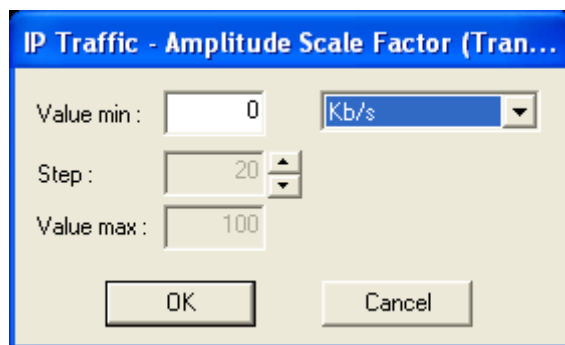


Tx Amplitude Scale Factor

(Transmit part)

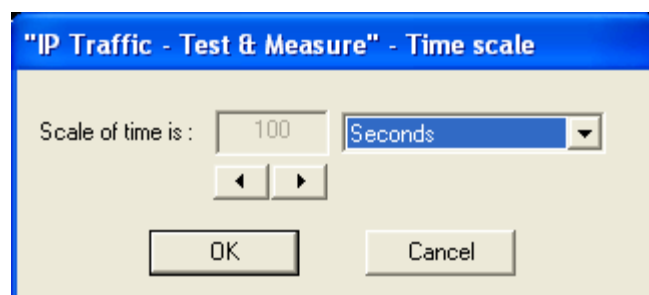
Rx Amplitude Scale Factor

(Receive part)



Time Scale

=====>



When you change values during processing, the graphic is automatically updated with the new values.

◆ **Statistics Display = Packet Statistics**

This display is only available off-line if sniffed traffic files have been already processed.

The two columns “Computer A ==> Computer B” and “Computer B ==> Computer A” display all IP packets exchanged and show if packets have been lost or received.

For each part, a synthesis is calculated and shown just under the packets list.

The screenshot shows the 'Offline Packet Statistics' window in the IP Traffic - Test & Measure application. The window is divided into two main sections for 'Computer A ==> Computer B' and 'Computer B ==> Computer A'. Each section contains a table of packet statistics with columns: Time (UTC), Sta..., Tra..., Port -> ..., IP size (pro...), and Identi... (ID). Below these tables are summary statistics for each direction, including Total Computer A/B, Packets, Lost, % Lost, Delay, Jitter, and TCP status. The interface also features a 'Remote Traffic Files' section at the bottom with buttons for Download, Process Files, Play, Pause, Stop, and Export Statistics.

Description of the column headers for the packets list

Time (UTC): in this column different symbols are used.

- the '⌚' (clock) symbol indicates that the absolute time reference is not available in one of the two traffic capture files used. In such case, **IP Traffic - Test & Measure** considers that the packet transit delay is valued to 0 for the first packet. For the following packets, the transit delay value is calculated by using the first packet as reference. Therefore, the calculated value for these packets corresponds to the time transit variation in relation to this first packet.
- the 'PC' symbol indicates that the PC clock has been used to timestamp the packet.
- the 'GPS' symbol is used when the GPS time was available to timestamp the packet. The GPS time can be provided by the z100, z200 or z300 Time Device.

Status: 2 states: **LOST**(*) or **Sent** (meaning that the packet has been sent and received).

Note:

You can navigate from one **LOST** packet to another one in the (A) or (B) file by double-clicking the left button of your mouse.

Transit in ms (accuracy): time expressed in milliseconds for the packet transit delay and precision of the measure in brackets. Three values can be displayed for the accuracy:

- (?) The question-mask means that the software cannot define the accuracy of the measurement because time stamping of packets in the source and the target files has not been done with an absolute time reference (use of one of the Time Device i.e. z100, z200 or z300) and a precise clock. This case is encountered in particular when the PC clock has been used to timestamp the sent or received packets.

- (**±5**) More or less five means that the accuracy is less than or equal to **5 milliseconds**. This accuracy is obtained via the use of the z100/z200 GPS Time Device delivering an absolute time reference.
- (**±1**) More or less one means that the accuracy is less than or equal to **1 millisecond**. This accuracy is obtained via the use of:
 - o the z100/z200 GPS Time Device delivering an absolute time reference and via the zClock product delivering a very precise clock.
 - o the z300 NTP Time Server delivering an absolute time reference.

Ports: xxxx-yyyy with xxxx = source port number and yyyy= destination port number

IP size (protocol): **IP size** is the size of the IP packet (including the IP header) and **(protocol)** is the protocol used (TCP or UDP).

Description of the column headers for the synthesis

Port → Port (Protocol): indicates the Source Port number and the Destination Port number of the connection.

Packets: number of packets found for this connection.

Lost: number of LOST(*) packets for this connection.

%Lost: percentage of LOST(*) packets.

Transit Delay: average of the transit delay calculated for all packets of the connection.

Jitter: average of the jitter values calculated for all packets of the connection (please refer to “[Calculation of statistics displayed in the synthesis of the “Packets Statistics” tab](#)” to get more details on jitter calculation).

TCP Retransmission: number of TCP packets retransmitted

LOST(*): see the “Process Files...” button description above for the definition of a lost packet.

All these results can be saved in a file by using the “Save...” button as shown in the following example in a text format.

This file is saved as a .txt file. Then it has been formatted using Excel (import is made with the tab as separator). Only a few lines have been selected to illustrate.

Reference time	SYN represents the synchronization point. PC indicates that the PC clock has been used to timestamp this packet.
Status	Indicates that this packet has been ‘Sent’ or ‘LOST’.
Transit in ms (accuracy)	Packet transit delay expressed in milliseconds. (?) means that the accuracy of the measure cannot be defined.

Note:

If the sniffed traffic files contain GPS location, the location is exported into the statistics file. Two columns are created. The first one is the GPS location of the computer when it sends the packet and the second one is the GPS location when the other computer receives the packet.

Note:

The column "Transit Delay" available for the list of packets and for the synthesis means:

- a transit delay if the PCs have been synchronized using one of the Time Device i.e. z100, z200 or z300*
- or a transit delay variation in the other cases. In this case, the first delay is not available: it is the reference time to calculate the delta time between both PCs. IP Traffic adds/subtracts the delta time to the other delays calculated. The result value is a transit delay variation in millisecond. However, it isn't a jitter in the sense that the delay variation refers to the first packet of the list where the jitter refers to the previous packet.*

Computer A is: 192.168.0.30 - Computer B is: 192.168.0.130										
Synthesis for Computer A										
Connection(Protocol)	Packets	Lost	% Lost	Delay	Jitter	TCP Retransmission				
Total Computer A	7508	5	0%	122 ms	1 ms	0				
2010 -> 1053 (TCP)	2508	0	0%	0 ms	0 ms	0				
1064 -> 2011 (UDP)	5000	5	0%	184 ms	1 ms	N/A				
Computer A ==> Computer B										
Reference time	Location of Computer A	Location of Computer B	Time (UTC)	Status	Transit in ms (accuracy)	Source Port	Destination Port	IP size	(protocol)	Identifier
GPS	Lat +48° 44' 38.03" Lon - 3° 28' 21.11" Alt 121 Speed 0.000 m/s	Lat +48° 44' 37.94" Lon - 3° 28' 20.71" Alt 122 Speed 0.000 m/s	21:55:03.559	Sent	180 (± 5)	1064	2011	1488	(UDP)	x9567
GPS	Lat +48° 44' 38.03" Lon - 3° 28' 21.11" Alt 121 Speed 0.000 m/s	Lat +48° 44' 37.94" Lon - 3° 28' 20.71" Alt 122 Speed 0.000 m/s	21:55:03.579	Sent	180 (± 5)	1064	2011	1488	(UDP)	x9568
GPS	Lat +48° 44' 38.03" Lon - 3° 28' 21.11" Alt 121 Speed 0.000 m/s	Lat +48° 44' 37.94" Lon - 3° 28' 20.71" Alt 122 Speed 0.000 m/s	21:55:03.598	Sent	171 (± 5)	1064	2011	1488	(UDP)	x9569
...
GPS	Lat +48° 44' 37.99" Lon - 3° 28' 20.99" Alt 122 Speed 0.000 m/s	Lat +48° 44' 37.96" Lon - 3° 28' 20.76" Alt 122 Speed 0.000 m/s	21:56:36.804	Sent	185 (± 5)	1064	2011	1488	(UDP)	xAD1F
GPS	Lat +48° 44' 37.99" Lon - 3° 28' 20.99" Alt 122 Speed 0.000 m/s	Lat +48° 44' 37.96" Lon - 3° 28' 20.76" Alt 122 Speed 0.000 m/s	21:56:36.826	Sent	183 (± 5)	1064	2011	1488	(UDP)	xAD20
GPS	Lat +48° 44' 37.99" Lon - 3° 28' 20.99" Alt 122 Speed 0.000 m/s	Lat +48° 44' 37.96" Lon - 3° 28' 20.76" Alt 122 Speed 0.000 m/s	21:56:36.837	Sent	1 (± 5)	2010	1053	40	(TCP)	xAD21
PC	Lat +48° 44' 37.99" Lon - 3° 28' 20.99" Alt 122 Speed 0.000 m/s		21:56:36.845	LOST	...	1064	2011	1488	(UDP)	xAD22
GPS	Lat +48° 44' 37.99" Lon - 3° 28' 20.99" Alt 122 Speed 0.000 m/s	Lat +48° 44' 37.96" Lon - 3° 28' 20.76" Alt 122 Speed 0.000 m/s	21:56:36.867	Sent	182 (± 5)	1064	2011	1488	(UDP)	xAD23
...

Synthesis for Computer B										
Connection(Protocol)	Packets	Lost	% Lost	Delay	Jitter	TCP Retransmission				
Total Computer B	5007	4	0%	1 ms	0 ms	4				
1053 -> 2010 (TCP)	5007	4	0%	1 ms	0 ms	4				
1053 -> 2010 (TCP)	5007	4	0%	1 ms	0 ms	4				
Computer B ==> Computer A										
Reference time	Location of Computer B	Location of Computer A	Time (UTC)	Status	Transit in ms (accuracy)	Source Port	Destination Port	IP size	(protocol)	Identifier
GPS	Lat +48° 44' 37.94" Lon - 3° 28' 20.71" Alt 122 Speed 0.000 m/s	Lat +48° 44' 38.03" Lon - 3° 28' 21.11" Alt 121 Speed 0.000 m/s	21:55:20.725	Sent	1 (± 5)	1053	2010	48	(TCP)	x3D21
GPS	Lat +48° 44' 37.94" Lon - 3° 28' 20.71" Alt 122 Speed 0.000 m/s	Lat +48° 44' 38.03" Lon - 3° 28' 21.11" Alt 121 Speed 0.000 m/s	21:55:20.726	Sent	1 (± 5)	1053	2010	40	(TCP)	x3D22
GPS	Lat +48° 44' 37.94" Lon - 3° 28' 20.71" Alt 122 Speed 0.000 m/s	Lat +48° 44' 38.03" Lon - 3° 28' 21.11" Alt 121 Speed 0.000 m/s	21:55:20.728	Sent	3 (± 5)	1053	2010	1500	(TCP)	x3D23
...
GPS	Lat +48° 44' 37.94" Lon - 3° 28' 20.72" Alt 121 Speed 0.000 m/s	Lat +48° 44' 38.01" Lon - 3° 28' 21.05" Alt 122 Speed 0.000 m/s	21:55:56.395	Sent	2 (± 5)	1053	2010	1500	(TCP)	x43A7
GPS	Lat +48° 44' 37.94" Lon - 3° 28' 20.72" Alt 121 Speed 0.000 m/s	Lat +48° 44' 38.01" Lon - 3° 28' 21.05" Alt 122 Speed 0.000 m/s	21:55:56.415	Sent	1 (± 5)	1053	2010	1500	(TCP)	x43A8
GPS	Lat +48° 44' 37.94" Lon - 3° 28' 20.72" Alt 121 Speed 0.000 m/s	Lat +48° 44' 38.01" Lon - 3° 28' 21.05" Alt 122 Speed 0.000 m/s	21:55:56.435	Sent	2 (± 5)	1053	2010	1500	(TCP)	x43A9
PC	Lat +48° 44' 37.94" Lon - 3° 28' 20.72" Alt 121 Speed 0.000 m/s		21:55:56.455	LOST	...	1053	2010	1500	(TCP)	x43AA
GPS	Lat +48° 44' 37.94" Lon - 3° 28' 20.72" Alt 121 Speed 0.000 m/s	Lat +48° 44' 38.01" Lon - 3° 28' 21.05" Alt 122 Speed 0.000 m/s	21:55:56.475	Sent	2 (± 5)	1053	2010	1500	(TCP)	x43AB
...

Four examples are shown more precisely in the PART 14 “Examples of sniffed traffic files” at the end of this user guide.

PART 11 Calculation Mode for the Statistics

11.1 Introduction

IP Traffic - Test & Measure allows calculating a set of statistics associated to every part of this tool:

- IP Generator
- IP Answering
- Traffic Sniffer
- Traffic Observer

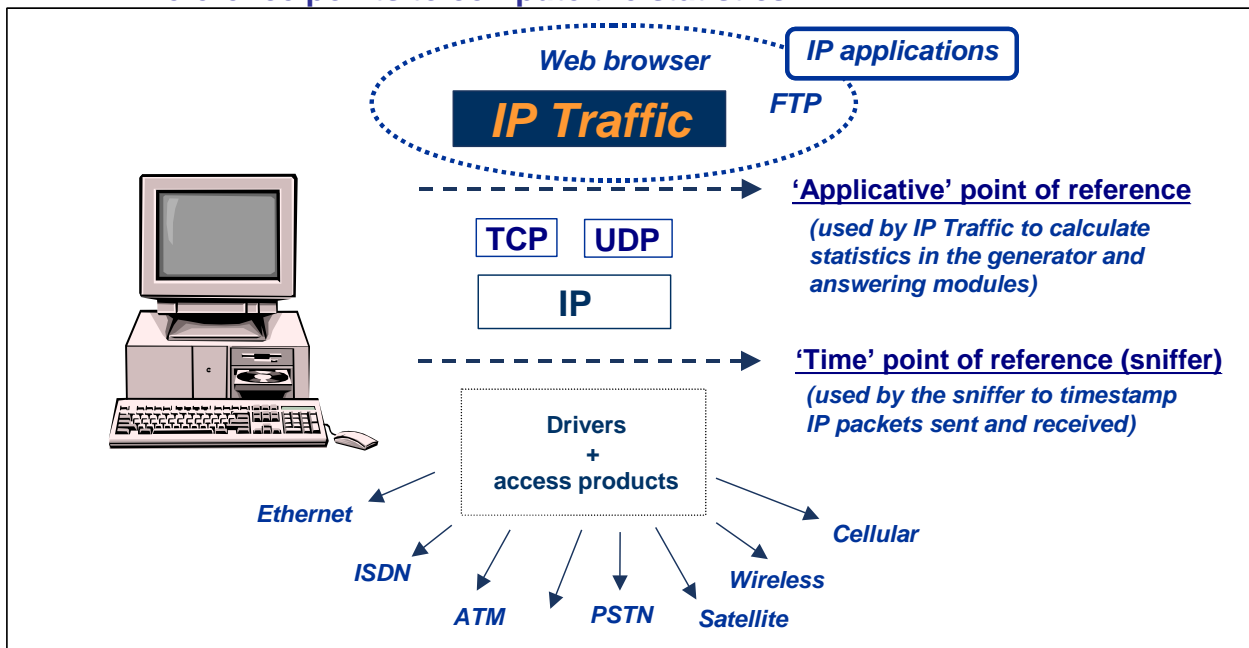
The statistics can be calculated on-line (real time mode) or off-line (differed time).

The off-line mode requires the analysis of two sniffed traffic files (the local traffic file and the remote traffic file sent back on the local machine) and allows calculating parameters such as the PER quality (Packet Erasure Rate) and the packet transit delay.

A sniffed traffic file is captured by the “Traffic Sniffer” module (with filters customizable by the user) which stores on hard disk and timestamps all the IP frames sent and received.

11.2 Statistics computed by IP Traffic - Test & Measure

11.2.1 Reference points to compute the statistics



IP Traffic - Test & Measure uses two points of reference.

- ***'Applicative' point of reference***

In the 'IP Generator' and the 'IP Answering' modules, the statistics (e.g. throughput, RTT,...) are calculated at the application level (above the TCP/IP stack). These statistics refer to data sent or received by **IP Traffic - Test & Measure**, and are independent of the protocol used (TCP or UDP).

Illustration: the 'Tx Throughput' parameter displayed in the « IP Generator – Traffic + Statistics » tab for each active IP connection, is computed by using the following formula: data volume sent on the IP connection during the last seconds (defined by the 'Throughput sampling period' – this parameter is defined in the following paragraph and represents the sampling period of the throughput. The transmitted volume of data corresponds to the sum of the packet size sent at the WinSock2 interface (i.e. the 'Applicative' point of reference).

- ***'Time' point of reference***

The Traffic Sniffer uses this point of reference in order to timestamp IP packets sent and received. Timestamp of packets is made at the nearest of the physical link (under the TCP/IP stack). Therefore, **IP Traffic - Test & Measure** can identify lost and retransmitted IP packets. The values and statistics of the 'Traffic Observer' tab use this point of reference.

Illustration: the 'IP Throughput snapshot' parameter presented in this tab and valued for each active IP connection, is calculated according to the following formula: volume of data sent on the connection during the last second. The volume of data sent corresponds to the sum of IP datagram with regard to the driver access except the IP header. At this level, one sees really the totality of the transmitted data whatever the protocol used (for example, TCP packets retransmission participate in the volume of data transmitted).

11.2.2 Statistics description

This paragraph lists all statistics calculated by **IP Traffic - Test & Measure** for the different parts. On-line statistics are blue colored and statistics only available off-line are red colored.

◆ *“IP Generator – Traffic + Statistics” tab*

- Tx Throughput
- Rx Throughput
- Tx Packets Throughput
- Rx Packets Throughput
- Tx Packets
- Rx Packets
- Tx Volume
- Rx Volume
- Jitter
- Volume to send
- Remaining volume
- Seq. numb errors (sequence numbering errors)
- Mean RTT (Round Trip Time)
- Min RTT
- Max RTT
- RTT summary (Minimum, Maximum and Mean RTT based on all RTT values calculated)

◆ *“IP Answering – Parameters + Statistics” tab*

- Tx Throughput
- Rx Throughput
- Tx Packets Throughput
- Rx Packets Throughput
- Tx Packets
- Rx Packets
- Tx Volume
- Rx Volume
- Jitter
- Volume to send
- Remaining volume
- Seq. numb errors (sequence numbering errors)
- Data not echoed

♦ The 'Traffic Observer' tab

With the **on-line** mode, the 'Statistics display' object displays the following parameters:

- ⇒ Table of values (if 'Statistics display' = values):
 - IP throughput snapshot
 - IP throughput average
 - UDP or TCP throughput
 - Inter packet delay
- ⇒ Graph: **IP Throughput** with the statistical laws **average**, **standard deviation** and **confidence distance**
- ⇒ Graph: **Inter packet delay** with the statistical laws **average**, **standard deviation** and **confidence distance**

With the **off-line** mode, the 'Statistics display' object displays the following parameters:

- ⇒ Table of values (if 'Statistics display' = values):
 - IP throughput snapshot
 - IP throughput average
 - UDP or TCP throughput
 - Inter packet delay
 - Packet Erasure Rate (PER)
 - Packet Transit Delay
- ⇒ Graph: **IP Throughput** with the statistical laws **average**, **standard deviation** and **confidence distance**
- ⇒ Graph: **Inter packet delay** with the statistical laws **average**, **standard deviation** and **confidence distance**
- ⇒ Graph: **PER quality** with the statistical laws **average**, **standard deviation** and **confidence distance**
- ⇒ Graph: **Packet transit delay** with the statistical laws **average**, **standard deviation** and **confidence distance**
 - ⇒ Tables of packets sent and received (if 'Statistics display' = **Packet statistics** and sniffed traffic files have been previously processed)

♦ Main Window: IP Generator and IP Answering throughputs (based on UDP and TCP data only)

This calculation is based using a sampling period (this parameter - Throughput sampling period, is defined by using the "Configuration / General Parameters" item menu. If the sampling period is for example of 5 seconds, **IP Traffic - Test & Measure** realizes the sum of received or sent⁽²⁾ data Volume⁽¹⁾ for the last 5 seconds and divides the result by 5 to obtain the throughput. Note that this throughput is an application level throughput (i.e. this throughput corresponds to the TCP and/or UDP payload throughput). This calculation is realized for the both parts (IP Generator and IP Answering) and displayed at the bottom of the **IP Traffic - Test & Measure** window.

⁽¹⁾ The Volume is the number of bytes sent to or received from the Winsock API by **IP Traffic - Test & Measure**. The Winsock API doesn't include the MAC neither the IP nor the protocols (TCP, UDP, etc.) headers. This means for example, when using an Ethernet frame size of 70 bytes long containing a UDP packet, the relevant **IP Traffic - Test & Measure** packet volume is: 70 (Ethernet frame size) – 14 (MAC) – 20 (IP) – 8 (UDP) = **28 bytes** taken into account in the volume by **IP Traffic - Test & Measure**.

⁽²⁾ The sent volume increases as soon as the Winsock API accepts the request to send from **IP Traffic - Test & Measure**.

11.3 General parameters used to calculate the statistics

The 'General parameters' item of the 'Configuration' menu contains parameters used for display and to calculate the statistics.

"IP Traffic - Test & Measure" - General Parameters

Refresh Time and Throughput Sampling Period
 The refresh time parameter defines the frequency of statistics updates on "IP Traffic - Test & Measure". This parameter also applies to statistics exportation
 The throughput sampling period defines the number of seconds of traffic needed to calculate the throughput.

Refresh Time (1 to 60 seconds)

Throughput Sampling Period (1 to 60 seconds)

TCP and UDP received Data Timeout
 These parameters are for the IP Generator Part only. When there is no more data to be sent, "IP Traffic - Test & Measure" continues to receive data until the timeout expires. Then the connection is released. When the timeout is 0, the connection is stopped as soon as there is no more data to be sent.

Timeout for TCP Packets echoed (1 to 9,999 ms)

Timeout for UDP Packets echoed (1 to 9,999 ms)

"IP Traffic - Test & Measure" Buffer Size (SO_RCVBUF and SO_SNDBUF)
 The buffers used by "IP Traffic - Test & Measure" to dialog with the Winsock API influence the throughput performance for high speed network. The best performance can be reached with a high buffer size. Change in one of these sizes concerns the new connections only.

Receive Buffer Size (1,024 to 65,535 bytes)

Transmit Buffer Size (1,024 to 65,535 bytes)

OK Cancel

Refresh time: this parameter defines the frequency to update the man machine interface. The different statistical values are updated all the xx seconds (for all tabs) where xx is the value defined by the user.

This parameter is also used to update the display of the following items:

- the Time Device state (if selected)
- the 'zClock' state (if selected)
- the Uncertainty value (if zClock or a Time Device selected)
- the 'Activity' counter
- 'File size' and "Time before disk limit" for the 'Traffic Sniffer' activity
- the Statistics Export Processes (on IP Generator and IP Answering Parts)

Throughput sampling period: this parameter specifies the last traffic seconds to use in order to calculate the throughput. More this value is high and more the average is smoothed. This parameter is also used to calculate the **IP throughput average** parameter of the 'Traffic Observer'.

Notes

Every second, the following processes are realized:

+ Calculation of the CPU load ('Activity' counter),

+ Calculation of the statistics for activity ('IP Generator Activity' and 'IP Answering Activity' displayed at the bottom of the **IP Traffic - Test & Measure** main window).

Every 5 seconds, update of 'Activity Sniffer' is made (see 'Traffic Sniffer' - Traffic overview during capture).

These values of 1 and 5 seconds are not customizable and are fixed in the current version of the software.

11.4 Calculation method used by IP Traffic - Test & Measure to compute statistics.

This document describes what calculation method is used by **IP Traffic - Test & Measure** to compute statistics.

11.4.1 The two calculation methods

◆ *Based on a sampling period*

The statistics defined in this category are calculated by using a sampling period. The size of these sampling periods are defined either by the “Throughput Sampling Period” or by the “Acquisition period of statistics” specified in the “Configuration > General Parameters” window.

◆ *Cumulative*

The statistics defined in this category are cumulative statistics. They are reset when a new connection or a new analysis is launched.

11.4.2 IP Traffic - IP Generator statistics

Calculation method	Sampling	Cumulative
Tx Throughput	X	
Rx Throughput	X	
Tx Packets Throughput	X	
Rx Packets Throughput	X	
Jitter	X	
Tx Packets		X
Rx Packets		X
Tx Volume		X
Rx Volume		X
Mean RTT (cumulative average)	X	
Min RTT	X	
Max RTT	X	
Sequence Error Number	X	
Mean RTT (summary)	X	
RTT Min (summary)	X	
RTT Max (summary)	X	
Tx+Rx Throughput (Activity)	X	

Table 1 - IP Traffic - Test & Measure - IP Generator calculation method

11.4.3 IP Traffic - IP Answering statistics

Calculation method	Sampling	Cumulative
Tx Throughput	X	
Rx Throughput	X	
Tx Packets Throughput	X	
Rx Packets Throughput	X	
Jitter	X	
Tx Packets		X
Rx Packets		X
Tx Volume		X
Rx Volume		X
Date Not Echoed		X
Sequence Error Number	X	
Tx+Rx Throughput (Activity)	X	

Table 2 - IP Traffic - Test & Measure - IP Answering calculation method

11.4.4 IP Traffic – Traffic Observer statistics

Calculation method	Sampling	Cumulative
IP Throughput Snapshot*	X	
IP Throughput Average**	X	
UDP or TCP Throughput*	X	
Inter Packet Delay*	X	
Packet Transit Delay*	X	
Packet Erasure Rate*	X	

*: These values are instantaneous values (the sampling is based on the “Acquisition period of statistics” specified in the “Configuration > General Parameters” window.

** : This value are an average based on the sampling period defined by the “Throughput Sampling Period” specified in the “Configuration > General Parameters” window.

Table 3 - IP Traffic - Test & Measure – Traffic Observer calculation method

11.4.5 IP Traffic – Packets Statistics Synthesis

Calculation method	Sampling	Cumulative
Packets		X
Lost		X
% Lost		X
Delay		X
Jitter		X
TCP Retransmission		X

Table 4 - IP Traffic - Test & Measure – Packets Statistics calculation method

11.5 Detailed description for calculation of the statistics

11.5.1 The 'IP Generator – Traffic + Statistics' tab

The statistics in this tab are calculated at the 'Applicative' point of reference.

Tx Throughput = volume of data sent on the connection during the last seconds considered for calculation (see above description of the 'Throughput sampling period' parameter).

Rx Throughput = volume of data received on the connection during the last seconds considered for calculation (see above description of the 'Throughput sampling period' parameter).

Tx Packets Throughput = number of data packets sent on the connection during the last seconds considered for calculation (see above description of the 'Throughput sampling period' parameter). This statistic is only available with the UDP connections.

Rx Packets Throughput = number of data packets received on the connection during the last seconds considered for calculation (see above description of the 'Throughput sampling period' parameter). This statistic is only available with the UDP connections.

Tx Packets = It is the number of data packets sent on the connection. This statistic is only available with the UDP connections, because the TCP stack for the TCP connections cuts data to send in one or more TCP packets.

Rx Packets = It is the number of data packets received on the connection. This statistic is only available with the UDP connections, because the TCP stack for the TCP connections cuts data to send in one or more TCP packets.

Tx Volume = it's the number of data bytes sent on the connection.

Rx Volume = it's the number of data bytes received on the connection.

Jitter = The jitter is the transit delay variation. This value is available only if the packets include the Timecode information (see "Parameters" in the IP Generator tab). For each received packet, the process to find the Timecode information is applied. If the RTT identifier is found, IP Traffic proceeds as follows: First, it compares the "time when sent" of the previously received packet with the "time when sent" of the last received packet. This information is added in the timecode structure just before sending the packet. Then, IP Traffic compares the arrival time of the previously received packet with the arrival time of the last received packet. After that, IP Traffic compares these two results. If the transit delay is a constant, the results should be the same. In the other case, it means that a jitter is found. IP Traffic adds the absolute value of this comparison and calculates the mean jitter (using a sampling period). Note that the jitter displayed on the IP Answering part is a one-way jitter and the jitter displayed on the IP Generator part is a two-ways jitter. Note also, that this jitter is an application level statistic. An IP level jitter is available with the offline mode analysis.

Volume to send = Size of data (in bytes) to send on the connection. This information is displayed only if the 'IP Generator' can give this value, as by example for a file or for a mathematical law.

Remaining volume = size of data (in bytes) remaining to send on the connection. This information is available only if the 'Volume to send' parameter has been calculated.

Seq. numb errors (sequence numbering errors) = It's the number of packets whose the sequence number is not correct. This value is available only if the packets include the Timecode information. For each received packet, the process to find the Timecode information is applied. If the RTT identifier is found, IP Traffic tests if the sequence number of the received packet follows the sequence number of the previous received packet. If an error is detected, the 'Sequence numbering errors' parameter is incremented. Note that the sequence error number is incremented of one unit even if the sequence number gap is one unit, ten units or more. Moreover, no distinction is made about the origin of this error. IP Traffic doesn't know if the gap is due to a packet lost or a desequenced packet. To calculate this parameter on the IP Generator part, the remote 'IP Answering' module must be configured in 'echoer' mode (each packet received is transmitted to the originator). This statistic is not available with TCP. This statistics is also available when the UDP connection on the remote IP Answering is using the Generator mode with Timecode enabled.

Mean RTT (Round Trip Time) = average of the differences between the sending times and the receiving times (the multimedia timers of the OS are used, giving an accuracy of 1 ms – Microsoft information). This value is available only if the packets include the Timecode information. For each received packet, the process to find the Timecode information is applied. If the RTT identifier is found, IP Traffic compares the "time when sent" of the last received packet with the arrival time of this packet. The difference gives a RTT value.

To calculate this parameter, the remote must be configured in echoer mode for the connection.

RTT information

The information necessary to calculate the RTT parameter is included in each data packet, at the beginning of the data.

Format of the RTT header (in little endian notation) is structured as follows:

- 4 bytes magic number (always 0x54 0x87 0x54 0x41)
- 4 bytes sequence number
- 4 bytes time when sent
- 2 bytes length (without the RTT header)

Min RTT = minimum value of the differences between the sending times and the receiving times (the multimedia timers of the OS are used, giving an accuracy of 1 ms – Microsoft information) for one connection. This is the minimum RTT value since the connection beginning.

Max RTT = maximum value of the differences between the sending times and the receiving times (the multimedia timers of the OS are used, giving an accuracy of 1 ms – Microsoft information) for one connection. This is the maximum RTT value since the connection beginning.

RTT Summary = minimum, maximum and average of the differences between the sending times and the receiving times (the multimedia timers of the OS are used, giving an accuracy of 1 ms – Microsoft information) but for all connections. The average is calculated on all RTT values of all connections that are using the Timecode option. In others words, the average is not an average of the Mean RTT of each connection.

Remark

The "IP Generator" builds data packets according to parameters defined by the user (contents, size and inter packet delay). The data packets are then provided to the Winsock 2 interface to be sent by the TCP/IP stack with the selected protocol (TCP or UDP). The volume of data sent or received does not include the encapsulated data added by the TCP/IP stack.

11.5.2 The 'IP Answering – Parameters + Statistics' tab

The statistics in this tab are calculated at the 'Applicative' point of reference.

Tx Throughput = see previous description above.

Rx Throughput = see previous description above.

Tx Packets Throughput = see previous description above.

Rx Packets Throughput = see previous description above.

Tx Packets = see previous description above.

Rx Packets = see previous description above.

Tx Volume = see previous description above.

Rx Volume = see previous description above.

Jitter = Jitter is the mean variation of delays on packets received. This value is only available when the Timecode option is selected (on the remote 'IP Generator'). This value corresponds to the mean one-way variation only.

Volume to send = see previous description above.

Remaining volume = see previous description above.

Seq. numb errors (sequence numbering errors) = see previous description above.

Data not echoed = this information is available only if the working mode of the connection is defined as 'Echoer' or 'Echoer file' and indicates that the "IP Answering" module has not been able to re-send data due to the TCP/IP stack performances.

For an UDP connection, it's the number of packets not re-sent.

For a TCP connection, it's the number of bytes not re-sent.

11.5.3 The 'Traffic Observer' tab

The statistics in this tab are calculated at the driver level (under the TCP/IP stack).

The parameters described in this paragraph are calculated for each active connection. As a connection can send and receive simultaneously data, the two values Tx (Transmit) and Rx (Receive) are calculated for each parameter.

Calculation is made simultaneously for the 32 connections (16 for the 'IP Generator' module and 16 for the 'IP Answering' module). Definition of terms used in this paragraph:

- the term 'IP data' does not include the IP header.
- the term 'protocol data' does not include the IP header and the specific header of the protocol. In this way for a TCP connection, the ACKnowledge packet does not contain data.
- Most values displayed in the 'Traffic Observer' tab are 'snapshot' values.

◆ Calculation of instantaneous values

The coherence between the numerical values "Statistical values" and their graphical display is respected by using the following rules:

- The scale unit defined by the 'Time scale' parameter for the graph allows calculating the number of milliseconds of traffic for 1 pixel.
- For each data acquisition (see description of the 'Acquisition period for statistics' parameter in general parameters used for statistics), **IP Traffic - Test & Measure** updates the statistics with the following manner:
 - ⇒ **Example 1:** a pixel is valued to 30 ms and 'Acquisition period for statistics' is valued to 100 ms.
 - First data acquisition: data associated to the pixels number 1, 2 and 3 correspond to 90% of the acquisition. The rest of 10% is used with the next acquisition.
 - Second data acquisition: the previous rest (10%) added to the 20% of the new acquisition are associated to the pixel number 4, then 30 % for pixel #5 and 30% for pixel #6. The rest of 20% will be used with the next acquisition.
 - ⇒ **Example 2:** a pixel is valued to 200 ms and 'Acquisition period for statistics' is valued to 80 ms.
 - First data acquisition: there is not enough data to associate to one pixel. Data is put aside (the rest for the next acquisition is 80 ms).
 - Second data acquisition: the rest and the new data are not sufficient to correspond to 1 pixel. The new rest is then 160 ms.
 - Third data acquisition: the rest and new data can be associated to pixel #1 (this pixel represents the two first acquisitions and 50% of the third). Then the rest is 50% that will be used with the next acquisition.

The 'snapshot' value is the last calculated value allocated to a pixel.

◆ Triggers update

Each time a value is allocated to a pixel, the comparison is made with the trigger values. Then the min or max trigger value is updated if the value exceeds the threshold.

◆ Calculation of parameters displayed in the "Statistical values" table

IP throughput snapshot = instantaneous throughput calculated by using the IP data volume received on the connection.

IP throughput average = average of the IP throughput by using the IP data volume received on the connection during the last seconds used for calculation (see the 'Throughput sampling period' parameter)

UDP or TCP throughput = instantaneous throughput calculated by using the protocol data volume received on the connection.

Inter packet delay = instantaneous average distance from time between two successive received IP packets, calculated by dividing the sum of the distances by the number of received packets.

Packet Erasure Rate (PER) = instantaneous rate of loss packets, expressed in percentage of the number of packets not received with regard to the number of packets sent.

Packet transit delay = instantaneous delay for the transfer of packets. It's the average of the transfer delays for all packets exchanged between two **IP Traffic - Test & Measure** machines. The transfer delay (named 'transit delay') for a packet is the difference of time between the time when the packet has been sent and the time when the packet has been received.

Both times – sent and received time - are stored in the record of the capture file made by the 'Traffic Sniffer'.

♦ **Calculation of statistics displayed in the synthesis of the "Packets Statistics" tab**

Packets = number of packets found for this connection.

Lost = number of packets which are not be found in the both files (File A and File B)

% Lost = percentage of packets considered as lost on the total number of packets found for the selected connection(s).

Transit Delay = average of the transit delay calculated for each packet of the selected connection(s).

Jitter = Average of the jitter calculated for each packet (found in both files) of the selected connection(s). For one packet, the jitter is calculated as follows: for each packet, the process compares the timestamp of the previous packet with the timestamp of the current packet in File A.

Then the process finds the timestamps of the packets used in file A in the file B and does the same comparison. After that, the process compares these two results. If the transit delay is a constant, the results should be the same. In the other case, it means that a jitter exists. The absolute value is added to be able to calculate the mean jitter of the selecting connection.

♦ **Statistical laws for the graphs**

IP Traffic - Test & Measure allows displaying four graphs for the following parameters:

IP Throughput = corresponds to the '**IP throughput snapshot**' parameter (see above)

Inter packet delay = corresponds to the '**Inter packet delay**' parameter (see above)

PER quality = corresponds to the '**Packet Erasure Rate (PER)**' parameter (see above)

Packet transit delay = corresponds to the '**Packet transit delay**' parameter (see above)

For these parameters, three statistical laws are calculated and can be displayed:

- **Average**
- **Standard deviation**
- **Confidence distance**

Formulas used to calculate these variables:

- **Average** m : $m = \frac{\sum_{i=1}^n x_i}{n}$
- **Standard deviation** σ : $\sigma = \sqrt{v}$ (with variance v defined as: $v = \frac{\sum_{i=1}^n x_i^2}{n} - m^2$)
- **Confidence distance** : 95.45 % of the values are between $(m - 2\sigma)$ and $(m + 2\sigma)$.

Notes:

- n is the minimum between the number of calculated pixels and the number of displayed pixels.
- the confidence distance is calculated only at the time of display.

PART 12 Command Line Parameters

The **IP Traffic - Test & Measure** software can be started by using a command line with parameters.

12.1 General rule

Parameters should be separated from the application name by a space. The application name of **IP Traffic - Test & Measure** is "IPTraff.exe". Under Windows, the application name is not case sensitive.

12.2 Start IP Traffic - Test & Measure and open a context file

The context file contains all parameters of **IP Traffic - Test & Measure**. These parameters can be saved in this file and reloaded later.

The command line parameter to start the **IP Traffic - Test & Measure** and load a context file: **-START**

Syntax: **-START:filename**

Where filename may be:

C:\temp\Scenario4_ContextFile_PC#A.Ctx or

"C:\Program Files\IP Traffic\Scenario4_ContextFile_PC#A.Ctx". The " symbol is necessary to use spaces in filenames or directories.

There is NO space between the parameter -START: and the filename.

Example:

IPTraff -START: "C:\Program Files\IP Traffic\Scenario4_ContextFile_PC#A.Ctx"

12.3 Stop IP Traffic - Test & Measure

There is only one command line parameter to stop **IP Traffic - Test & Measure**.

Syntax: **-STOP**

Example:

IPTraff -STOP



Under Windows Vista, you must have the administrator rights to be able to execute the "IPTraff.exe -STOP" command.

PART 13 Appendix

13.1 Description of the Mathematical Laws used by IP Traffic - Test & Measure

IP Traffic - Test & Measure is based on the use of random number generation laws to determine the starting time connection and data volume to send, and for the Inter Packet Delay in the 'IP Generator' module. Four mathematical laws are offered. **Uniform**, **Exponential** and **Gauss** laws are used for starting time connection and data volume. **Pareto**'s law is only used for data volume. The mathematical laws are used:

⇒ For the unitary mode when the mathematical law data source is selected. In this case, only data volume laws are available.

⇒ For the automatic mode: starting time connection generation and data volumes laws are required parameters.

Hereafter is a detailed description of each mathematical law.

13.1.1 Uniform Law

❖ Presentation:

The Uniform law has two parameters: α and β . It generates a random number included uniformly between α and β . If α is equal to β , the generated number is always $\alpha = \beta$.

With the Uniform law, the units used are millisecond for the starting time connection generation laws and byte for the data volume to send laws.

❖ Mathematical function:

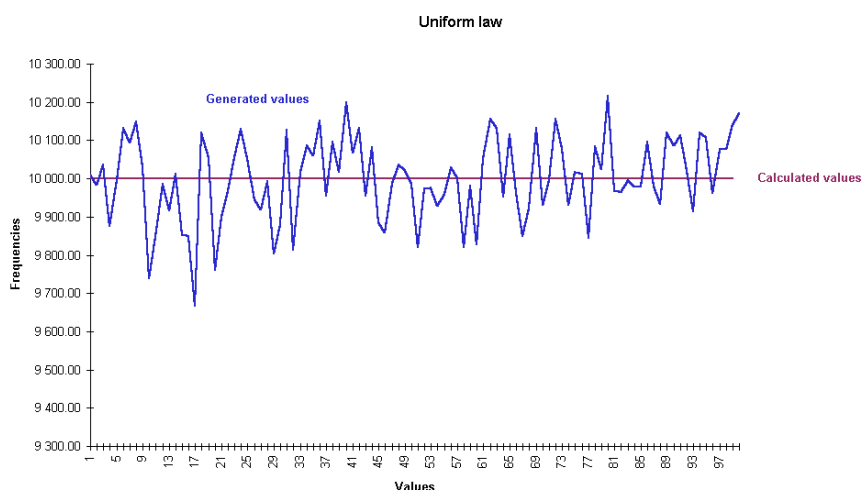
Uniform law on (α, β) range

$$f(x) = 1/(\beta - \alpha) \quad \text{if } \alpha < x < \beta$$

$$f(x) = 0 \quad \text{else}$$

❖ *Uniform law - example of generated values for 1000000 draws for this law with: $\alpha = 0$ and $\beta = 100$.*

The factor 1000000 is because the figure intends to show the actual behavior of the random generator. To do that, we draw 1000000 times a random value and count the actual frequencies. The theoretical (= calculated values) curve and actual (= generated values) curve are displayed below.



13.1.2 Exponential Law

❖ Presentation

The Exponential law has only one parameter: λ . The more λ is small, the more the power of 10 of the generated number is high.

The unit is the millisecond for the starting time connections generation laws and byte for the data volume laws.

❖ Mathematical function:

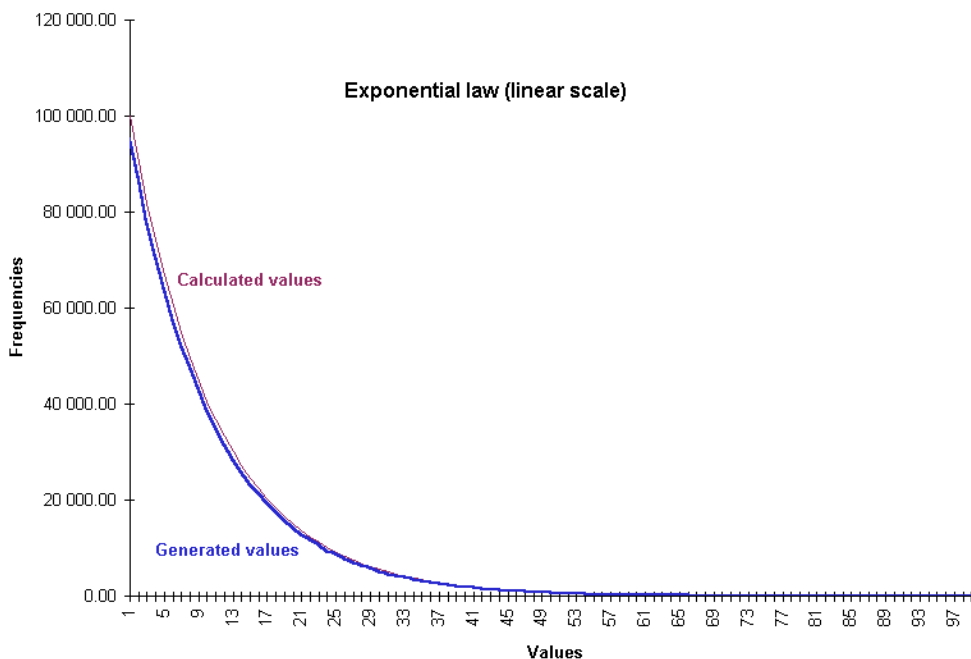
Exponential law ($\lambda > 0$)

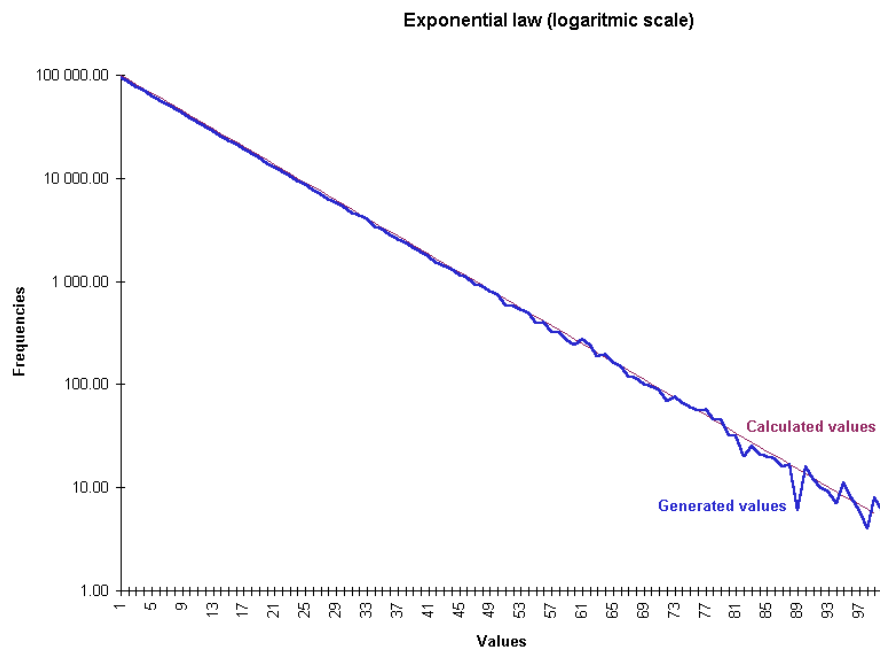
$$f(x) = \lambda e^{-\lambda x} \quad \text{if } x \geq 0$$

$$f(x) = 0 \quad \text{if } x < 0$$

❖ Exponential law - example of generated values for 1000000 draws with: $\lambda = 0,1$.

The factor 1000000 is because the figure intends to show the actual behavior of the random generator (not to show the theory of the exponential law). To do that, we draw 1000000 times a random value and count the actual frequencies. The theoretical (=calculated values) and actual (=generated values) curves match perfectly for bigger values.





❖ *Exponential law- Table of generated values:*

Values	Starting time laws results	Data volume laws results
$\lambda = 1$	10 ms	10 bytes
$\lambda = 0,1$	100 ms	100 bytes
$\lambda = 0,01$	1s	1 Kbytes
$\lambda = 0,001$	10s	10 Kbytes
$\lambda = 0,0001$	1mn43	100 Kbytes
$\lambda = 0,00001$	17mn19	1 Mbytes
$\lambda = 0,000001$	2h53	10 Mbytes
Precision limit for λ		

13.1.3 Law of Pareto

❖ Presentation:

This mathematical law is available only for data volume generation in the unitary and automatic mode.

The law of Pareto is based on two parameters: a and β . a unit is the final unit of the volume. β does not have unit because it represents a coefficient of variation of result around a value.

The following values have been noticed:

$\beta = 1000$	Result very near to a
$\beta = 100$	Result very near to a
$\beta = 15$	Result between the interval $[a, a \times 2]$ (estimation)
$\beta = 1$	Result between the interval $[a, \beta]$, β is very high ($a \times 1000000$)
$\beta = 0,1$	Result too high – Calculation bursting.

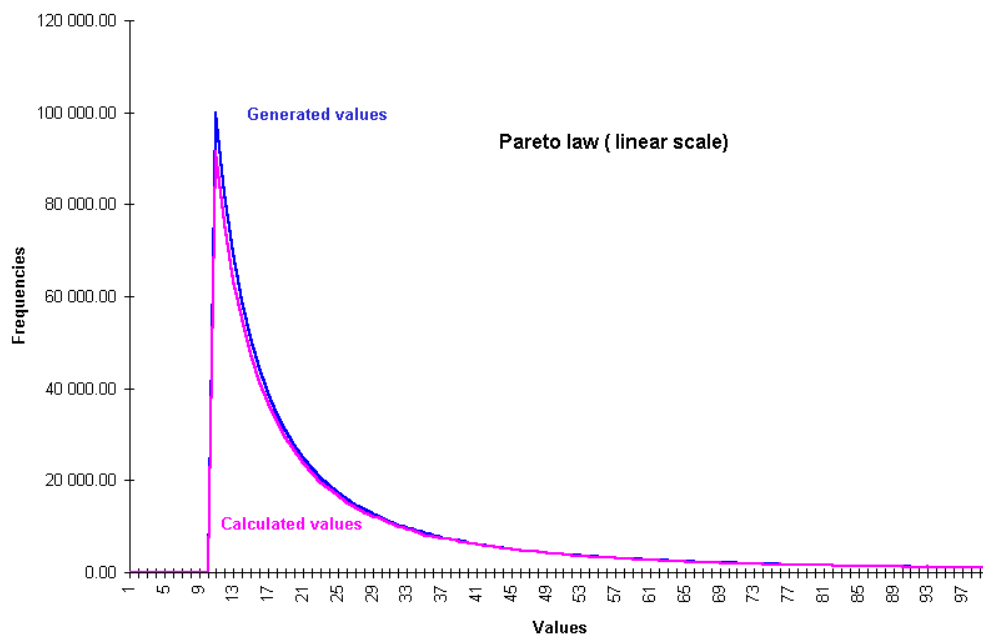
The law of Pareto offers the advantage to generate a result statistically very near to a , but it can generate in some exceptional cases a number very far from a .

❖ Mathematical function:

Pareto law ($a, \beta \geq 0$)

$$f(x) = \beta a^\beta x^{-\beta-1} \quad \text{if } x \geq a$$

$$f(x) = 0 \quad \text{if } x < a$$



❖ Pareto Law - example of generated values for $1000000\beta a^\beta x^{-\beta-1}$ with: $a = 10$ and $\beta = 1$.

13.1.4 Gauss law

❖ Presentation:

The Gauss law has two parameters: μ (average) and σ (standard deviation).

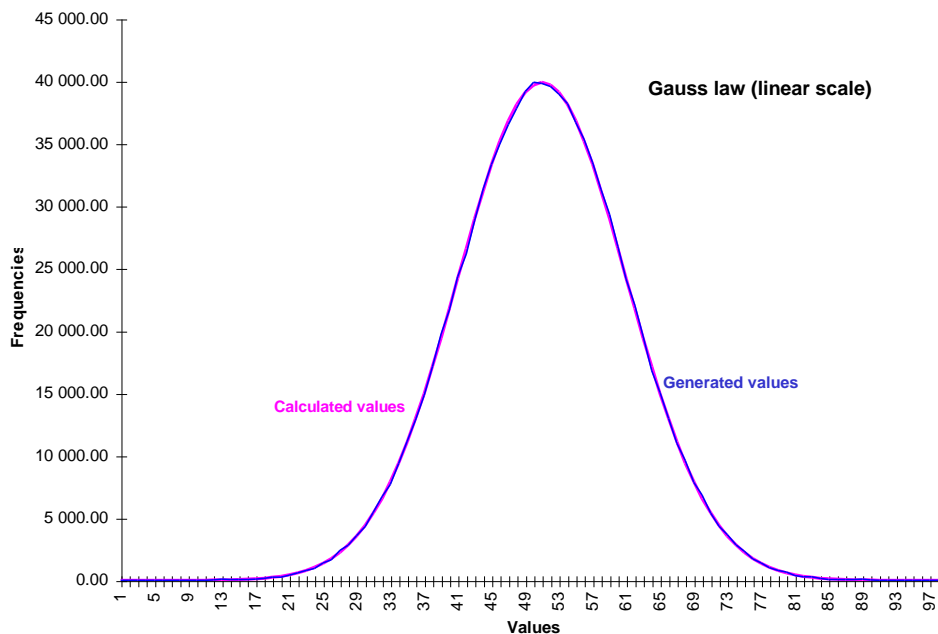
With this law, the unit used is the millisecond for the starting time connection generation laws and byte for the data volume to send laws.

❖ Mathematical function:

Gauss law on $(-\infty, +\infty)$ range

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}} \quad \text{for } x \in \mathbb{R}, \text{ with average } \mu \text{ and variance } \sigma^2$$

❖ Gauss law - example of generated values with: $\mu = 50$ and $\sigma = 10$.



13.2 IP Traffic - Test & Measure Traces

In case of problem when using **IP Traffic - Test & Measure**, the trace functionality allows retrieving in a file or in a debug window, information regarding Winsock exchanges made by **IP Traffic - Test & Measure**.

Traces activation is done by modifying directly in the registry database of Windows, the value of DebugLevel in the key \\HKEY_CURRENT_USER\\SOFTWARE\\ZTI\\IPTraffic\\Settings.

TraceFile parameter defines the name for the file receiving traces (by default DEBUG.LOG).

The user shall reset the content of this file manually to avoid disk space wasting. If the *TraceFile* parameter is not selected (empty chain), traces are sent to the debug standard output -via OutputDebugString- in external tools trace (e.g. 'Softlce' from Compuware, the Microsoft Development environment).

IP Traffic - Test & Measure must be restarted after
"DebugLevel" or "TraceFile" parameter modification.

13.3 Configuration parameters saved in the Registry database

13.3.1 General configuration parameters

The based key to access parameters is [\\HKEY_CURRENT_USER\Software\ZTI\IPTraffic\Settings](#). Updated information about Registry is available in the file "Version.txt" delivered with the **IP Traffic - Test & Measure** software.

The user may change the General parameters to configure **IP Traffic - Test & Measure** to the local environment or to specific needs.



Parameters associated to the help should not be changed without express recommendation from ZTI Communications Support to avoid help unusable.

Key name	Type	Default value (dec)	Description
DEBUGLEVEL	REG_DWORD	0	0x00000000 No traces. 0x00000001 Add errors in the trace. 0x00000002 Important information for the Support. 0x00000010 Add verbose information used by the ZTI Communications Support. 0x00000080 Save debug information into a file specified by the DEBUGFILENAME key. 0x00000100 Add the current time to each trace message. 0x00000400 Add intermediate value computed during the statistics process providing information to the Observer Tab. 0x00001000 Detail the operation of the Sniffer Analyzer when splitting a captured file into data files replay. 0x00004000 Provide information for the GPS. 0x00010000 Detail operations of the Replay mode 0x00020000 Detail operations for the Off-line mode. 0x00080000 Specific flag for statistics generated at the 'IP Generator' and 'IP Answering' levels.
DEBUGFILENAME	REG_SZ	DEBUG.LOG	Filename to save the traces.
DEPTHFORPACKETANALYSIS	REG_DWORD	500	Parameter used in the search algorithm of the 'Traffic Observer' to calculate the packets statistics.
UDPINACTIVITY	REG_DWORD	10	For UDP connections, timer (expressed in seconds) used in the Generator mode to identify a connection has stopped (10 seconds by default).
TCPINACTIVITY	REG_DWORD	10	For TCP connections, timer (expressed in seconds) to detect the 'IP Generator' has stopped the connection (10 seconds by default). "IP Traffic" closes the TCP connection.
SENDTIMEOUT	REG_DWORD	500	Maximal period (expressed in milliseconds) allocated to send/receive data (default is 500 milliseconds).
TCPCONNECTRETRYCOUNTER	REG_DWORD	0x1	Number of retry to establish a TCP connection
TCPNODELAY	REG_DWORD	0x0	0x0: Nagle algorithm enabled Other value: Nagle algorithm disabled
TCPRECEIVERPACKETSIZE	REG_DWORD	8192	Buffer size (expressed in bytes) used by "IP Traffic" to get TCP data from the Winsock2 interface. It is not the MTU. If the size is big then the performances are better because Winsock 2 is called less often. Max value = 65,535
FILETRANSFERINACTIVITY	REG_DWORD	5	When the file downloading is active, this timer (expressed in seconds) is used to detect the sender has stopped the connection (5 seconds by default). "IP Traffic" closes the file transfer connection when the timer

			is reached.
FILETRANSFERPACKETSIZE	REG_DWORD	1460	Maximum size of a packet used during a file transfer. (Expressed in bytes. Default value = 1460. Max value = 65,535).
RPCPORT	REG_DWORD	1001	This is the port number used by the RPC server to dialog with the Automation Tool.
AUTOMATION PATH	REG_SZ	x	Full path name to Aut_IPTraff.exe ("Automation Tool for IP Traffic" binary file.
IPTRAFFICPATH	REG_SZ	x	Full path name to the IP Traffic - Test & Measure binary file.
USELOCALTIME	REG_DWORD	x	Save in the registry the time reference used by the Automation Tool
DRIVERFILTERMODE	REG_DWORD	32	Mode use by the traffic sniffer to capture the data on the link. Here are the two main values: 0x00000020 NDIS_PACKET_TYPE_PROMISCUOUS 0x00000080 NDIS_PACKET_TYPE_ALL_LOCAL

Warning: IP Traffic - Test & Measure must be restarted after each modification of these parameters.

13.3.2 Help configuration parameters



These parameters are for information only. They must not be changed. These information are located in [\HKEY_LOCAL_MACHINE\Software\ZTI\IPTraffic](#)

The following registry values list is given for information ONLY.

Key name	Type	Default value (dec)	Description
ACROREADINFO	REG_SZ	x	Reserved
ACROREADTIMER	REG_DWORD	x	Reserved
HELP-GENERAL	REG_DWORD	x	Reserved
HELP-OBSERVER	REG_DWORD	x	Reserved
HELP-AUTOMATICMODE	REG_DWORD	x	Reserved
HELP-UNITARYMODE	REG_DWORD	x	Reserved
HELP-SNIFFER	REG_DWORD	x	Reserved
HELP-GPS	REG_DWORD	x	Reserved
HELP-REPLAYMODE	REG_DWORD	x	Reserved
HELP-REPLAYMODE-RCV	REG_DWORD	x	Reserved
HELP-FILEMANAGER	REG_DWORD	x	Reserved
HELP-EXPORTSTATS-SENDER	REG_DWORD	x	Reserved
HELP-EXPORTSTATS-RECEIVER	REG_DWORD	x	Reserved
HELP-PARAMCNX-SENDER	REG_DWORD	x	Reserved
HELP-FILEDOWNLOADING	REG_DWORD	x	Reserved
HELP-PARAMCNX-RECEIVER	REG_DWORD	x	Reserved
CURRENTVERSION	REG_SZ	V 2.5.0	Current version installed.
INSTALLATIONPATH	REG_SZ	x	Selected installation path ('[Your Windows Drive]\Program Files\IP Traffic' by default.

13.4 Default Values of a Context

The default values when opening a new context are:

♦ IP Generator parameters

IP address	NO_ADDRESS		
Port Number	2009		
Protocol	TCP		
Testing mode	Unitary mode	Data source	Packet generator (number of packets: infinite, packet contents: fix = 5A)
		Packets size	Fix = 1460 bytes
		Inter Packet Delay	Fix = 0 ms
		RTT option	No

♦ IP Answering parameters

IP address	ANY_ADDRESS
Port number	2009
Protocol	TCP
Receiving working mode	Absorber
Replay mode	Disabled

♦ Configuration

TCP stack parameters

TCP Buffer size		
	S0_RCVBUF	65535
	S0_SNDBUF	65535
TCP Windows size		
	TCPWindowSize	Windows configuration dependant
	SACKS Options	Windows configuration dependant

Display parameters

Refresh time	2 s
Throughput sampling period	5 s

Connection parameters

Timeout for TCP packets echoed	500 ms
Timeout for UDP packets echoed	700 ms

File Operating Modes parameter

File Operating Mode	Overwrite
----------------------------	-----------

AutoComplete parameter

Historical Record	activated
--------------------------	-----------

◆ Time Reference

Time Device selection

Type Device type to use	None
-------------------------	------

z100 / z200 parameter

Port number	No GPS
Save GPS Position	No
Saving interval	30 seconds

z300 parameter

z300 IP Address	None
-----------------	------

zClock parameter

zClock plugged	None
----------------	------

◆ File transfer

Port number	2500
-------------	------

◆ Operating Mode

Mode	Local
------	-------

◆ Remote Control

Remote Port number	2600
Remote IP address	NO_ADDRESS
Remote Context File	None

◆ Traffic Sniffer

Capture parameters

User-filters	None
Type of filter used	All TCP and UDP packets
Adapters selected	All adapters found when launching the software

Capture sniffed traffic in file parameters

Filename	None
Save only headers	No
Automatic refresh mode	No
Enable automatic start and stop	No

◆ Traffic Observer

Mode	Generator
Statistics display	Values

Graphical units

UNIT	Value	Trigger
IP throughput	0-100 Kb/s	10-90 Kb/s
Inter packet delay	0-50 ms	10-90 ms
PER quality	0-100	10-90
Packet transit delay	0-1000 ms	100-900 ms

13.5 External File for the 'IP Generator' module

The IP Generator module can use an external file defined by the user. Information of this file is used to send data packets on an IP connection. This file is independent of the specified protocol (UDP or TCP).

The file is composed of two sections: [HEADER] and [DATA].

Section [HEADER] : Code, Parameters

Section [DATA] : data size, delay (in milliseconds) before sending of next packet

Example of external data file [generation of random characters comprised between 32(decimal value) and 48 (decimal value)]

```
;
;   Sample DataFile for «IP Traffic» generator
;
;   Section [HEADER] defines the content
;       1, char                = fix character
;       2, cmin, cmax          = random character
;       3, c1, c2              = alternate character
;       4, FileName            = Content is based on a file
;
[HEADER]
    2, 32, 48

[DATA]
    100, 20
    200, 10
    300, 30
    400, 40
    500, 5
    600, 50
    700, 60
    800, 70
    10, 80
    20, 10
    30, 20
    40, 30
    50, 50
    60, 60
    70, 100
    80, 200
```

Section [HEADER] : Code, Parameters

Code	Meaning	Parameters	Example
1	Fix character	Char to use	1, 'Z'
2	Random character	Char 1 (min), Char 2 (max)	2, 32,48
3	Alternate character	Char 1, Char 2	3, x32,x48
4	File	Filename	4, C:\Temp\test.bin

Coding of characters:

- character between quotes, e.g. 'Z'
- decimal value, e.g. 32
- hexadecimal value, e.g. X32

13.6 External DLL for the 'IP Generator' module

The 'IP Generator' module loads this external DLL. This DLL must offer three entry points described in the following paragraphs:

- **TrafficInit**
- **PacketDelay**
- **PacketData**

An example of external DLL is available. See the directory IPTraffic\SAMPLES\User-DLL with all files to compile and generate the DLL (DllSample.dll).

13.6.1 TrafficInit

BOOL CALLBACK TrafficInit(int CnxID, unsigned long IPAddr, unsigned char protocol, unsigned port)

To init a new connection identified by par CnxID.

Parameters:

CnxID	Connection identifier
IPAddr	Remote IP address
Protocol	Protocol to use (UDP or TCP)
Port	Port number

Return codes:

True	The DLL is ready to provide data to the IP Generator.
False	The DLL can't provide data. The complementary error code is handled by the DLL and the DLL must warn the user directly.

Remark:

When a connection must use an external DLL, the IP Generator module verifies that the DLL is present (via LoadLibrary). Then it looks for the 3 required entry points. **TrafficInit()** is called when a connection is established with the remote.

13.6.2 PacketDelay

BOOL CALLBACK PacketDelay(int CnxID, unsigned long *pulDelay)

Parameters:

CnxID	Connection identifier
pulDelay	Address for delay expressed in milliseconds

Return codes:

True	The DLL has provided the delay for the next packet. If this delay equals 0, the IP Generator calls immediately PacketData() .
False	The DLL has not provided a delay. The IP Generator stops the connection.

Remark:

The **PacketDelay()** function is used to get the delay before a new packet contents.

13.6.3 PacketData

BOOL CALLBACK PacketData(int CnxID, unsigned short usBufferSize, unsigned char *pBuffer, unsigned short *pusUsedSize)

Parameters:

CnxID	Connection identifier
usBufferSize	Max size of the buffer (pBuffer)
pBuffer	Address of data to send
pusUsedSize	Address of the data size to send. If size equals 0, a new delay is asked. To avoid a 'deadlock', it is not authorized to provide more than 2 data packets with a zero size.

Return codes:

True	The DLL has provided data to send immediately.
False	The DLL has not provided data. The IP Generator stops the connection.

Remark:

Before calling the **PacketData()** function, the buffer pointed by pBuffer is initialized with zeros. The used length is initialized with zeros. The maximum size is 1460 in the sample.

13.7 IP Traffic - Test & Measure features versus OS, protocols and IP versions.

The array below shows the **IP Traffic - Test & Measure** features based on the Windows versions, on the protocols and on the IP versions. The cross in a cell indicates when the feature is available.

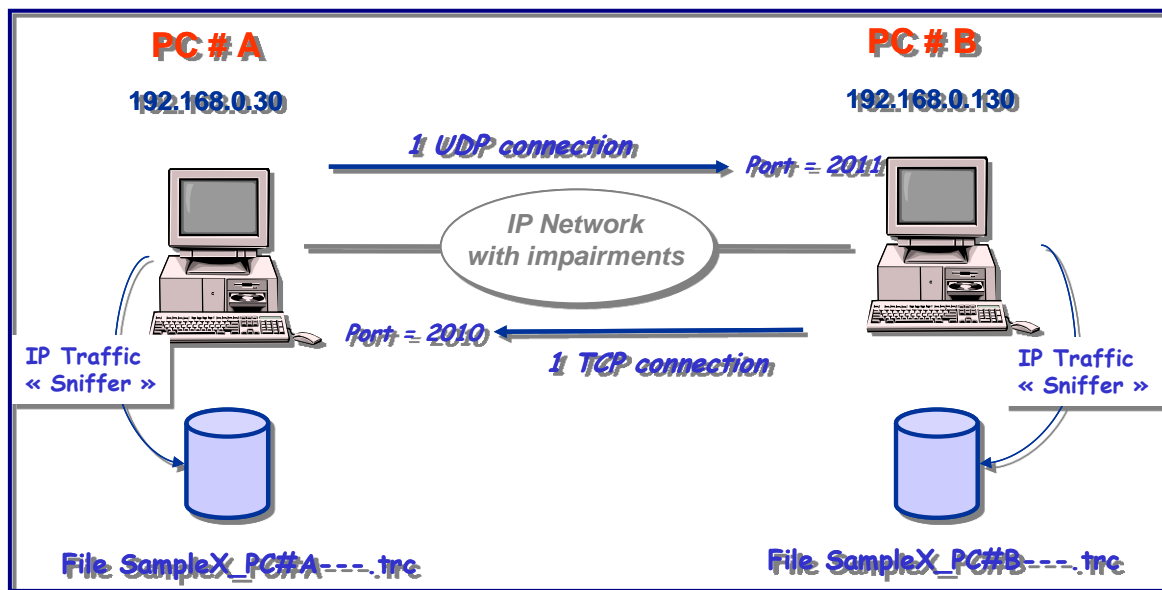
Protocol / IP Version	TCP		UDP		ICMP	
	IPv4	IPv6	IPv4	IPv6	IPv4	IPv6
OS Versions						
Windows 2000	x		x		x	
Windows XP	x	x	x	x	x	x
Windows Server 2003	x	x	x	x	x	x
Windows Vista	x	x	x	x	x	x
IP Generator Part						
Unitary Mode	x	x	x	x	x	x
Automatic Mode	x	x	x	x		
Interface Selection	x	x	x	x	x	x
IP Answering Part						
Absorber Mode	x	x	x	x		
Absorber File Mode	x	x	x	x		
Echoer Mode	x	x	x	x		
Echoer File Mode	x	x	x	x		
Absorber Generator	x	x	x	x		
Interface Selection	x	x	x	x		
Traffic Sniffer Part						
Capture and filters	x	x	x	x		
Traffic Observer Part						
Online Mode	x	x	x	x		
Offline Mode	x	x	x	x		
Traffic Generator Parameters (used by the Unitary Mode and the Absorber Generator Mode)						
Max Data Size (in bytes)	65535	65535	65507	65507	65535	65535
TTL / Hop Limit	x	x	x	x	x	x
DSCP	x		x		x (except under Vista)	
Mean Throughput (Pkts/s)			x	x	x	x
Mean Throughput (kb/s)	x	x	x	x		
RTT	x	x	x	x		

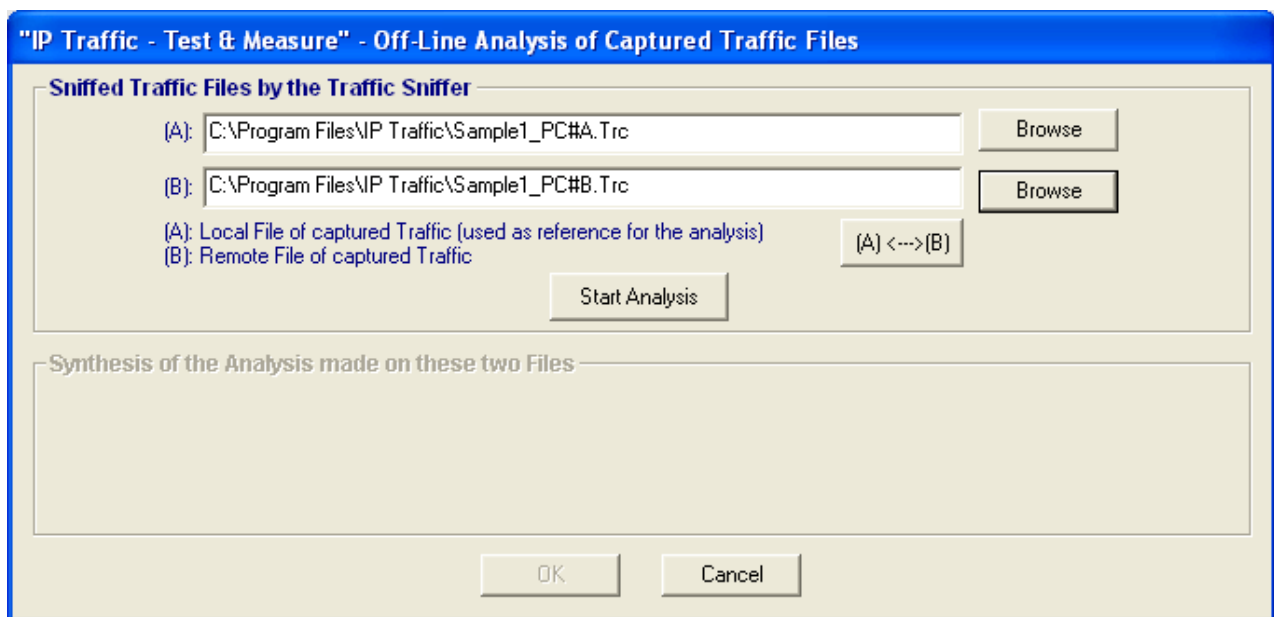
PART 14 Examples of sniffed traffic files

Six traffic captured files are provided to illustrate the off-line analysis:

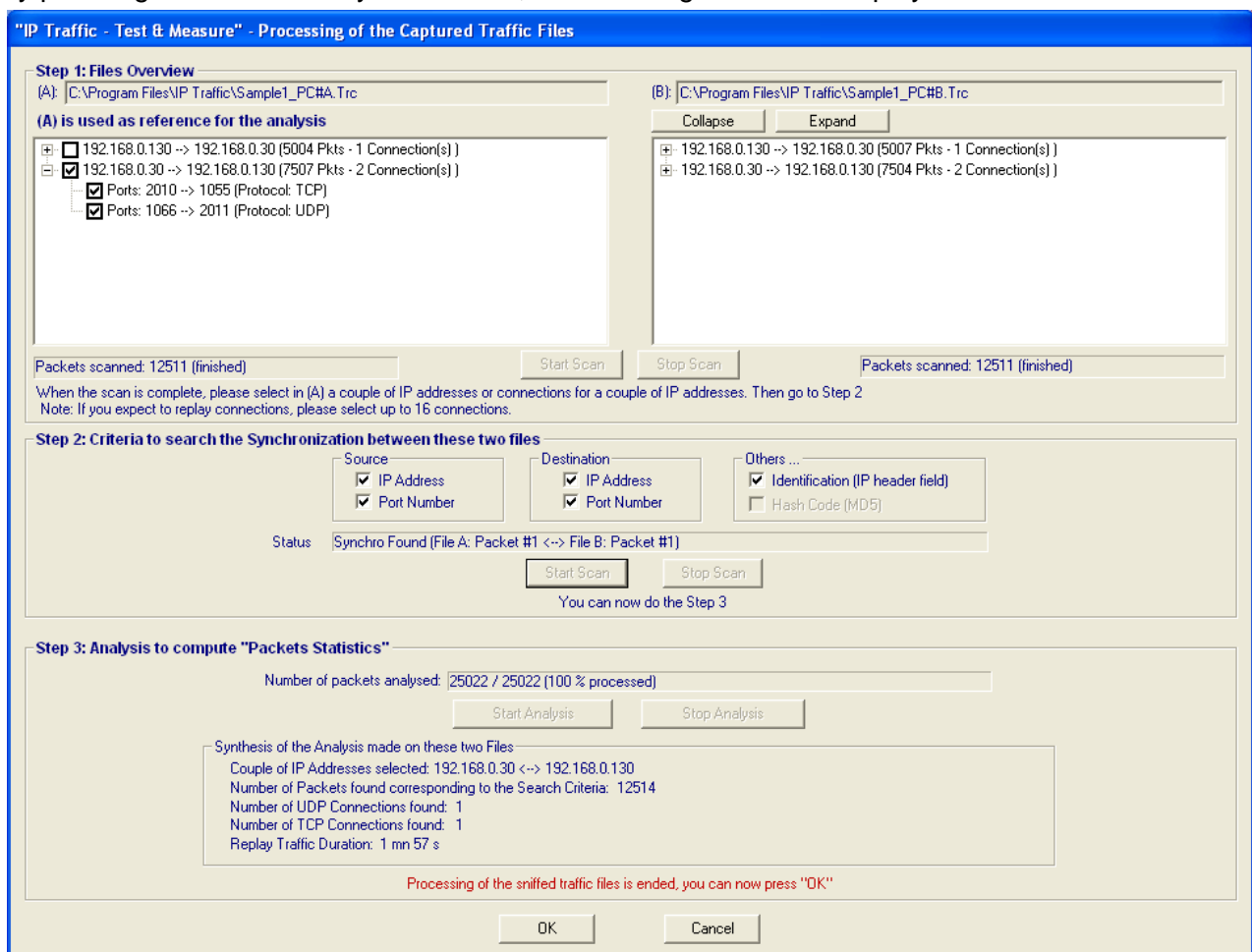
- Example 1: two files without use of the z100 Time Device and the zClock module
([Sample1_PC#A.Trnc](#) and [Sample1_PC#B.Trnc](#))
- Example 2: two files with use of the z100 Time Device
([Sample2_PC#A_with_z100.Trnc](#) and [Sample2_PC#B_with_z100.Trnc](#))
- Example 3: two files with use of the z100 Time Device and the zClock module
([Sample3_PC#A_with_z100&zClock.Trnc](#) and [Sample3_PC#B_with_z100&zClock.Trnc](#))
- Example 4: two files with IPv6 packets
([Sample4_PC#A_with_IPv6.Trnc](#) and [Sample4_PC#B_with_IPv6.Trnc](#))

The test configuration used to generate three first traffic files is defined as below:



Example 1: no Time Device and no zClock module

By pressing the « Start Analysis » button, the following window is displayed.



In the Step 1 the couple of IP addresses 192.168.0.30 → 192.168.0.130 is selected. Then the synchronization between these two files is found for the step 2. After running the step 3, the synthesis is displayed showing 1 TCP and 1 UDP connections.

By using the “Packet Statistics” option, the following results are displayed.

Offline Packet Statistics

Computer A ==> Computer B

Save ...

Computer B ==> Computer A

IP address of A: 192.168.0.30

IP address of B: 192.168.0.130

Time (UTC)	Sta...	Tra...	Port -> ...	IP size (pro...	Identi...
22:00:43.428	Sent	...	2010->1...	48 (TCP)	xD013
PC 22:00:43.451	Sent	0 (?)	2010->1...	40 (TCP)	xD014
PC 22:00:43.490	Sent	0 (?)	2010->1...	40 (TCP)	xD015
PC 22:00:43.530	Sent	0 (?)	2010->1...	40 (TCP)	xD016
PC 22:00:43.570	Sent	0 (?)	2010->1...	40 (TCP)	xD017
PC 22:00:43.611	Sent	0 (?)	2010->1...	40 (TCP)	xD018
PC 22:00:43.651	Sent	0 (?)	2010->1...	40 (TCP)	xD019
PC 22:00:43.691	Sent	0 (?)	2010->1...	40 (TCP)	xD01A
PC 22:00:43.731	Sent	0 (?)	2010->1...	40 (TCP)	xD01B
PC 22:00:43.771	Sent	0 (?)	2010->1...	40 (TCP)	xD01C
PC 22:00:43.810	Sent	0 (?)	2010->1...	40 (TCP)	xD01D
PC 22:00:43.850	Sent	0 (?)	2010->1...	40 (TCP)	xD01E
PC 22:00:43.890	Sent	0 (?)	2010->1...	40 (TCP)	xD01F

Time (UTC)	Sta...	Tra...	Port -> ...	IP size (pro...	Identi...
22:00:43.420	Sent	...	1055->2...	48 (TCP)	x6441
PC 22:00:43.420	Sent	0 (?)	1055->2...	40 (TCP)	x6442
PC 22:00:43.423	Sent	1 (?)	1055->2...	1500 (TCP)	x6443
PC 22:00:43.442	Sent	1 (?)	1055->2...	1500 (TCP)	x6444
PC 22:00:43.462	Sent	1 (?)	1055->2...	1500 (TCP)	x6445
PC 22:00:43.481	Sent	1 (?)	1055->2...	1500 (TCP)	x6446
PC 22:00:43.501	Sent	1 (?)	1055->2...	1500 (TCP)	x6447
PC 22:00:43.521	Sent	1 (?)	1055->2...	1500 (TCP)	x6448
PC 22:00:43.541	Sent	1 (?)	1055->2...	1500 (TCP)	x6449
PC 22:00:43.561	Sent	1 (?)	1055->2...	1500 (TCP)	x644A
PC 22:00:43.582	Sent	1 (?)	1055->2...	1500 (TCP)	x644B
PC 22:00:43.602	Sent	2 (?)	1055->2...	1500 (TCP)	x644C
PC 22:00:43.622	Sent	1 (?)	1055->2...	1500 (TCP)	x644D

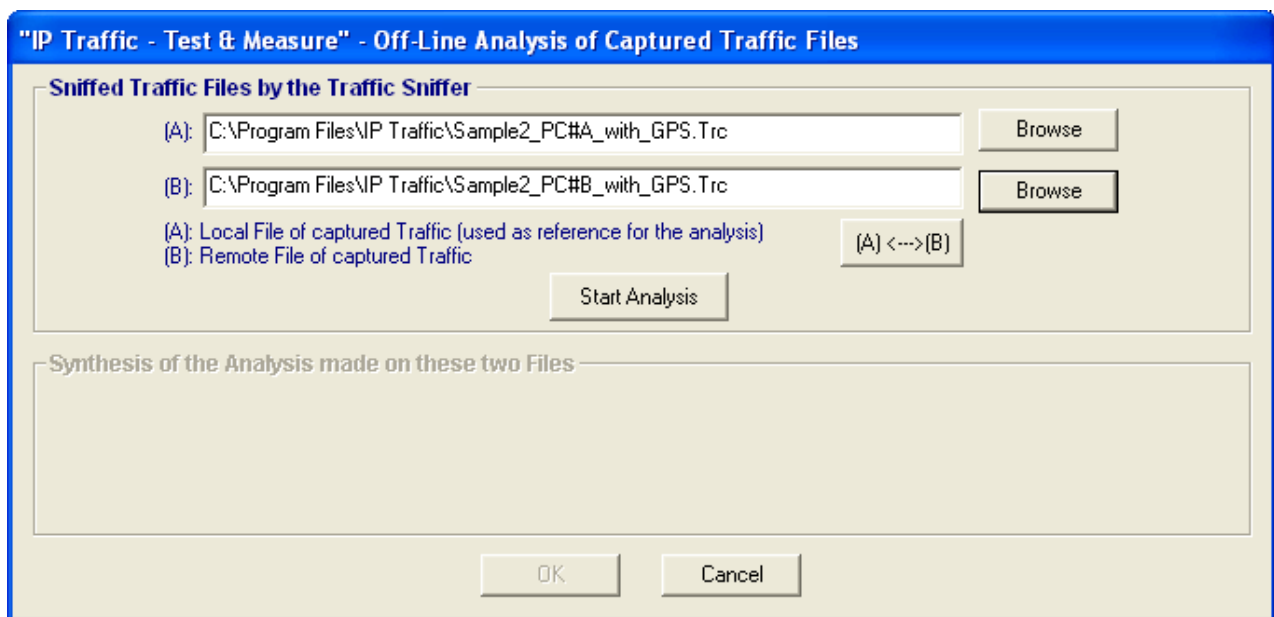
Port -> Port(Pro...	Packets	Lost	% ...	Delay	Jitter	TCP...
Total Computer A	7507	3	0%	120 ms	1 ms	0
1066 -> 2011 (U...	5000	3	0%	178 ms	1 ms	N/A
2010 -> 1055 (T...	2507	0	0%	6 ms	0 ms	0

Port -> Port(Pro...	Packets	Lost	% ...	Delay	Jitter	TCP...
Total Computer B	5007	3	0%	8 ms	0 ms	3
1055 -> 2010 (T...	5007	3	0%	8 ms	0 ms	3

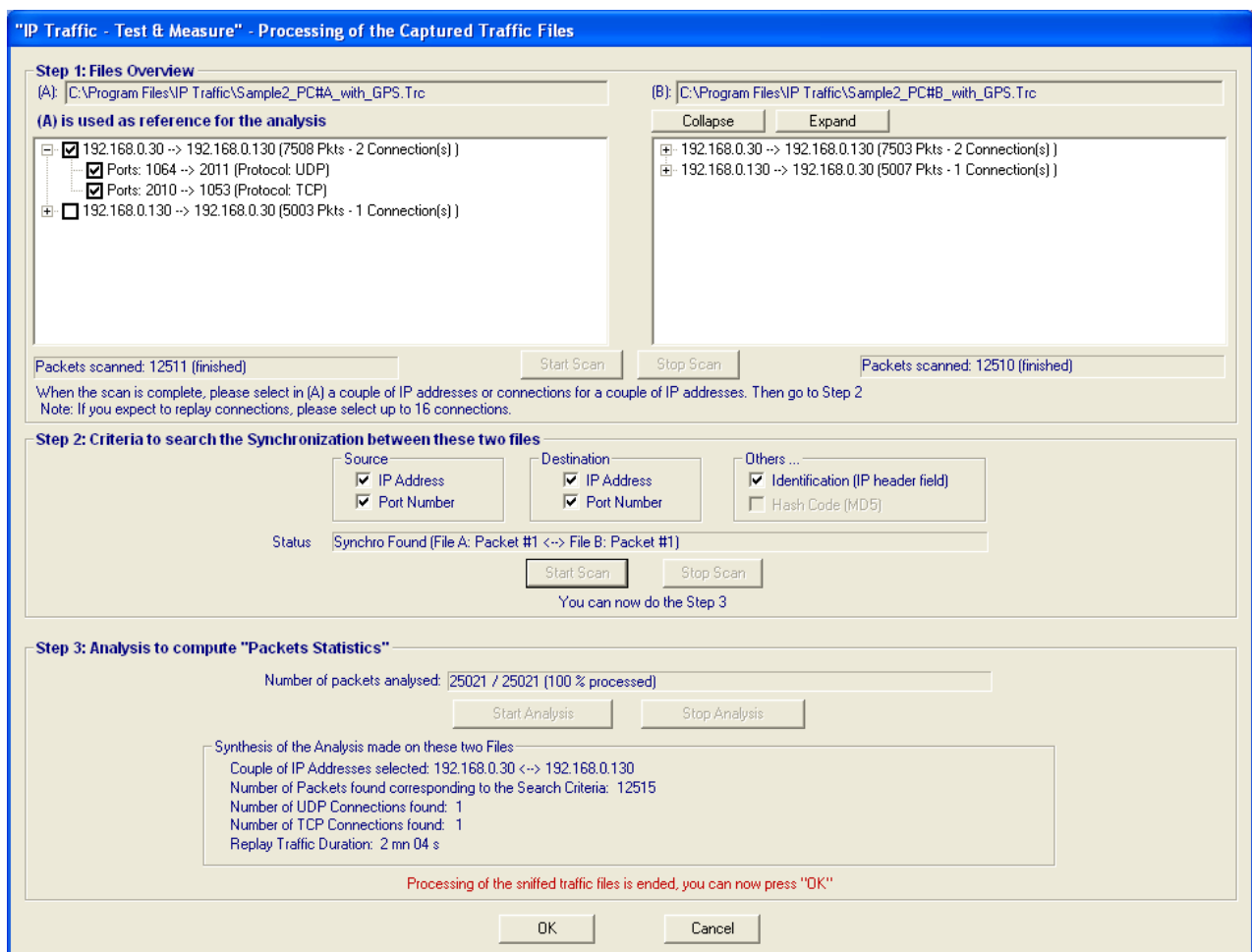
In this example, 3 UDP packets have been lost and the transit delay has an average of 178 ms for the UDP connection. 3 TCP packets sent by the PC #B have been lost and the average for the transit delay is 8 ms. Note also that 3 TCP packets sent by the PC #B have been retransmitted.

Note:

The ‘Transit ...’ column contains the symbols (?) to indicate that the accuracy for measurement cannot be defined (no common clock reference between the PCs and the PC clock is used for packet time stamping by the IP Traffic Sniffer when capturing the packets).

Example 2: use of the z100 Time Device and no zClock module

By pressing the « Start Analysis » button, the following window is displayed.



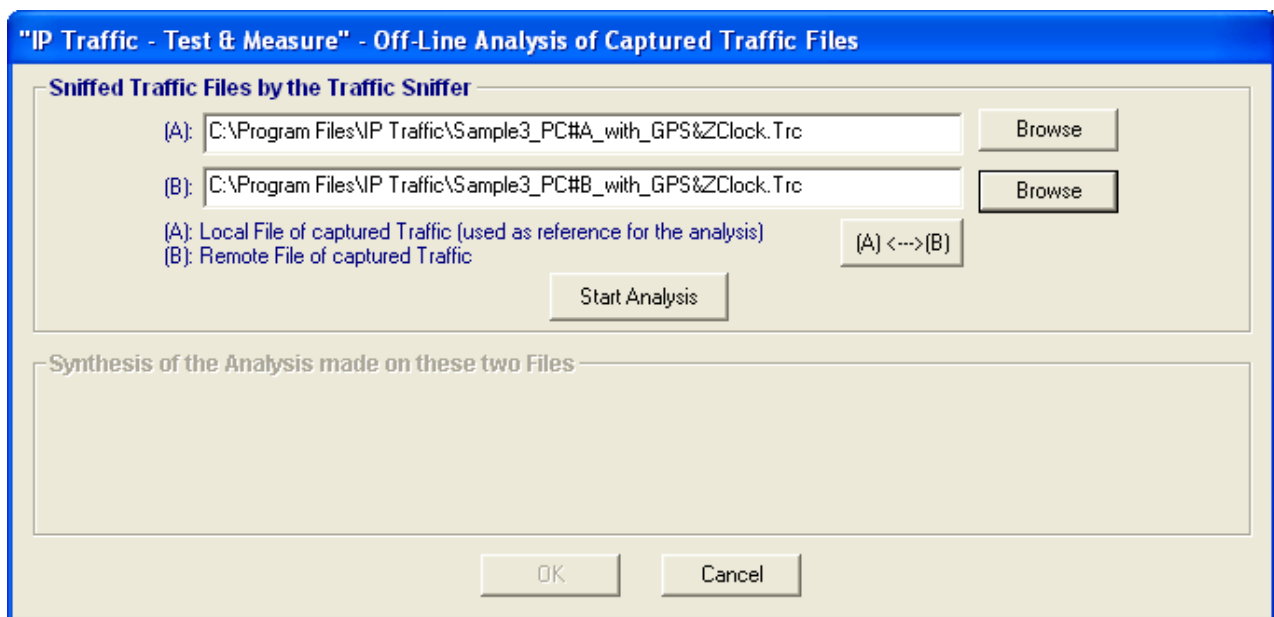
In Step 1, the couple of IP addresses 192.168.0.30 ➔ 192.168.0.130 is selected. Then the synchronization between these two files is found for the step 2. After running the step 3, the synthesis is displayed showing 1 TCP and 1 UDP connections.

By using the “Packet Statistics” option, the following results are displayed.

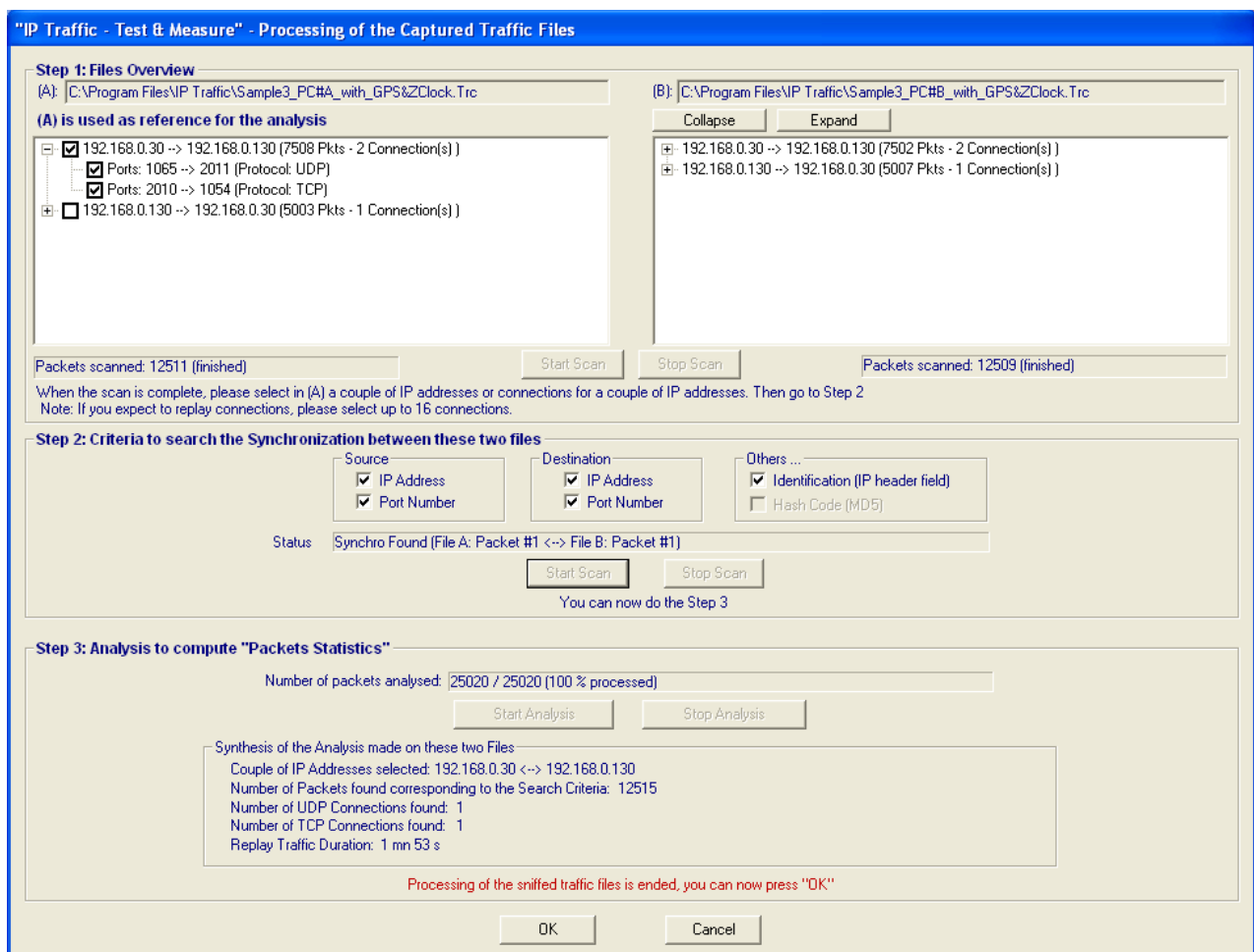
Offline Packet Statistics (on Driver Statistics)													
Computer A ==> Computer B						Save ...		Computer B ==> Computer A					
IP address of A: 192.168.0.30						IP address of B: 192.168.0.130							
Time (UTC)	St...	Transit ...	Port -> ...	IP size (p...	Identi...	Time (UTC)	St...	Tran...	Port -> ...	IP size (pro...	Identi...		
21:55:03.559	Sent	180 (± 5)	1064->2...	1488 (UDP)	x9567	21:55:20.725	Sent	1 (± 5)	1053->2...	48 (TCP)	x3D21		
21:55:03.579	Sent	180 (± 5)	1064->2...	1488 (UDP)	x9568	21:55:20.726	Sent	1 (± 5)	1053->2...	40 (TCP)	x3D22		
21:55:03.598	Sent	171 (± 5)	1064->2...	1488 (UDP)	x9569	21:55:20.728	Sent	3 (± 5)	1053->2...	1500 (TCP)	x3D23		
21:55:03.620	Sent	179 (± 5)	1064->2...	1488 (UDP)	x956A	21:55:20.747	Sent	1 (± 5)	1053->2...	1500 (TCP)	x3D24		
21:55:03.639	Sent	179 (± 5)	1064->2...	1488 (UDP)	x956B	21:55:20.767	Sent	2 (± 5)	1053->2...	1500 (TCP)	x3D25		
21:55:03.661	Sent	178 (± 5)	1064->2...	1488 (UDP)	x956C	21:55:20.787	Sent	1 (± 5)	1053->2...	1500 (TCP)	x3D26		
21:55:03.685	Sent	173 (± 5)	1064->2...	1488 (UDP)	x956D	21:55:20.807	Sent	1 (± 5)	1053->2...	1500 (TCP)	x3D27		
21:55:03.717	Sent	171 (± 5)	1064->2...	1488 (UDP)	x956E	21:55:20.827	Sent	1 (± 5)	1053->2...	1500 (TCP)	x3D28		
21:55:03.739	Sent	180 (± 5)	1064->2...	1488 (UDP)	x956F	21:55:20.847	Sent	1 (± 5)	1053->2...	1500 (TCP)	x3D29		
21:55:03.758	Sent	170 (± 5)	1064->2...	1488 (UDP)	x9570	21:55:20.866	Sent	2 (± 5)	1053->2...	1500 (TCP)	x3D2A		
21:55:03.780	Sent	179 (± 5)	1064->2...	1488 (UDP)	x9571	21:55:20.886	Sent	1 (± 5)	1053->2...	1500 (TCP)	x3D2B		
21:55:03.799	Sent	179 (± 5)	1064->2...	1488 (UDP)	x9572	21:55:20.906	Sent	2 (± 5)	1053->2...	1500 (TCP)	x3D2C		
21:55:03.821	Sent	178 (± 5)	1064->2...	1488 (UDP)	x9573	21:55:20.926	Sent	1 (± 5)	1053->2...	1500 (TCP)	x3D2D		
21:55:20.947	Sent	2 (± 5)	1053->2...	1500 (TCP)	x3D2E								
Port -> Port(Pro...	Packets	Lost	% ...	Delay	Jitter	TCP...	Port -> Port(Pro...	Packets	Lost	% ...	Delay	Jitter	TCP...
Total Computer A	7508	5	0%	122 ...	1 ms	0	Total Computer B	5007	4	0%	1 ms	0 ms	4
2010 -> 1053 (T...	2508	0	0%	0 ms	0 ms	0	1053 -> 2010 (T...	5007	4	0%	1 ms	0 ms	4
1064 -> 2011 (U...	5000	5	0%	184 ...	1 ms	N/A							

In this example, 5 UDP packets have been lost and the transit delay has an average of 184 ms for the UDP connection. 4 TCP packets sent by the PC #B have been lost and the average for the transit delay is 1 ms. Note also that 4 TCP packets sent by the PC #B have been retransmitted.

Note: the “Transit ...” column indicates the symbols (± 5) in order to precise that the accuracy for measurement is less than or equal to 5 ms (due to use of the z100 Time Device that delivers a precise time reference used for packet time stamping by the IP Traffic Sniffer when capturing the packets).

Example 3: use of the z100 Time Device and the zClock module

By pressing the « Start Analysis » button, the following window is displayed.



In Step 1, the couple of IP addresses 192.168.0.30 → 192.168.0.130 is selected. Then the synchronization between these two files is found for the step 2. After running the step 3, the synthesis is displayed showing 1 TCP and 1 UDP connections.

By using the “Packet Statistics” option, the following results are displayed.

Offline Packet Statistics

Computer A ==> Computer B

Save ...

Computer B ==> Computer A

IP address of A: 192.168.0.30

IP address of B : 192.168.0.130

Time (UTC)	St...	Transit ...	Port -> ...	IP size (p...	Identi...
21:57:54.267	Sent	182 (± 1)	1065->2...	1488 (UDP)	xB2BC
21:57:54.285	Sent	184 (± 1)	1065->2...	1488 (UDP)	xB2BD
21:57:54.306	Sent	183 (± 1)	1065->2...	1488 (UDP)	xB2BE
21:57:54.326	Sent	183 (± 1)	1065->2...	1488 (UDP)	xB2BF
21:57:54.347	Sent	182 (± 1)	1065->2...	1488 (UDP)	xB2C0
21:57:54.367	Sent	182 (± 1)	1065->2...	1488 (UDP)	xB2C1
21:57:54.388	Sent	191 (± 1)	1065->2...	1488 (UDP)	xB2C2
21:57:54.408	Sent	181 (± 1)	1065->2...	1488 (UDP)	xB2C3
21:57:54.427	Sent	182 (± 1)	1065->2...	1488 (UDP)	xB2C4
21:57:54.449	Sent	191 (± 1)	1065->2...	1488 (UDP)	xB2C5
21:57:54.468	Sent	191 (± 1)	1065->2...	1488 (UDP)	xB2C6
21:57:54.490	Sent	190 (± 1)	1065->2...	1488 (UDP)	xB2C7
21:57:54.509	Sent	190 (± 1)	1065->2...	1488 (UDP)	xB2C8

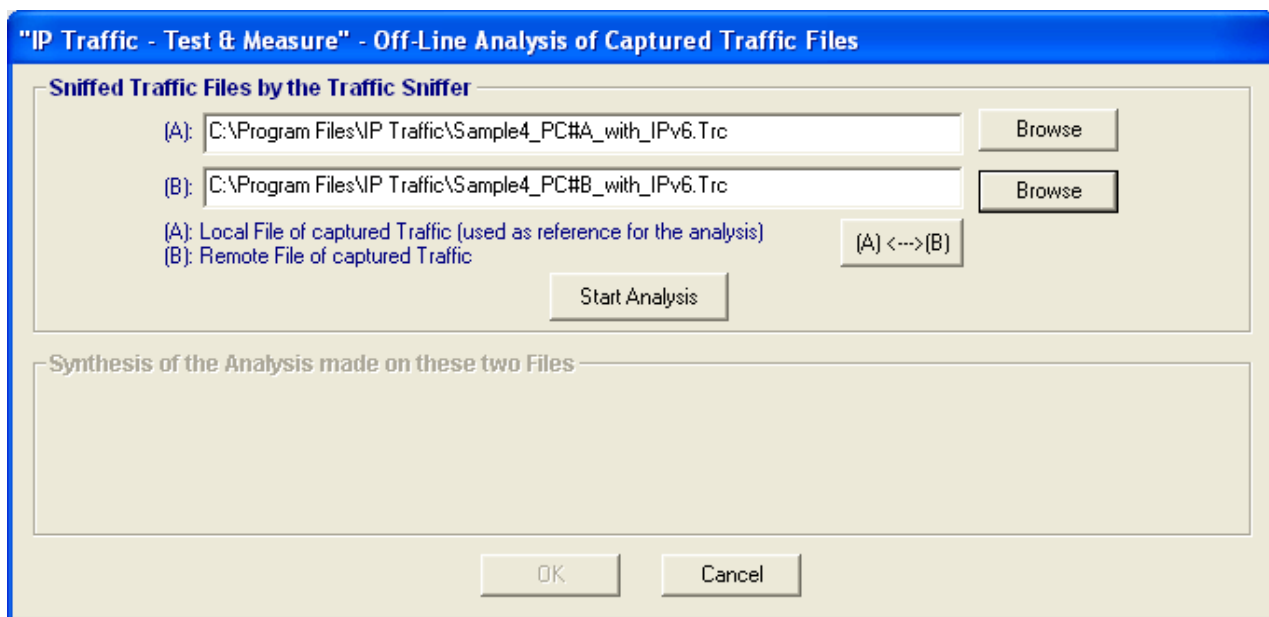
Port -> Port(Pro...	Packets	Lost	% ...	Delay	Jitter	TCP...
Total Computer A	7508	6	0%	123 ...	1 ms	0
2010 -> 1054 (T...	2508	0	0%	0 ms	0 ms	0
1065 -> 2011 (U...	5000	6	0%	186 ...	1 ms	N/A

Time (UTC)	St...	Tran...	Port -> ...	IP size (pro...	Identi...
21:58:00.793	Sent	0 (± 1)	1054->2...	48 (TCP)	x50B1
21:58:00.794	Sent	0 (± 1)	1054->2...	40 (TCP)	x50B2
21:58:00.796	Sent	1 (± 1)	1054->2...	1500 (TCP)	x50B3
21:58:00.815	Sent	1 (± 1)	1054->2...	1500 (TCP)	x50B4
21:58:00.835	Sent	1 (± 1)	1054->2...	1500 (TCP)	x50B5
21:58:00.855	Sent	1 (± 1)	1054->2...	1500 (TCP)	x50B6
21:58:00.875	Sent	1 (± 1)	1054->2...	1500 (TCP)	x50B7
21:58:00.895	Sent	1 (± 1)	1054->2...	1500 (TCP)	x50B8
21:58:00.915	Sent	1 (± 1)	1054->2...	1500 (TCP)	x50B9
21:58:00.935	Sent	1 (± 1)	1054->2...	1500 (TCP)	x50BA
21:58:00.955	Sent	1 (± 1)	1054->2...	1500 (TCP)	x50BB
21:58:00.975	Sent	1 (± 1)	1054->2...	1500 (TCP)	x50BC
21:58:01.046	Sent	1 (± 1)	1054->2...	1500 (TCP)	x50BD
21:58:01.066	Sent	1 (± 1)	1054->2...	1500 (TCP)	x50BE

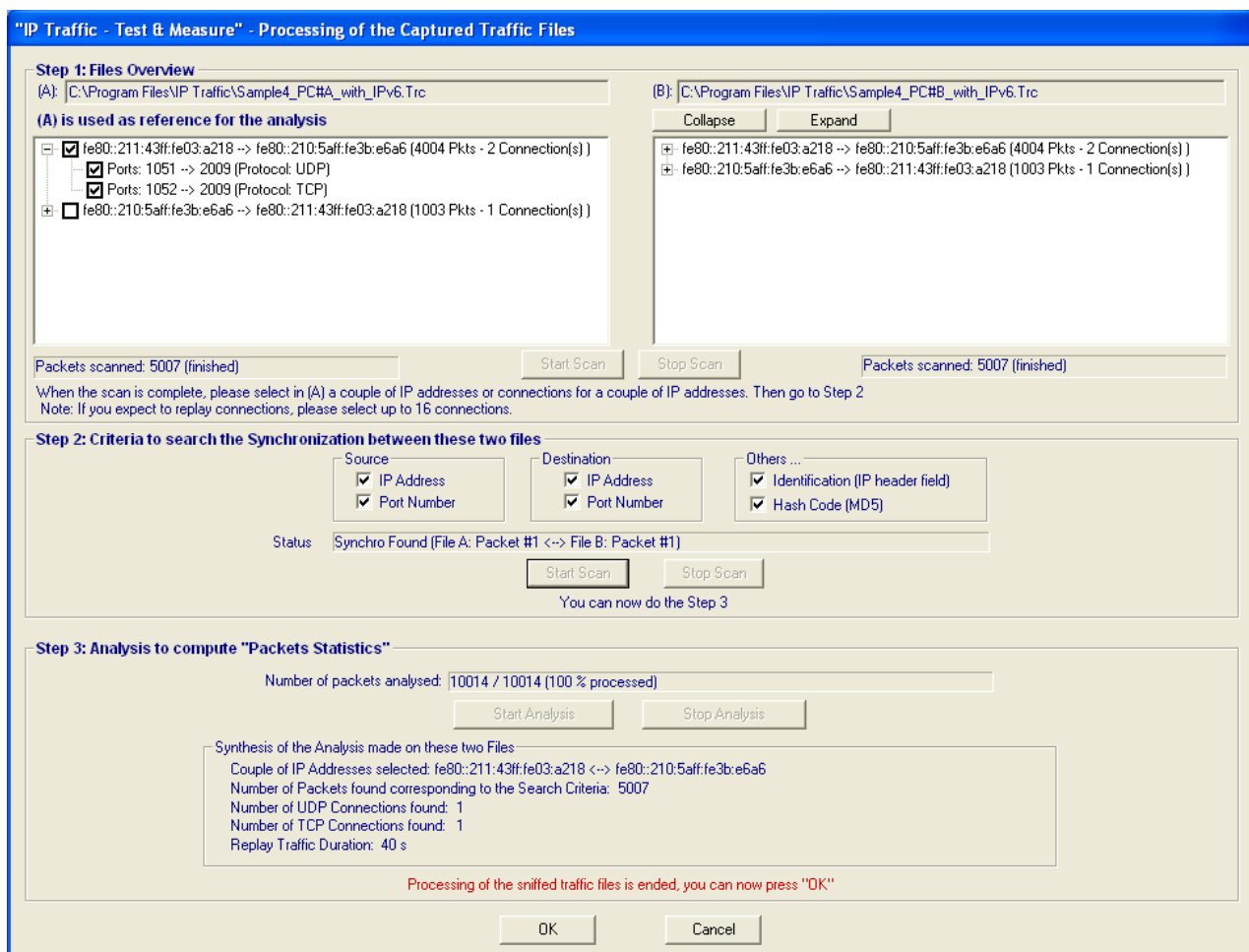
Port -> Port(Pro...	Packets	Lost	% ...	Delay	Jitter	TCP...
Total Computer B	5007	4	0%	1 ms	0 ms	4
1054 -> 2010 (T...	5007	4	0%	1 ms	0 ms	4

In this example, 6 UDP packets have been lost and the transit delay has an average of 186 ms for the UDP connection. 4 TCP packets sent by the PC #B have been lost and the average for the transit delay is 1 ms. Note also that 4 TCP packets sent by the PC #B have been retransmitted.

Note: the “Transit ...” column indicates the symbols (± 1) in order to precise that the accuracy for measurement is less than or equal to 1 ms (due to use of the z100 Time Device that delivers a precise time reference and the zClock module used for packet time stamping by the “Traffic Sniffer” when capturing the packets).

Example 4: capture containing IPv6 packets

By pressing the « Start Analysis » button, the following window is displayed.



In Step 1, the couple of IP addresses `fe80::211:43ff:fe03:a218` → `fe80::210:5aff:fe3b:e6a6` is selected. Then the synchronization between these two files is found for the step 2. After running the step 3, the synthesis is displayed showing 1 TCP and 1 UDP connections.

By using the “Packet Statistics” option, the following results are displayed.

Offline Packet Statistics

Computer A ==> Computer B

Save ...

Computer B ==> Computer A

IP address of A: fe80::211:43ff:fe03:a218

IP address of B : fe80::210:5aff:fe3b:e6a6

Time (UTC)	Sta...	Tra...	Port -> ...	IP size (pro...	Identi...
16:27:49.350	Sent	...	1051->2...	1488 (UDP)	N/A
PC 16:27:49.351	Sent	0 (?)	1052->2...	64 (TCP)	N/A
PC 16:27:49.351	Sent	0 (?)	1052->2...	60 (TCP)	N/A
PC 16:27:49.354	Sent	0 (?)	1052->2...	1500 (TCP)	N/A
PC 16:27:49.370	Sent	0 (?)	1051->2...	1488 (UDP)	N/A
PC 16:27:49.375	Sent	0 (?)	1052->2...	1500 (TCP)	N/A
PC 16:27:49.389	Sent	0 (?)	1051->2...	1488 (UDP)	N/A
PC 16:27:49.394	Sent	0 (?)	1052->2...	1500 (TCP)	N/A
PC 16:27:49.410	Sent	0 (?)	1051->2...	1488 (UDP)	N/A
PC 16:27:49.415	Sent	0 (?)	1052->2...	1500 (TCP)	N/A
PC 16:27:49.429	Sent	0 (?)	1051->2...	1488 (UDP)	N/A
PC 16:27:49.434	Sent	0 (?)	1052->2...	1500 (TCP)	N/A
PC 16:27:49.450	Sent	0 (?)	1051->2...	1488 (UDP)	N/A

Port -> Port(Pro...	Packets	Lost	% ...	Delay	Jitter	TCP...
Total Computer A	4004	0	0%	0 ms	0 ms	0
1052 -> 2009 (T...	2004	0	0%	0 ms	0 ms	0
1051 -> 2009 (U...	2000	0	0%	0 ms	0 ms	N/A

Time (UTC)	Sta...	Tra...	Port -> ...	IP size (pro...	Identi...
16:27:57.618	Sent	...	2009->1...	64 (TCP)	N/A
PC 16:27:57.642	Sent	0 (?)	2009->1...	60 (TCP)	N/A
PC 16:27:57.682	Sent	0 (?)	2009->1...	60 (TCP)	N/A
PC 16:27:57.722	Sent	0 (?)	2009->1...	60 (TCP)	N/A
PC 16:27:57.762	Sent	0 (?)	2009->1...	60 (TCP)	N/A
PC 16:27:57.802	Sent	0 (?)	2009->1...	60 (TCP)	N/A
PC 16:27:57.842	Sent	0 (?)	2009->1...	60 (TCP)	N/A
PC 16:27:57.882	Sent	0 (?)	2009->1...	60 (TCP)	N/A
PC 16:27:57.921	Sent	0 (?)	2009->1...	60 (TCP)	N/A
PC 16:27:57.962	Sent	0 (?)	2009->1...	60 (TCP)	N/A
PC 16:27:58.002	Sent	0 (?)	2009->1...	60 (TCP)	N/A
PC 16:27:58.042	Sent	0 (?)	2009->1...	60 (TCP)	N/A
PC 16:27:58.082	Sent	0 (?)	2009->1...	60 (TCP)	N/A

Port -> Port(Pro...	Packets	Lost	% ...	Delay	Jitter	TCP...
Total Computer B	1003	0	0%	0 ms	0 ms	0
2009 -> 1052 (T...	1003	0	0%	0 ms	0 ms	0

In this example: no lost packets and no delay.

In fact, in this example, GPS and zClock systems were not used. That is why, IP Traffic - Test & Measure can't give a transit delay. In that case, the values shown in the “delay” column are closed to the jitter.

Note:

The “Transit ...” column contains the symbols (?) to indicate that the accuracy for measurement cannot be defined (no common clock reference between the PCs and the PC clock is used for packet time stamping by the IP Traffic Sniffer when capturing the packets).