Trace graph 2.02 help

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TABLE OF CONTENTS:

==================

1. File menu

1.1. Open a trace file

1.2. Save trace as mat file

1.3. Save figure to jpeg

1.4. Save figure to tiff

1.5. Copy figure to clipboard

2. Network information menu

2.1. Simulation information

2.2. Current node information

2.3. Simulation End2End delays

2.4. Delays between current and other node

2.5. Average numbers of intermediate nodes for the whole network

2.6. Average numbers of intermediate nodes between current and other node

2.7. Simulation processing times at intermediate nodes

2.8. Processing times at current node

2.9. Simulation Round Trip Times

2.10. Round Trip Times between current and other node

3. Options menu

3.1. Overlay graphs

3.2. Automatically refresh information

3.3. Automatically refresh graphs

3.4. Direct connection

3.5. Count packets IDs only once

3.6. Time interval

3.7. Use specified edges for histograms

3.8. Save information

3.9. Save graphs

3.10. Mark each plotted point

3.11. Add minor grid to the axes

3.12. Add major grid to the axes

3.13. Zoom on

3.14. Legend on

3.15. Flow ID

3.16. Turbo mode

3.17. Save graphs statistics

3.18. Log scaling on X, Y, Z axes

3.19. Load a graph

4. 2D Graphs menu

5. 3D Graphs menu

6. Histograms menu

7. Other options

8. Shortcuts

9. Supported file formats

9.1. Wired (see http://www.isi.edu/nsnam/ns/doc/node234.html for details)

9.2. Wireless (see http://www.isi.edu/nsnam/ns/doc/node166.html for details)

9.3. New trace file format (wireless, see http://www.isi.edu/nsnam/ns/doc/node168.html for details)

9.4. Wired-wireless

9.5. Wired-new trace file format

9.6. Converting your own trace files formats into Trace graph trace file format

10. Trace graph script file format

11. Trace graph configuration file

12. System requirements

13. Author contact

NOTE! There can be more than one Trace graph run at a time.

NOTE! The time used in network information and graphs is given in seconds.

1. FILE MENU

============

1.1. Open a trace file

----------------------

A trace file or a mat-file can be opened from the File->Open menu

or from the command line, for example:

trgraph c:\out.tr

trgraph c:\out.mat

TIME INTERVAL can be specified (only with .tr file!) in seconds to load data only between

it's beginning and end, for example:

trgraph c:\out.tr 1.237 3.456

The more 'd' events and lines the longer file loading time because of preliminary calculations.

Loading very big files (for example with 200000 or more lines) can take even a half an hour or more.

When no error appears it means the program is still loading a file.

A trace file is parsed and saved to 'temp' (always) and 'temp1' (only if TIME INTERVAL is specified)

files before loading. Temporary files are saved in Trace graph format (see 9.6).

1.2. Save trace as mat file

---------------------------

A mat-file can be saved from the File->Save menu.

Saving a trace file into a mat-file increases speed of file loading.

The more 'd' events and lines the longer file loading time because of preliminary calculations.

Saving a trace file (only once) into a mat-file after loading lets

to load it from mat-file in a few seconds!

IMPORTANT! Some Trace graph versions can save different information into a mat-file,

so it's better to create a new mat-file for a trace file! See whatsnew.txt for changes.

1.3. Save figure to jpeg

------------------------

Saves graphs window as a jpeg picture.

1.4. Save figure to tiff

------------------------

Saves graphs window as a tiff picture (lossless compression).

1.5. Copy figure to clipboard

-----------------------------

Copies graphs windows to clipboard as a bitmap.

THIS OPTION DOESN'T WORK UNDER UNIX!

2. NETWORK INFORMATION MENU

===========================

2.1. Simulation information

---------------------------

This is information about the whole simulated network.

Only Count packets IDs only once, PACKET TYPE, START TIME and END TIME options (see 3.5, 7)

have influence on the results. Here are some options which need some explanations:

- Number of forwarded packets: number of successful 'f' events, each packet ID is counted once

when Count packets IDs only once option is ON (see 3.5) or as many times as it's forwarded

when Count packets IDs only once option is OFF

- Number of forwarded bytes: number of successfully forwarded bytes, each packet is counted

as many times as it's forwarded

- Number of lost packets: number of sent by the source and never received by the destination packets

(packets with -Id field equal -1 are skipped, see 9.6)

- Number of dropped packets: number of drop ('d') events.

2.2. Current node information

-----------------------------

This is information about CURRENT NODE.

CURRENT NODE is the source and OTHER NODE is the destination when numbers of generated/sent/forwarded

packets/bytes are counted.

CURRENT NODE is the destination and OTHER NODE is the source when numbers of received/dropped

packets/bytes are counted.

Here are some options which need some explanations:

- Number of lost packets:

When DIRECT CONNECTION option is ON (see 3.4):

= number of forwarded packets by CURRENT NODE - number of received packets by OTHER NODE

When DIRECT CONNECTION option is OFF:

= number of sent packets by CURRENT NODE - number of received packets by OTHER NODE.

See 3.5 for another details.

2.3. Simulation End2End delays

------------------------------

This is information about End2End delays.

End2End delay = time (in seconds) when packet was received by OTHER NODE - time (in seconds) when packet was sent by CURRENT NODE.

SOURCE AND DESTINATION TRACE LEVEL options are used for the calculations (wireless, mixed and Trace graph formats only), i.e.

only packets sent at source trace level and received at destination trace level are considered.

Trace level (AGT, RTR, MAC) at the source and destination nodes can be chosen from the list.

See SHORTCUTS for CN, ON, PID explanations.

2.4. Delays between current and other node

------------------------------------------

This information is shown if OTHER NODE is checked.

It shows End2End delays (in seconds) between CURRENT NODE (sender) and OTHER NODE (receiver) when

DIRECT CONNECTION option is OFF (see 3.4). When DIRECT CONNECTION option is ON it shows delays

between CURRENT NODE (forwards packets) and OTHER NODE (receives packets).

SOURCE AND DESTINATION TRACE LEVEL options are used for the calculations (wireless, mixed and Trace graph formats only), i.e.

only packets sent at source trace level and received at destination trace level are considered. When DIRECT CONNECTION option is on

only DESTINATION TRACE LEVEL option is used (for Other node) because Current node forwards packets only at RTR trace level.

Trace level (AGT, RTR, MAC) at the source (Current node) and destination node (Other node) can be chosen from the list.

See 8. SHORTCUTS for PID explanation.

2.5. Average numbers of intermediate nodes for the whole network

----------------------------------------------------------------

Average number of nodes receiving packets = sum of numbers of all the intermediate nodes (nodes between source and destination nodes)

receiving packets sent by all the source nodes / number of received packets at all the

destination nodes

Average number of nodes forwarding packets = sum of numbers of all the intermediate nodes (nodes between source and destination nodes)

forwarding packets sent by all the source nodes / number of received packets at all the

destination nodes

Numbers of intermediate nodes are calculated in the same way like in Number of intermediate nodes graphs.

For example, if we take results (Y axis) from 'All packets IDs vs number of intermediate nodes-fwd' graph, sum all of them and divide

by number of packets IDs (X axis) we get the same result as from 'Average number of nodes forwarding packets' information.

DIRECT CONNECTION option is turned OFF.

2.6. Average numbers of intermediate nodes between current and other node

-------------------------------------------------------------------------

Average number of nodes receiving packets = sum of numbers of all the intermediate nodes (nodes between Current node-source and

Other node-destination) receiving packets sent by Current node / number of received packets

at Other node

Average number of nodes forwarding packets = sum of numbers of all the intermediate nodes (nodes between Current node-source and

Other node-destination) forwarding packets sent by Current node / number of received packets

at Other node

Numbers of intermediate nodes are calculated in the same way like in Number of intermediate nodes graphs.

For example, if we take results (Y axis) from 'Packets IDs vs number of intermediate nodes-rec' graph, sum all of them and divide

by number of packets IDs (X axis) we get the same result as from 'Average number of nodes receiving packets' information.

DIRECT CONNECTION option is turned OFF.

2.7. Simulation processing times at intermediate nodes

------------------------------------------------------

Processing time at intermediate node for a packet = time when the packet was forwarded - time when the packet was received

For minimal and maximal processing time node number and packet ID is shown.

2.8. Processing times at current node

-------------------------------------

Processing time at current node for a packet = time when the packet was forwarded - time when the packet was received

When OTHER NODE is checked only packets forwarded at Current node to Other node are considered.

For minimal and maximal processing time packet ID is shown.

2.9. Simulation Round Trip Times

--------------------------------

Round Trip Time (RTT) for a packet = time when ACK (acknowlegde) packet sent by the destination was received by the source -

time when the packet was sent by the source

SOURCE AND DESTINATION TRACE LEVEL options are used for the calculations (wireless, mixed and Trace graph formats only), i.e.

only packets sent at source trace level and received at destination trace level are considered.

Trace level (AGT, RTR, MAC) at the source node can be chosen from the list.

SENT PACKET and ACK PACKET options are used to select sent packet type at the source and ACK packet type at the destination.

See shortcuts for SPID, SPAK, ACK explanations.

2.10. Round Trip Times between current and other node

-----------------------------------------------------

Round Trip Time (RTT) for a packet = time when ACK (acknowlegde) packet sent by Other node was received by Current node -

time when the packet was sent by Current node

SOURCE AND DESTINATION TRACE LEVEL options are used for the calculations (wireless, mixed and Trace graph formats only), i.e.

only packets sent at source trace level and received at destination trace level are considered.

Trace level (AGT, RTR, MAC) at the source node (Current node) can be chosen from the list.

SENT PACKET and ACK PACKET options are used to select sent packet type at Current node and ACK packet type at Other node.

See shortcuts for SPID, SPAK, ACK explanations.

3. OPTIONS MENU

===============

3.1. Overlay graphs

-------------------

Up to 7 graphs can be plotted in the window when this option is on.

Default is OFF.

3.2. Automatically refresh information

--------------------------------------

When this option is ON (default) all the information from the Network information menu refreshes when

for example PACKET TYPE is changed (see 7. Other options). Works similar to 3.2. Automatically change graphs.

Default is OFF.

3.3. Automatically refresh graphs

---------------------------------

When this option is on all the plotted graphs refresh if for example

PACKET TYPE is changed (see 7. Other options).

Default is OFF.

3.4. Direct connection

----------------------

This option specifies connection type between CURRENT NODE and OTHER NODE.

It works if OTHER NODE is checked. It only concerns receiving and dropping events.

When this option is ON analysis is done as if CURRENT NODE was directly connected to OTHER NODE.

When this option is OFF analysis is done as if CURRENT NODE was the source connected to OTHER NODE

(destination node) via intermediate nodes.

If there's no connection between CURRENT NODE and OTHER NODE calculations results are equal zero.

Default is OFF.

3.5. Count packets IDs only once

---------------------------------

When this option is ON packets IDs are counted only once. When it's OFF the same packets are counted as many times

as they are received (number of receive events), forwarded (number of forward events) or dropped (number of drop events).

For example a node can receive the same packet 5 times, so when this option is ON the packet is counted only once not 5 times.

This option works with the following network information and graphs:

\* Simulation information:

- Number of forwarded packets

- Number of dropped packets

\* Current node information:

- Number of received packets

- Number of forwarded packets

- Number of dropped packets

\* 2D graphs:

- Throughput of receiving packets at current node

- Throughput of forwarding packets at current node

- Throughput of dropping packets at current node

- Throughput of receiving packets

- Throughput of forwarding packets

- Throughput of dropping packets

\* 3D graphs:

- Numbers of forwarded packets at all the nodes

- Numbers of received packets at all the nodes

- Numbers of dropped packets at all the nodes.

If packets IDs are not unique results will be wrong. See 8 for shortcuts.

Default is OFF.

3.6. Time interval

------------------

Simulated network can be analysed in a selected time interval.

START TIME is the beginning of the time interval. END TIME is the end of the time interval.

When this option is on trace file lines with time between START TIME and END TIME are selected.

Default is OFF.

See also 1.1.

3.7 Use specified edges for histograms

--------------------------------------

When this option is ON edges specified in the field Hist. egdes (see 7. Other options) are used when plotting histograms.

For example the field can be: 0.03 0.05 0.07. See 6. Histograms for calculations details.

3.8. Save information

---------------------

When this option is ON all the visible information from Network information window are saved to text files.

A saved file name format:

'trace file or mat file name'-'information name' 'options'.trg

for example:

DoS.tr-node 0 info.trg

DoS.tr-node 5 delays ON\_0.trg

Saved files have 'trg' extensions.

Files are saved to a trace file or a mat file directory.

Default is OFF.

3.9. Save graphs

----------------

When this option is ON all the plotted graphs data is saved into separated text files.

A saved file name format:

'trace file or mat file name'-'graph legend'.trg

for example:

dos.mat-Throughput at current node (sending) X\_time TIL\_0,016499 CN\_0.trg

There is a change in the description: ':' is changed to '\_'.

Saved files have 'trg' extensions.

Saved files contain 1 or 2 or 3 columns (X Y Z coordinates).

When there is an empty plot only '0' is saved into a file.

Files are saved to a trace file or a mat file directory.

Default is OFF.

3.10. Mark each plotted point

----------------------------

When this option is ON all the plotted data points are marked with a circle.

Default is OFF.

3.11. Add minor grid to the axes

--------------------------------

Adds minor grid to the current axes in the graphs windows.

Default is OFF.

3.12. Add major grid to the axes

--------------------------------

Adds major grid to the current axes in the graphs windows.

Default is OFF.

3.13. Zoom on

------------

Turns zoom ON/OFF when 2D graphs or histograms are plotted.

When zoom is OFF legend can be moved holding left mouse button.

Default is ON.

3.14. Legend on

---------------

Turns legend ON/OFF when 2D graphs or histograms are plotted.

Legend can be edited by double click on it with left mouse button

when zoom is OFF.

Default is ON.

3.15. Flow ID

-------------

When this option is ON flow ID is used in wired trace files analysis.

Default is OFF.

3.16. Turbo mode

----------------

This option is used only for delays and jitter calculations.

Analysis results are in most cases wrong but sometimes they are the same as if the option was OFF.

The results depend on the trace file.

Default is OFF.

3.17. Save graphs statistics

----------------------------

When this option is ON all the plotted graphs statistics are saved into separated text files.

A saved file name format:

'trace file or mat file name'-STATS-'graph legend'.trg

for example:

dos.mat-STATS-Throughput at current node (sending) X\_time TIL\_0,016499 CN\_0.trg

There is a change in the description: ':' is changed to '\_'.

Saved files have 'trg' extensions.

Saved files contain statistics for X, Y and Z axes values.

Files are saved to a trace file or a mat file directory.

Default is OFF.

3.18. Log scaling on X, Y, Z axes

---------------------------------

When this option is ON natural logarithm of X/Y/Z axis values is calculated and plotted.

Only values greater than zero are plotted. Log scaling on X and Y axes works only with 2D graphs.

Log scaling on Z axis works only with 3D graphs.

Default is OFF.

3.19. Load a graph

------------------

This option loads graphs from .trg files saved using Save graphs option (3.9). There's only legend

(file name without .trg), no axes labels. Text file with graph data should have 2 (X Y) or 3 (X Y Z) columns separated with space.

All files in this format should be read.

4. 2D GRAPHS

============

\* 2D graphs can be zoomed in/out. An area to zoom can be marked in with left mouse button.

To zoom out press right mouse button.

\* 'simulation' in the graphs names means the graphs concern the whole network.

\* 'CN2ON' and 'between CN and ON' in the graphs names means the graphs concern only CURRENT NODE

and OTHER NODE (DIRECT CONNECTION option is used, see 3.4).

NOTE! DON'T FORGET TO CHECK OTHER NODE WHEN PLOTTING GRAPHS FOR CURRENT AND OTHER NODE.

\* Graphs concerning 'r' events in the whole network use DIRECT CONNECTION option (see 3.4).

When DIRECT CONNECTION is ON all the 'r' events are counted. When DIRECT CONNECTION is OFF

only 'r' events where CURRENT NODE=DESTINATION NODE are counted. This option should be used

only if OTHER NODE is checked.

\* There is a legend for each graph. It shows the name of a graph and contains additional

description (see chapter 8).

\* When there are no packets transmitted an empty graph is plotted (Y values are equal zero).

\* 'all', 'simulation' or lack of 'at current node' in the names of the graphs

means that the whole simulation events are analysed (not only events at the CURRENT NODE).

\* When THROUGHPUT graph is plotted TIME INTERVAL LENGTH option is used. To plot a THROUGHPUT graph

sum of sizes (... bits) or number (... packets) of generated/sent/forwarded/received packets

is calculated every TIME INTERVAL and divided by it's LENGTH. THROUGHPUT (... bits) is shown in BITS.

THROUGHPUT (... packets) shows numbers of packets in every TIME INTERVAL. TIME INTERVAL LENGTH

is equal 1 second by default. See 3.5 for details about some THROUGHPUT graphs.

\* THROUGHPUT VS DELAY graph shows throughput (bits) on X axis and delay on Y axis. Throughput and delays

(minimal/average/maximal) are calculated every TIME INTERVAL. 'throughput of sending' means

throughput of sending or forwarding at CURRENT NODE. 'throughput of receiving' means

throughput of receiving at OTHER NODE. For 'throughput of sending...' graphs delays of sent packets

are calculated in the same time intervals as throughput is calculated. For 'throughput of receiving...'

graphs delays of received packets are calculated in the same time intervals as throughput is calculated.

When DIRECT CONNECTION is ON throughput of sending bits from CURRENT NODE to OTHER NODE means throughput

of forwarding bits from CN to ON. See 2.3, 2.4 for delays calculations. After throughput and delays

calculations throughput values are sorted in ascending order and then delays values are sorted

in the same order. Then a graph is plotted.

\* THROUGHPUT VS JITTER graph shows throughput (bits) on X axis and jitter on Y axis. It's similar to Throughput vs delay graphs.

If S(i) is the time packet i was sent from the sender, and R(i) is the time it was received by the receiver,

the jitter(i)=|(R(i+1)-S(i+1))-(R(i)-S(i)|.

\* THROUGHPUT VS PROCESSING TIME graph shows throughput (bits) on X axis and processing time on Y axis.

Throughput and processing times (minimal/average/maximal) are calculated every TIME INTERVAL. Throughput of receiving/forwarding bits

and processing times are calculated at Current node or in the whole network (simulation processing time).

\* THROUGHPUT VS RTT graph shows throughput (bits) on X axis and RTT on Y axis.

Throughput and RTT (minimal/average/maximal) are calculated every TIME INTERVAL. Throughput of sending bits

is calculated at Current node or in the whole network. RTT is calculated between Current node (source) and Other node (destination) or

in the whole network between all the sources and destinations. See 2.9, 2.10.

\* PACKET SIZE VS THROUGHPUT graph shows packet size on X axis and minimal/average/maximal throughput on Y axis.

Throughput is calculated in each TIME INTERVAL and then minimal/average/maximal value is calculated from all the time intervals.

\* PACKET SIZE VS DELAY graph shows minimal/average/maximal delay in the whole network (simulation End2End delay) or delay between

Current and Other node. See Direct Connection option.

\* PACKET SIZE VS JITTER graph shows minimal/average/maximal jitter in the whole network (simulation jitter) or jitter between

Current and Other node.

\* PACKET SIZE VS PROCESSING TIME graph shows minimal/average/maximal processing times in the whole network (simulation processing time)

or processing times between Current and Other node.

\* PACKET SIZE VS RTT graph shows minimal/average/maximal RTT in the whole network (simulation RTT) or RTT between

Current and Other node. See 2.9, 2.10.

\* JITTER (of ...) (Y axis) = current event (generate/send/receive/forward/drop) time -

previous event time / current event sequence number (X axis) - previous event sequence number.

\* SEND EVENTS TIME vs JITTER graph shows time when packets were sent (X axis) vs packets jitter (Y axis).

If S(i) is the time packet i was sent from the sender, and R(i) is the time it was received by the receiver,

the jitter(i)=|(R(i+1)-S(i+1))-(R(i)-S(i)|. Jitter definition is the same for RECEIVE EVENTS TIME vs JITTER graphs

and for PACKETS IDs vs JITTER graphs. SOURCE AND DESTINATION TRACE LEVEL options are used for the jitter calculations.

\* RECEIVE EVENTS TIME vs JITTER graph shows time when packets were received (X axis) vs packets jitter (Y axis).

SOURCE AND DESTINATION TRACE LEVEL options are used for the jitter calculations.

\* PACKETS IDs vs JITTER graph shows sent packets IDs (X axis) vs packets jitter (Y axis).

SOURCE AND DESTINATION TRACE LEVEL options are used for the jitter calculations.

\* SENT PACKET ID vs RTT graph shows sent packets IDs (X axis, not ack packets) at the source vs RTT (Y axis). See 2.9, 2.10.

\* SEND EVENTS TIME vs DELAYS graph shows time when packets were sent (X axis) vs packets delays (Y axis).

\* RECEIVE EVENTS TIME vs DELAYS graph shows time when packets were received (X axis) vs packets delays (Y axis).

\* FORWARD/RECEIVE EVENTS TIME vs PROCESSING TIMES graph shows time when packets were forwarded/received (X axis)

vs processing times (Y axis).

\* CUMULATIVE DISTRIBUTION is an empirical cumulative distribution function.

\* All send events time vs number of intermediate nodes graph shows time when packets were sent (X axis, for the whole

network) vs number of intermediate nodes (Y axis) forwarding (fwd) or receiving (rec) the packets between the source node

and the destination node. All receive events time vs number of intermediate nodes graph is similar. DIRECT CONNECTION MUST BE OFF.

\* Send events time at CN vs number of intermediate nodes graph shows time when packets were sent by CURRENT NODE (X axis)

vs number of intermediate nodes (Y axis) forwarding (fwd) or receiving (rec) the packets between the source node (CURRENT NODE)

and the destination node (OTHER NODE). Receive events time at ON vs number of intermediate nodes graph is similar.

DIRECT CONNECTION MUST BE OFF.

\* All packets IDs vs number of intermediate nodes graph shows packets IDs (X axis, for the whole network)

vs number of intermediate nodes (Y axis) forwarding (fwd) or receiving (rec) the packets between the source node and the destination node.

Packets IDs vs number of intermediate nodes concerns only CURRENT NODE (the source) AND OTHER NODE (the destination).

DIRECT CONNECTION MUST BE OFF.

\* For PACKET ID vs DELAY, PACKET ID vs PROCESSING TIME, PACKET ID vs JITTER, PACKET ID vs RTT and number of intermediate nodes graphs

packets IDs are sorted in ascending order.

SOURCE AND DESTINATION TRACE LEVEL options are used for all the End2End delays graphs.

See 2.3 and 2.4 for DELAYS details.

See 2.7 and 2.8 for PROCESSING TIMES details.

5. 3D GRAPHS

============

\* 3D graphs can be rotated. To rotate 3D graphs hold left mouse button.

\* CN means source node (X axis on the right side) and ON destination node (Y axis on the left side, see 8. Shortcuts, 3.4).

\* When there are no packets transmitted an empty graph is plotted (Z equals zero).

\* Sometimes when DIRECT CONNECTION option is ON (see 3.4) SUM OF NUMBER OF LOST PACKETS AT ALL THE NODES

graph can show higher values when PACKET TYPE option (see 7) is ON than if it's OFF. It means that

CURRENT NODE forwarded packet(s) directly to OTHER NODE and forwarded packet(s) with '-Id' field = -1

(see 2.1, 9.6) or forwarded packet(s) only with '-Id' field = -1.

OTHER NODE received some of them (if lost) both directly forwared and with '-Id' field = -1.

See 3.5 for details about some 3D graphs.

6. HISTOGRAMS

=============

\* histograms show frequency distribution

\* Each histogram has N containers where N=NUMBER OF HISTOGRAM INTERVALS.

\* Delays histograms show delays on X axis and number of packets (delays) on Y axis.

\* Delays between 2 nodes are calculated in the same way like in 2.4.

\* Processing times histograms show processing times on X axis and number of packets (processing times) on Y axis.

\* When USE SPECIFIED EDGES FOR HISTOGRAMS option is off NUMBER OF HISTOGRAM INTERVALS (containers) is used.

In the other case specified egdes (in the field HIST. EDGES) are used. Only values inside the edges are counted,

e.g. for edges 0.03 0.05 0.07 values are counted between 0.03 and 0.05 (>=0.03 and <0.05), between 0.05 and 0.07 (>=0.05 and <0.07),

and the last container shows count of any values of X that match the last value of HIST. EDGES (=0.07).

To plot value count e.g. greater than 0.05 (>=0.05) type 0.05 inf in the HIST. EDGES field.

To plot value count e.g. lower than 0.05 (<0.05) type 0 0.05 in the HIST. EDGES field.

7. OTHER OPTIONS

================

<-> button - switches between Current and Other node

CURRENT NODE - current node number

END TIME - time interval end (see 3.3)

FLOW ID - flow identificator (see 3.15 for details)

HIST. EDGES - histogram edges (see 3.7 for details)

NUMBER OF HISTOGRAM INTERVALS - number of histogram containers

OTHER NODE - other node number

PACKET TYPE - enables calculations for selected packet types (selected: +, deselected: -)

to select/deselect a packet type choose it from the list

all the types are deselected by default

if this options is not checked all the types are used in calculations

PACKET SIZE - enables calculations for selected packet sizes (selected: +, deselected: -)

to select/deselect a packet size choose it from the list

all the types are deselected by default

if this options is not checked all the sizes are used in calculations

SELECT/DESELECT ALL SIZES - selects or deselects all packets sizes from PACKET SIZE list

SOURCE/DESTINATION TRACE LEVEL - trace level at source/destination node used for End2End delays and some jitter calculations

(see 2.3, 2.4, 4)

START TIME - time interval beginning (see 3.3)

TIME INTERVAL LENGTH - for throughput graphs (see 4. 2D Graphs)

TITLE - sets graph title

X, Y, Z AXIS LABEL - sets labels for the axes

8. SHORTCUTS

============

Shortcuts are used in network information menu or graphs legend.

ACK: <acknowledge packet type> (for RTT)

CN: <current node number>

DC: <direct connection>

DTL: <destination trace level>

ET: <end time>

FID: <flow ID>

HISTEDGES: <histogram edges>

HISTINT: <number of histogram intervals>

IDx1: <count packets IDs only once is on> (see 3.5)

LSX: <log scaling on X axis>

LSY: <log scaling on Y axis>

LSZ: <log scaling on Z axis>

MARKPOINTS: <marks plotted data points with circles>

MAJORGRID: <adds major grid lines to the axes>

MINORGRID: <adds minor grid lines to the axes>

N/A: <not available> (see 2.4)

node: <node number>

ON: <other node number>

PID: <packet ID>

PT: <packet type>

PS: <packet size>

[sec]: <seconds>

seq#: <sequence number>

SPAK: <sent packet type> (for RTT)

SPID: <sent packet ID> (for RTT)

ST: <start time>

STL: <source trace level>

TIL: <time interval length> (for throughput graphs)

TM: <turbo mode>

X: <description of X axis>

Y: <description of Y axis>

9. SUPPORTED FILE FORMATS

=========================

\* Trace graph supports all NS trace file formats (one wired, two wireless, two wired+wireless) except http trace format.

Examples of these formats are shown below. Lines are copied from some files randomly.

Trace graph also has it's own trace file format. You can convert your own trace files into Trace graph

file format if your trace files are different from formats described in 9.1, 9.2, 9.3, 9.4, 9.5. See chapter 9.6 for details.

\* Trace graph reads trace files in wireless format (see 9.2) with HEXADECIMAL nodes numbers in the 11th column

('-Ms' field in new trace file format, see 9.3, 9.6). It converts all the numbers to decimal

and additionally creates 'temp' file in Trace graph format (see 9.6) in case some of the numbers can

be decimal before conversion. You can change these numbers in the 8th column (see 9.6) in 'temp' file yourself.

For example, a line before conversion:

s 5.000075000 \_10\_ MAC --- 0 AODV 104 [0 ffffffff a 800] ------- [10:255 -1:255 1 0] [0x2 0 1 [11 0] [10 1]] (REQUEST)

and after hex to dec conversion (a=10, 8th column):

s 5.000075000 10 MAC 0 AODV 104 10 10 -1 0 -1

NOTE! Header 'hex' has to be added to a trace file in format 9.2 to turn hex to dec conversion on. For example:

hex

M 0.0 nn 20 x 670 y 670 rp AODV

\* Files with IP addresses like e.g. 1.2.3.0 or 4123567:1 must have 'ip' header (doesn't concern Trace graph format, because it has no IPs),

for example:

ip

+ 1 1 0 cbr 1000 ------- 2 0.1.0.2 1.0.1.2 0 0

All the IPs must be converted into nodes numbers before loading a trace file.

To get all the IPs from a trace file you can type '-ip' after file name, e.g.

trgraph c:\out.tr -ip

You can also get IPs within a time interval (see 1.1, 3.6), e.g.

trgraph c:\out.tr -ip 1.1 2.3

IPs are saved to a file which name has the following format: trace file name + '.ip' extension.

If time interval is specified the file name format is e.g.: trace file name + 'ST\_1.1' + 'ET\_2.3' + '.ip' extension (see 8).

If a trace file is loaded from the File menu the file with IPs is generated automatically if doesn't exist.

You have to define relations between nodes numbers and IPs in the saved file with IPs. Below we have an example of such a file:

0.1.0.2 1:2

0.3.0.1 0:1

1.0.1.2 2:2

1.0.3.1 3:1

2048:2 5:2

4194305 6

4194305:2 6:2

4194307:1 4:1

6144:1 7:1

You've got to create the second column with node and (optionally) port number.

For wireless format (see 9.2) and wired + wireless format (see 9.4) there have to be ':' between node and port number.

For wired format (see 9.1), new trace file format (see 9.3) and wired + new trace file format (see 9.5) there have to be '.'

between node and port number. When IP file is created properly trace file can be loaded. Trace graph converts all the IPs into

nodes numbers line after line (strings are replaced) and writes an output trace file which name format is: trace file format

without extension + 'no\_ip.tr'. When you have the file with IPs you can do the conversion in another way - it can be much faster.

Then trace file with changed IPs is converted to Trace graph format, saved in 'temp' file and loaded.

NOTE! Because IPs are converted in the order they appear in the file (with '.ip' extension) sometimes you've got to remove some IPs

or change their order to avoid replacing other strings in a line or already replaced IPs.

For example first line must be removed because it's not neccessary:

1:0

0.1.0.2

0.3.0.1

\* Trace graph SKIPS LINES (formats 9.2, 9.3, 9.4, 9.5) WHICH DON'T CONTAIN ALL THE NECESSARY INFORMATION

(see columns description in 9.6) or CONVERTS THEM INTO Trace graph trace format if it's possible.

9.1. Wired

----------

+ 0.1 8 1 tcp 40 ------- 2 8.0 7.0 0 0

- 0.1 8 1 tcp 40 ------- 2 8.0 7.0 0 0

r 0.11016 8 1 tcp 40 ------- 2 8.0 7.0 0 0

9.2. Wireless

-------------

M 0.00000 0 (212.25, 215.07, 0.00), (392.36, 331.50), 13.75

s 82.613915213 \_2\_ RTR --- 3 DSR 24 [0 0 0 0] ------- [2:255 3:255 32 0] 1 [1 2] [0 2 0 0->0] [0 0 0 0->0]

r 82.620724496 \_5\_ RTR --- 4 DSR 44 [a2 5 3 800] ------- [3:255 2:255 255 5] 3 [0 2] [1 2 3 2->3] [0 0 0 0->0]

f 82.621436060 \_0\_ RTR --- 3 DSR 44 [0 ffffffff 5 800] ------- [2:255 3:255 32 0] 3 [1 2] [0 2 0 0->0] [0 0 0 0->0]

s 117.939882761 \_2\_ RTR --- 242 cbr 540 [0 0 0 0] ------- [2:1 4:0 32 4] [89] 0 1

r 117.942740948 \_4\_ RTR --- 242 cbr 540 [a2 4 2 800] ------- [2:1 4:0 32 4] [89] 1 1

9.3. New trace file format (wireless)

-------------------------------------

s -t 0.267662078 -Hs 0 -Hd -1 -Ni 0 -Nx 5.00 -Ny 2.00 -Nz 0.00 -Ne -1.000000 -Nl RTR -Nw --- -Ma 0 -Md 0 -Ms 0 -Mt 0 -Is 0.255 -Id -1.255 -It message -Il 32 -If 0 -Ii 0 -Iv 32

s -t 1.511681090 -Hs 1 -Hd -1 -Ni 1 -Nx 390.00 -Ny 385.00 -Nz 0.00 -Ne -1.000000 -Nl RTR -Nw --- -Ma 0 -Md 0 -Ms 0 -Mt 0 -Is 1.255 -Id -1.255 -It message -Il 32 -If 0 -Ii 1 -Iv 32

M 10.00000 0 (5.00, 2.00, 0.00), (20.00, 18.00), 1.00

s -t 10.000000000 -Hs 0 -Hd -2 -Ni 0 -Nx 5.00 -Ny 2.00 -Nz 0.00 -Ne -1.000000 -Nl AGT -Nw --- -Ma 0 -Md 0 -Ms 0 -Mt 0 -Is 0.0 -Id 1.0 -It tcp -Il 40 -If 2 -Ii 2 -Iv 32 -Pn tcp -Ps 0 -Pa 0 -Pf 0 -Po 0

r -t 10.000000000 -Hs 0 -Hd -2 -Ni 0 -Nx 5.00 -Ny 2.00 -Nz 0.00 -Ne -1.000000 -Nl RTR -Nw --- -Ma 0 -Md 0 -Ms 0 -Mt 0 -Is 0.0 -Id 1.0 -It tcp -Il 40 -If 2 -Ii 2 -Iv 32 -Pn tcp -Ps 0 -Pa 0 -Pf 0 -Po 0

NOTE! AGT and RTR and MAC or AGT and RTR trace levels should be ON in wireless simulations because

calculations results can be wrong when some of the trace levels are OFF.

NOTE! It's better to use old wireless format (9.2) than new trace format (faster file loading).

9.4. Wired-wireless

-------------------

A trace file in this format must have 'mixed12' header, for example:

mixed12 ip

+ 1 1 0 cbr 1000 ------- 2 0.1.0.2 1.0.1.2 0 0

- 1 1 0 cbr 1000 ------- 2 0.1.0.2 1.0.1.2 0 0

s 1.000000000 \_7\_ AGT --- 1 cbr 1000 [0 0 0 0] ------- [4194307:1 6144:1 32 0] [0] 0 0

s 1.001000000 \_7\_ RTR --- 1 cbr 1000 [0 0 0 0] ------- [4194307:1 6144:1 32 0] [0] 0 0

s 1.010000000 \_7\_ MAC --- 1 cbr 1000 [0 0 0 0] ------- [4194307:1 6144:1 32 0] [0] 0 0

NOTE! AGT, RTR and MAC trace levels have to be ON. See 9 for notes about 'ip' in the file header.

9.5. Wired-new trace file format

--------------------------------

A trace file in this format must have 'mixed13' header, for example:

mixed13 ip

+ 1 1 0 cbr 1000 ------- 2 0.1.0.2 1.0.1.2 0 0

- 1 1 0 cbr 1000 ------- 2 0.1.0.2 1.0.1.2 0 0

s -t 1.000000000 -Hs 7 -Hd -2 -Ni 7 -Nx 258.00 -Ny 244.00 -Nz 0.00 -Ne -1.000000 -Nl AGT -Nw --- -Ma 0 -Md 0 -Ms 0 -Mt 0 -Is 4194307.1 -Id 6144.1 -It cbr -Il 1000 -If 5 -Ii 1 -Iv 32 -Pn cbr -Pi 0 -Pf 0 -Po 0

s -t 1.001000000 -Hs 7 -Hd -2 -Ni 7 -Nx 258.00 -Ny 244.00 -Nz 0.00 -Ne -1.000000 -Nl RTR -Nw --- -Ma 0 -Md 0 -Ms 0 -Mt 0 -Is 4194307.1 -Id 6144.1 -It cbr -Il 1000 -If 5 -Ii 1 -Iv 32 -Pn cbr -Pi 0 -Pf 0 -Po 0

s -t 1.010000000 -Hs 7 -Hd -2 -Ni 7 -Nx 258.00 -Ny 244.00 -Nz 0.00 -Ne -1.000000 -Nl MAC -Nw --- -Ma 0 -Md 0 -Ms 0 -Mt 0 -Is 4194307.1 -Id 6144.1 -It cbr -Il 1000 -If 5 -Ii 1 -Iv 32 -Pn cbr -Pi 0 -Pf 0 -Po 0

NOTE! AGT, RTR and MAC trace levels have to be ON. See 9 for notes about 'ip' in the file header.

9.6. Converting your own trace files formats into Trace graph trace file format

---------------------------------------------------------------------------------

Trace graph trace file format has 12 columns (fields tags in brackets are from the file format described in 9.3):

1. event (s, r, f, d)

2. event time (-t)

3. current node number (-Ni)

4. trace level (-Nl) (AGT, RTR, MAC, IFQ)

5. packet unique ID (-Ii)

6. packet type (-It) plus 15-length(packet type) spaces before packet size

7. packet size (-Il)

8. other node number (-Ms)

9. hop from (-Is)

10. hop to (-Id)

11. next node number (-Hd)

12. sequence number (-Pi or -Ps, equals -1 if not present)

A file in this format must have the following header: tracegraph.

For example we have 2 first lines of a Trace graph trace file:

tracegraph

s 0.267662078 0 RTR 0 message 32 0 0 -1 -1 -1

Below we have 3 example lines of formats described in 9.2, 9.3 and 9.6.

The lines are from the same simulation, so trace formats differences can be seen.

s 0.267662078 \_0\_ RTR --- 0 message 32 [0 0 0 0] ------- [0:255 -1:255 32 0]

s -t 0.267662078 -Hs 0 -Hd -1 -Ni 0 -Nx 5.00 -Ny 2.00 -Nz 0.00 -Ne -1.000000 -Nl RTR -Nw --- -Ma 0 -Md 0 -Ms 0 -Mt 0 -Is 0.255 -Id -1.255 -It message -Il 32 -If 0 -Ii 0 -Iv 32

s 0.267662078 0 RTR 0 message 32 0 0 -1 -1 -1

Another example 3 lines:

D 78.470313904 \_0\_ IFQ ARP 2 tcp 80 [0 0 0 800] ------- [0:0 1:0 32 1] [0 0] 0 0

d -t 78.470313904 -Hs 0 -Hd 1 -Ni 0 -Nx 20.00 -Ny 18.00 -Nz 0.00 -Ne -1.000000 -Nl IFQ -Nw ARP -Ma 0 -Md 0 -Ms 0 -Mt 800 -Is 0.0 -Id 1.0 -It tcp -Il 80 -If 2 -Ii 2 -Iv 32 -Pn tcp -Ps 0 -Pa 0 -Pf 0 -Po 0

d 78.470313904 0 IFQ 2 tcp 80 0 0 1 1 0

As for wired format to Trace graph format conversion '+' must be replaced by 's' (4th column in Trace graph format=AGT, 8th column=0,

11th column=0) or 'r' (if '+' after 'r' for the same packet at the same node, 4th column=RTR, 8th column=-1, 11th column=4th column

in wired format), '-' must be replaced by 's' (4th column=MAC, 8th column=0, 11th column=0) or 'f' (4th column=RTR, 8th column=0,

11th column=4th column in wired format). For 'r' event 3rd column=4th column in wired format, 4th column=MAC, 8th column=3rd column

in wired format, 11th column=0. For 'd' event (4th column=RTR, 8th column=0, 11th column=4th column in wired format).

For example before conversion:

+ 1.00 1 0 cbr 1000 ------- 2 1.2 2.2 0 0

- 1.00 1 0 cbr 1000 ------- 2 1.2 2.2 0 0

after conversion:

s 1.00 1 AGT 0 cbr 1000 0 1.2 2.2 0 0

s 1.00 1 MAC 0 cbr 1000 0 1.2 2.2 0 0

10. TRACE GRAPH SCRIPT FILE FORMAT

==================================

To process a trace or a mat file automatically a Trace graph script file has to be written.

This option is useful when there is a lot of trace files to analyse or when trace files are big (see 11).

All the analysis results (graphs and network information) are saved to text files (see 3.8, 3.9).

Script files can be processed from the command line, for example:

trgraph c:\trgraph\out.tr -script c:\samplescript.txt

trgraph c:\mat\out.mat -script samplescript.txt

trgraph out.tr -script samplescript.txt

An example script file:

SAVE MAT FILE: ON

SAVE GRAPHS TO JPEG: ON

SAVE GRAPHS STATISTICS: ON

GRAPHS LEGEND: ON

RESET OPTIONS: ON

CLOSE PROGRAM WHEN FINISHED: ON

GRAPHS:

IDs of all the generated packets,PT: cbr,ST: 1.1,ET: 3.3,MARKPOINTS,MINORGRID

%Cumulative sum of numbers of generated packets at current node,PT: tcp,CN: 2,ON: 3,DC

CN2ON delays frequency distribution,HISTEDGES: 0.01 0.02 0.03 0.04,PT: cbr,STL: RTR,DTL: MAC

NETWORK INFORMATION:

Simulation information,PT: cbr

Current node information,FID: 1

The first 6 lines have to be like the ones above but they don't have to be in the same order.

All the 6 options can be ON or OFF. Options:

SAVE MAT FILE - saves a trace file when loaded to mat file (see 1.2)

SAVE GRAPHS TO JPEG - saves all the plotted graphs to jpeg files not only to text files (see 1.3)

SAVE GRAPHS STATISTICS - saves all the plotted graphs statistics to text files (see 3.17)

GRAPHS LEGEND - enables/disables legend on the graphs

RESET OPTIONS - turns all the options (like Packet type, Flow ID, Other node, Time interval, etc.) off

after each processed line from the script file

CLOSE PROGRAM WHEN FINISHED - closes (or not) Trace graph when analysis is done

The 7th line has to contain 'GRAPHS'. All the lines with graphs and network information names and options have to be ended

with a comma (,). All the options (see 8. Shortcuts) also have to be separated with a comma. Options parameters

(e.g. 1.1 is a parameter for ST:) have to be separated with spaces. Options with parameters have to be ended with

a colon (:) (e.g. PT:). Options without parameters cannot be ended with a colon (:) (e.g. DC, MINORGRID).

Lines beginning with '%' are skipped. Graphs and network information names have to be the same as these in the menus.

There is a sample script file (samplescript.txt) in the 'doc' subdirectory.

11. Trace graph configuration file

==================================

Trace graph configuration file must have name trgraph.cfg. If the file doesn't exist or values are wrong default configuration is set.

Variables list:

PRECISION - number of precision fields for the calculations results (range 1 - 16),

default value is 10

SPLIT - small vector length for splitting big vectors to speed up delays, jitter, RTT and file loading calculations

(range 100 - 100000), on my computer the best value is around 2500 (default value)

REMOVE TEMP FILE - temporary file in Trace graph format is removed after loading, option can be ON or OFF,

default value is ON

AUTOMATIC FORMAT DETECTION - enables (ON)/disables (OFF) automatic file format (see 9 for supported formats) detection,

when option is ON file headers like 'tracegraph', 'hex', 'mixed12', 'mixed13', 'ip', etc. (see 9) are not needed,

if option is OFF headers must be added to trace files,

default value is ON

MAXIMAL NUMBER OF LINES - maximal number of lines (greater than 99) to read for automatic file format detection,

if a format cannot be detected the number has to be increased or automatic detection has to be disabled,

default value is 1000, there is 'Maximal number of lines (...) has been processed' message after processing

number of lines set in the configuration file

12. SYSTEM REQUIREMENTS

=======================

I've checked Trace graph runs on a Pentium class machine with 32MB of RAM but it's very slow.

On my Celeron 366@525, 192MB, the speed is acceptable. Trace graph runs best in 1024x768 or

higher resolution. SYSTEM FONT SIZE HAS TO BE SET TO SMALL before running the program.

Matlab doesn't cope with larger fonts and some names are cut. It should be about 3 times free space

as a trace file size to load the trace file (doesn't concern mat files and trace files in Trace graph

format without a specified time interval). I don't know maximum trace file size that can be loaded

(I think it's less than 200MB). I only know that a 150MB trace file can be loaded.

NOTE! Loading trace files, delays, jitter, RTT and processing times calculations can take a long time.

13. AUTHOR CONTACT

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(if you email me and don't receive any answer it means my or your email hasn't been delivered so try ICQ)

ICQ UIN: 53167277

Network Simulator ns-2 web site: http://www.isi.edu/nsnam/ns/.

Matlab web site: http://www.mathworks.com.

Wroclaw University of Technology web site: http://www.pwr.wroc.pl.

Trace graph web site: http://www.geocities.com/tracegraph/.

Trace graph mirror web site: http://brylant.ists.pwr.wroc.pl/~jmalek/tracegraph.php.