

# TEACUP v0.4 - Command Reference

Sebastian Zander  
Centre for Advanced Internet Architectures, Technical Report 140314C  
Swinburne University of Technology  
Melbourne, Australia  
szander@swin.edu.au

## Abstract

This technical report lists all the TEACUP tasks implemented and their parameters.

## Index Terms

TCP, Testbed experiments

## I. INTRODUCTION

TEACUP<sup>1</sup> [1] is a software package designed to run TCP experiments. In this report we list all the tasks implemented by TEACUP v0.4 and their parameters.

The tasks are listed in alphabetical order. Each task is explained in its own sub section. For each task we list and explain all parameters. Note, that all task parameters are strings (as of Fabric version 1.8 and lower).

## II. ANALYSE\_ALL

This task computes Round Trip Time (RTT), TCP congestion window (CWND) and throughput statistics.

Parameter	Default Value	Explanation
exp_list	experiments_completed.txt	Specifies the file that contains the test ID list. Statistics will be computed for all experiments listed. Only used if test_id is an empty string.
min_values	'3'	Only data series with more than min_values data values are plotted.
omit_const	'0'	If set to '1' any data series that are constant for the the duration of the experiment are not plotted.
out_dir	''	Extracted data files and plots are generated in this directory. By default the files are generated in the directory where fab is executed.
replot_only	'0'	If set to '1' the data extraction is skipped and the plots are regenerated based on the data previously extracted.
resume_id	''	If a test ID is specified, the analysis will resume this test ID. The parameter implies that a list of test IDs is used, i.e. test_id is empty and exp_list points to a file of test IDs.
source_filter	''	Specify the sources or destinations to filter on. Metrics will only be plotted for the sources and destinations on the list. See [1] for how to specify the list
smoothed	'1'	If set to '1' (default) smoothed TCP RTTs are plotted. If set to '0' unsmoothed TCP RTT estimates are plotted and for SIFTR data the ERTT [2] estimates are plotted.
test_id	''	Specifies the test ID of the experiment to be analysed. If an empty string the test IDs will be read from exp_list.

<sup>1</sup> "TCP Experiment Automation Controlled Using Python"

### III. ANALYSE\_CMPEXP

This task allows to compare one of the metrics, such as RTT, CWND or throughput, for experiments with different settings.

Parameter	Default Value	Explanation
exp_list	experiments_completed.txt	Specifies the file that contains the test ID list. All listed experiments will be potentially included in the comparison. variables allows to further filter out experiments.
lnames	“	Semicolon-separated list of legend names to use for the flows filtered with source_filter. Must be of the same length as the source filter list.
metric	‘throughput’	The metric to use. Currently supported metrics are ‘throughput’, ‘sprtt’ or ‘tcprrt’.
min_values	‘3’	Only data series with more than min_values data values are plotted.
omit_const	‘0’	If set to ‘1’ any data series that are constant for the the duration of the experiment are not plotted.
out_dir	“	Extracted data files and plots are generated in this directory. By default the files are generated in the directory where fab is executed.
out_name	“	A user-defined string that is used as appendix for the generated plot file, it ca be used to describe the plot file.
ptype	‘box’	Specifies the type of plot. Must be either ‘box’, ‘median’ or ‘mean’.
res_dir	“	Directory that contains extracted data for the experiments. If this is an empty string, first analyse_all is executed before proceedings with generating the comparison plot.
smoothed	‘1’	If set to ‘1’ (default) smoothed TCP RTTs are plotted. If set to ‘0’ unsmoothed TCP RTT estimates are plotted and for SIFTR data the ERTT [2] estimates are plotted.
source_filter	“	Specify the sources or destinations to filter on. Metrics will only be plotted for the sources and destinations on the list. See [1] for how to specify the list
variables	“	Semicolon-separated list of the form <var>=<value>[;<var>=<value>]*, where <var> is an experiment variable name (the name as it appear in the file names) and value is a value. Only experiments where the variables listed had the values listed will be included in the comparison.
ymax	‘0’	By default (if ymax set to ‘0’) the maximum will be determined automatically. The parameter can be used to enforce a certain maximum, i.e. to generate different plots with the same scale.

### IV. ANALYSE\_CWND

This task extracts TCP CWND data and plots it over time.

Parameter	Default Value	Explanation
min_values	‘3’	Only data series with more than min_values data values are plotted.
omit_const	‘0’	If set to ‘1’ any data series that are constant for the the duration of the experiment are not plotted.

out_dir	“	Extracted data files and plots are generated in this directory. By default the files are generated in the directory where fab is executed.
replot_only	‘0’	If set to ‘1’ the data extraction is skipped and the plots are regenerated based on the data previously extracted.
source_filter	“	Specify the sources or destinations to filter on. Metrics will only be plotted for the sources and destinations on the list. See [1] for how to specify the list
test_id	“	Specifies the test ID of the experiment to be analysed. Must be specified.
ymax	‘0’	By default (if ymax set to ‘0’) the maximum will be determined automatically. The parameter can be used to enforce a certain maximum, i.e. to generate different plots with the same scale.

#### V. ANALYSE\_DASH\_GOODPUT

This task allows to compare the goodput of DASH-like flows over time.

Parameter	Default Value	Explanation
dash_log_list	“	Name of a file with a list of DASH logs (*_httperf_dash.log.gz), one name per line. For each log goodput is plotted over time. If this parameter is not specified, the list of DASH log files is set to all DASH log files for the specified experiment (test_id).
lnames	“	Semicolon-separated list of legend names to use for the flows filtered with source_filter. Must be of the same length as the number of DASH-like sources.
out_dir	“	Extracted data files and plots are generated in this directory. By default the files are generated in the directory where fab is executed.
replot_only	‘0’	If set to ‘1’ the data extraction is skipped and the plots are regenerated based on the data previously extracted.
test_id	“	Specifies the test ID of the experiment to be analysed.

#### VI. ANALYSE\_RTT

This task computes RTT using SPP [3], [4] and plots the RTT over time.

Parameter	Default Value	Explanation
min_values	‘3’	Only data series with more than min_values data values are plotted.
omit_const	‘0’	If set to ‘1’ any data series that are constant for the duration of the experiment are not plotted.
out_dir	“	Extracted data files and plots are generated in this directory. By default the files are generated in the directory where fab is executed.
replot_only	‘0’	If set to ‘1’ the data extraction is skipped and the plots are regenerated based on the data previously extracted.
source_filter	“	Specify the sources or destinations to filter on. Metrics will only be plotted for the sources and destinations on the list. See [1] for how to specify the list
test_id	“	Specifies the test ID of the experiment to be analysed. Must be specified.

udp_map	“	This parameter allows to specify a map that defines how to combine unidirectional UDP flows, as SPP needs bidirectional flows. The format is:  <ip1>:<port1>:<ip2>:<port2>[;<ip3>:<port3>:<ip4>:<port4>] Each entry specifies the two sources (in terms of IP address and port) that are then linked to each other and treated as a bidirectional flow. This parameter is useful if UDP flows are not symmetric, i.e. the sending and receiving ports differ.
ymax	‘0’	By default (if ymax set to ‘0’) the maximum will be determined automatically. The parameter can be used to enforce a certain maximum, i.e. to generate different plots with the same scale.

## VII. ANALYSE\_TCP\_RTT

This task extracts the TCP RTT estimate and plots the estimate over time.

Parameter	Default Value	Explanation
min_values	‘3’	Only data series with more than min_values data values are plotted.
omit_const	‘0’	If set to ‘1’ any data series that are constant for the the duration of the experiment are not plotted.
out_dir	“	Extracted data files and plots are generated in this directory. By default the files are generated in the directory where fab is executed.
replot_only	‘0’	If set to ‘1’ the data extraction is skipped and the plots are regenerated based on the data previously extracted.
smoothed	‘1’	If set to ‘1’ (default) smoothed TCP RTTs are plotted. If set to ‘0’ unsmoothed TCP RTT estimates are plotted and for SIFTR data the ERTT [2] estimates are plotted.
source_filter	“	Specify the sources or destinations to filter on. Metrics will only be plotted for the sources and destinations on the list. See [1] for how to specify the list
test_id	“	Specifies the test ID of the experiment to be analysed. Must be specified.
ymax	‘0’	By default (if ymax set to ‘0’) the maximum will be determined automatically. The parameter can be used to enforce a certain maximum, i.e. to generate different plots with the same scale.

## VIII. ANALYSE\_TCP\_STAT

This task allows to extract an arbitrary TCP statistic and plot that statistic over time.

Parameter	Default Value	Explanation
min_values	‘3’	Only data series with more than min_values data values are plotted.
omit_const	‘0’	If set to ‘1’ any data series that are constant for the the duration of the experiment are not plotted.
out_dir	“	Extracted data files and plots are generated in this directory. By default the files are generated in the directory where fab is executed.
replot_only	‘0’	If set to ‘1’ the data extraction is skipped and the plots are regenerated based on the data previously extracted.

siftr_index	'9'	Index (column number starting with 1) of the statistic in SIFTR log files.
source_filter	'	Specify the sources or destinations to filter on. Metrics will only be plotted for the sources and destinations on the list. See [1] for how to specify the list
test_id	'	Specifies the test ID of the experiment to be analysed. Must be specified.
web10g_index		Index (column number starting with 1) of the statistic in web10g log files.
ylabel	'	Y-axis label for the graph.
ymax	'0'	By default (if ymax set to '0') the maximum will be determined automatically. The parameter can be used to enforce a certain maximum, i.e. to generate different plots with the same scale.
yscaler	'1.0'	Scaling factor for the extracted values.

#### IX. ANALYSE\_THROUGHPUT

This task extracts the packet sizes from the tcpdump files and plots throughput over time.

Parameter	Default Value	Explanation
min_values	'3'	Only data series with more than min_values data values are plotted.
omit_const	'0'	If set to '1' any data series that are constant for the the duration of the experiment are not plotted.
out_dir	'	Extracted data files and plots are generated in this directory. By default the files are generated in the directory where fab is executed.
replot_only	'0'	If set to '1' the data extraction is skipped and the plots are regenerated based on the data previously extracted.
source_filter	'	Specify the sources or destinations to filter on. Metrics will only be plotted for the sources and destinations on the list. See [1] for how to specify the list
test_id	'	Specifies the test ID of the experiment to be analysed. Must be specified.
ymax	'0'	By default (if ymax set to '0') the maximum will be determined automatically. The parameter can be used to enforce a certain maximum, i.e. to generate different plots with the same scale.

#### X. AUTHORIZE\_KEY

This task can be used to append the current user's public RSA key to the ~/.ssh/authorized\_keys file of the remote user. The user can then login via SSH without having to enter a password. The task has no parameters.

#### XI. CHECK\_CONFIG

This task performs a number of sanity checks for the given config.py file. It will terminate with an error message if there is an error in the config file. Otherwise, it will terminate with an OK message. The task has no parameters.

## XII. CHECK\_CONNECTIVITY

This task checks the connectivity between each pair of hosts using ping. The task only checks connectivity on the test network, it does not check connectivity on the control network. The task has no parameters.

## XIII. CHECK\_HOST

The task checks if all necessary tools are installed on a host. If a required tool is missing the task will terminate with an error. The task has no parameters.

## XIV. COPY\_FILE

The task will copy a file from the local file system to the remote host(s). If hosts are not explicitly specified, the task will copy the file to all hosts listed in the config.py file including the router (TPCONF\_router plus TPCONF\_hosts). The file will be copied as the user env.user, which must be specified in config.py (or on the command line).

Parameter	Default Value	Explanation
file_name	''	Name of the file on the local file system.
remote_path	''	Path on the remote where the file shall be copied to.

## XV. EXEC\_CMD

The task will execute a command on the remote host(s). If hosts are not explicitly specified, the task will copy the file to all hosts listed in the config.py file including the router (TPCONF\_router plus TPCONF\_hosts).

Parameter	Default Value	Explanation
cmd	''	Command to be executed. Will be passed to sh -c.

## XVI. GET\_NETINT

This task will return the network interface name(s).

Parameter	Default Value	Explanation
int_no	'0'	The interface number starting with 0.
windump	'0'	On Windows there are two names: 1) the name Windows uses and 2) the name Windump uses. If this parameter is set to '0' the task will return the Windows name, if this parameter is set to '1' it will return the Windump name.

## XVII. GET\_NETMAC

This task returns the MAC address of a host's control network or experimental network network interface.

Parameter	Default Value	Explanation
internal_int	'0'	If set to '0' the MAC for the testbed interface is returned (works only for hosts but not the router). If set to '1' the MAC address of the control interface is returned.

### XVIII. GET\_TYPE

This task returns the type of host(s), e.g. 'Linux', 'FreeBSD' or 'CYGWIN'. The task has no parameters.

### XIX. INIT\_CC\_ALGO

This task configures the congestion control for a host.

Parameter	Default Value	Explanation
algo	'default'	The name of the algorithm. Currently, this can be 'newreno', 'cubic', 'cdg', 'htcp', 'vegas' on FreeBSD or Linux and 'compound' on Windows.

### XX. INIT\_ECN

This task enables or disables explicit congestion notification (ECN) for a host.

Parameter	Default Value	Explanation
ecn	'0'	If set to '0' ECN is disabled, if set to '1' ECN is enabled.

### XXI. INIT\_HOST

This task performs basic initialisation for a host (other than the router), including disabling the TCP host cache and disabling various NIC offloading mechanisms, such as TCP segmentation offloading (TSO). The task has no parameters.

### XXII. INIT\_HOST\_CUSTOM

This task executes custom initialisation commands on hosts based on the config.py settings. The task has no parameters.

### XXIII. INIT\_OS

This task initialises the OS on host(s), i.e. it reboots hosts into the desired OS.

Parameter	Default Value	Explanation
boot_timeout	'100'	Number of seconds to wait for host to reboot. After this timeout give up or power cycle host if do_power_cycle is set to '1'
do_power_cycle	'0'	If set to '0' do not power cycle. If set to '1' power cycle host if it does not come up after boot_timeout seconds.
file_prefix	''	Prefix for generated PXE configuration file.
force_reboot	'0'	If set to '0' host is not rebooted if the current OS equals the desired OS. If set to '1' the host is always rebooted.
os_list	''	Comma-separated list of OS names ('Linux', 'FreeBSD' or 'CYGWIN'), one name for each host to reboot. The order must be the same as the order of the hosts specified with the fab -H command line parameter.

## XXIV. INIT\_PIPE

This task configures a pipe on the router.

Parameter	Default Value	Explanation
attach_to_queue	''	This parameter works on Linux only! It allows to direct matching packets into an existing queue referenced by the specified queue ID (counter), but to emulate flow-specific delay/loss (different from the delay and loss of other traffic going through the same queue). If attach_to_queue is specified, the matching traffic will go through the already existing queue but the emulated delay/loss is set by the current init_pipe.
bidir	'0'	If set to '0' the pipe is unidirectional (packets going from source to dest only). If set to '1' the pipe is bidirectional (packets going from source to dest and packets going from dest to source). Note that in the bidirectional case there are completely different buffers in both directions.
counter	'1'	Unique ID of pipe/queue (must be an integer).
delay	''	Emulated delay in milliseconds. By default if empty string, the emulated delay is zero.
dest		Destination IP or destination network (<ip>[/<prefix>]). Must be specified.
loss	''	Emulated packet loss rate. By default if empty string, the emulated loss rate is zero.
queue_disc	''	The queuing discipline / AQM mechanism used. This can be the same of any of the queuing disciplines supported by Linux, such as 'fq_codel', 'codel', 'red', 'choke', 'pfifo', 'pie' etc. On FreeBSD the only queuing disciplines available are 'fifo' and 'red'. For compatibility, with FreeBSD one can specify 'fifo' on Linux, which is mapped to 'pfifo' ('pfifo' is the default for HTB classes, which we use for rate limiting). Must be specified explicitly.
queue_disc_params	''	String of AQM parameters passed unchanged to Linux tc or FreeBSD Dummynet.
queue_size	''	Queue size in packets or bytes (depending on AQM used). Can be set to 'bdp' which will set the size according to the nominal BDP. If 'bdp' is specified and queue_size must be in packets, then the BDP size is configured based on the assumption that the average packet length is 600 bytes. The default depends on the operating system and possible also on the queueing discipline; hence this should be explicitly specified.
queue_size_mult	'1.0'	A multiplier for queue size. This should only be used if queue_size if set to 'bdp'. This allows to vary the queue size in multiples of the nominal BDP.
rate	''	Rate limit. Must be specified in bytes or with unit specifiers allowed by Linux tc or FreeBSD Dummynet. For example, Linux tc allows to specify 'kbit' or 'mbit'.



rtt	“	Emulated RTT in milliseconds. This parameter only needs to be specified if queue_size is set to ‘bdp’ and the RTT is not 2·delay of the current pipe (e.g. if we set up asymmetric delay with attach_to_queue).
source	“	Source IP or source network (<ip>[/<prefix>]). Must be specified.

#### XXV. INIT\_ROUTER

This task performs basic initialisation of the router, for example it sets up the root for queuing disciplines and disables NIC offloading mechanisms on Linux. The task has no parameters.

#### XXVI. KILL\_OLD\_PROCESSES

This task kills any possible old processes on the host(s). The task has no parameters.

#### XXVII. LOG\_QUEUE\_STATS

This task log the queue statistics from the router.

Parameter	Default Value	Explanation
file_prefix	“	Prefix for generated log files.
local_dir	‘.’	Local directory where log files are stored.
remote_dir	“	Directory on the remote host where the log files are initially created and stored before they are copied and removed. By default if remote_dir is empty, the log files are created in the home directory of the user (env.user).

#### XXVIII. LOG\_SYSDATA

This task logs various information from the host(s), such as the output of uname, the list of currently running processes, the list of all sysctl variables.

Parameter	Default Value	Explanation
file_prefix	“	Prefix for generated log files.
local_dir	‘.’	Local directory where log files are stored.
remote_dir	“	Directory on the remote host where the log files are initially created and stored before they are copied and removed. By default if remote_dir is empty, the log files are created in the home directory of the user (env.user).

#### XXIX. POWER\_CYCLE

This task power cycles the host(s). It requires a config.py that specifies the power controller(s) for the host(s). The task has no parameters.

#### XXX. RUN\_EXPERIMENT\_MULTIPLE

This task runs a series of experiments based on the parameters to vary (specified in config.py).

Parameter	Default Value	Explanation
test_id	''	The test ID prefix used.
resume	'0'	If set to '0' do all experiments. If set to '1' do not repeat experiments that have been completed already according to experiments_completed.txt.

### XXXI. RUN\_EXPERIMENT\_SINGLE

This task runs a single experiment with the default parameters in config.py.

Parameter	Default Value	Explanation
test_id	''	The test ID prefix used.

### XXXII. SANITY\_CHECKS

This task executes the check\_host, check\_connectivity and kill\_old\_processes tasks for the host(s). The task has no parameters.

### XXXIII. SHOW\_PIPES

This task shows the current pipe setup and statistics on the router. The task has no parameters.

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