

LxTxViewer User Guide

Aug. 2016

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HOW TO SETUP LxTxViewer

* Computer Requirements

1. OS: Windows 2003 or later; Windows 7 or later recommended.
2. CPU: 2GHz, 2 core or more recommended.
3. Memory: 2GB or more free memory.

* LxTxViewer Components

1. LxTxViewer.exe: Main program.

2. ltx.trx: Linux program. ltx collects performance data on the linux server. To prevent security breach by malicious software masquerading as ltx program, ltx is transformed as ltx.trx by an encryption algorithm.

LxTxViewer.exe retransforms ltx.trx into original ltx file, and uploads this file to linux server. Any replacement of ltx.trx not transformed by the encryption algorithm (to compromise the linux server) will not function correctly.

This binary program is compiled in CentOS 4.0 as below:

```
Linux centos-4.0 2.6.9-5.0.3.EL #1 Sat Feb 19 15:25:58 CST 2005 x86_64 x86_64 x86_64 GNU/Linux  
ldd (GNU libc) 2.3.4
```

This linux version, and later linuxes are compatible.

LxTxViewer.exe uploads ltx to /tmp directory of the linux server, and executes it.

3. desc.txt: Text file used to display help description on the performance chart.

* Installation is not required

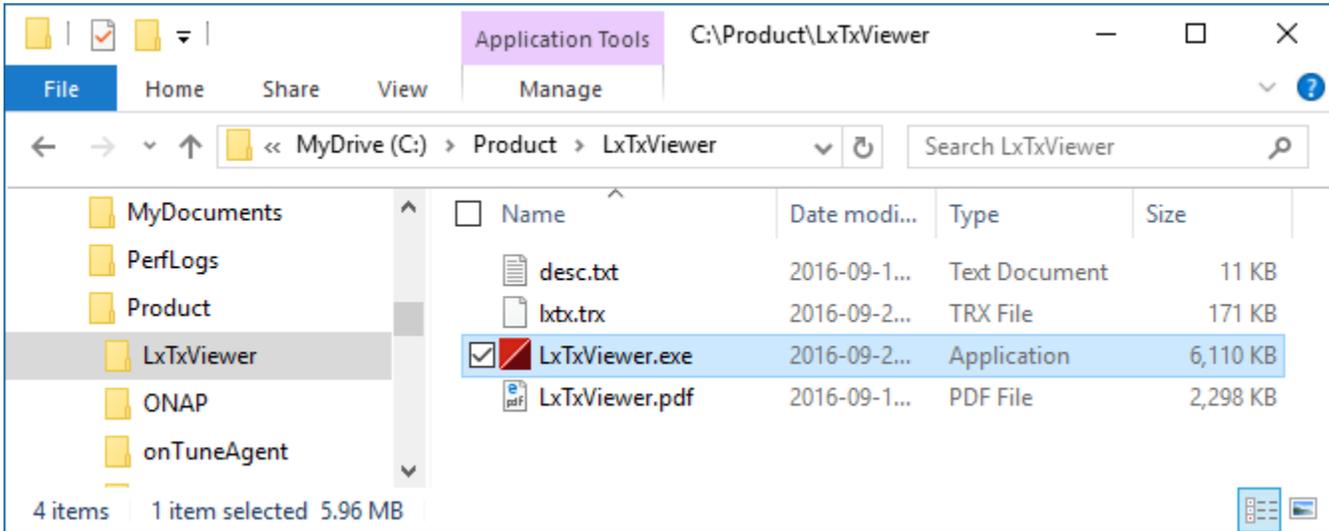
- Copy LxTxViewer.exe, ltx.trx and desc.txt to any folder(or extract LxTxViewer.zip) in your PC (or laptop) and run LxTxViewer.exe.

A note on Black color background preference:

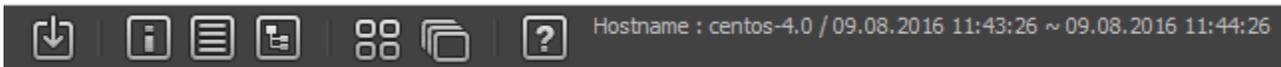
We prefer a black color background to a white color background's higher brightness in order to minimize eye strain.

STARTING LxTxViewer

1. Run LxTxViewer.exe

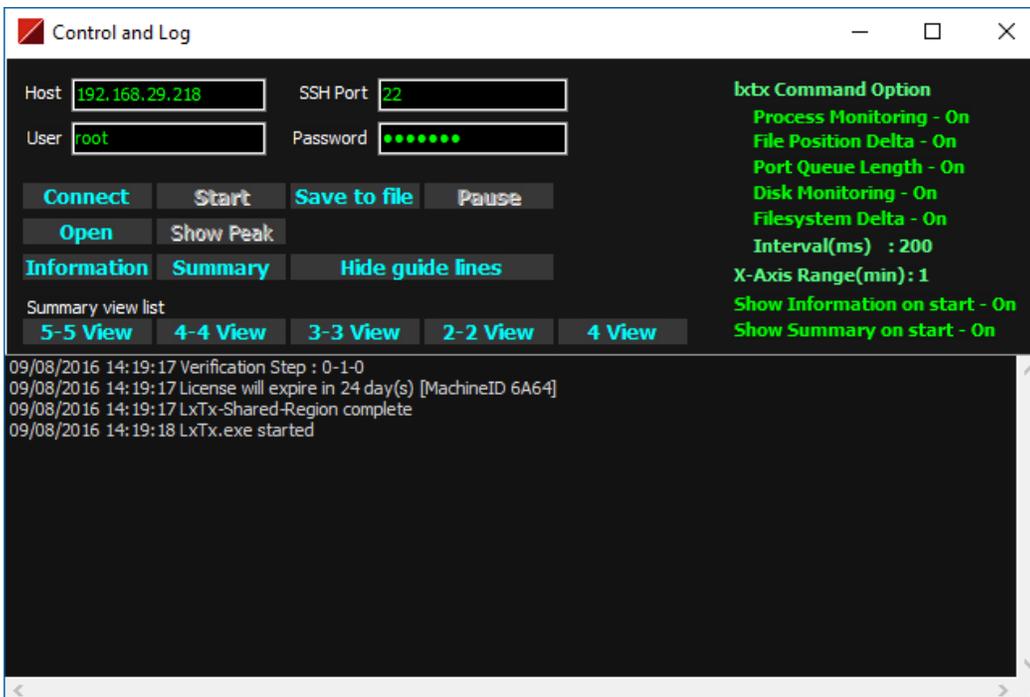


2. Tool bar



- Icons above from left to right : “Control and Log”; “Show server information view”; “Show summary chart view”; “Performance item selection”; “Window arrange to tile”; “Window arrange to cascade”, and “Help”.

i) Control and Log: Toggle button in order to open/close “Control and Log” window.



ii) Show server information view:

Column	Value
OS	Linux 3.10.0-229.14.1.el7.x86_64 x86_64
Distributor	CentOS
Description	CentOS Linux release 7.1.1503 (Core)
Release	7.1.1503
Model	VMware Virtual Platform
Serial	VMware-56 4d 67 17 85 a5 9a 22-fa ce a0 de a7 d7 30 8b
Logical Core	4
Clock(MHz)	3198
CPU Model	Intel(R) Core(TM) i7-4790S CPU @ 3.20GHz
H/T	N
Sibling/Core	1
Memory(MB)	979
Swap(MB)	3967
Current Time	08/30/2016 11:06:02
Boot Time	07/19/2016 09:36:42
Uptime	42 day(s) 01:29:20
TimeZone	-5 hour(s)
Page Size	4096
ClockTick	100
eno16777736	192.168.29.205 / 255.255.255.0 / 192.168.29.255 (IP / Netmask / Broadcast)
lo	127.0.0.1 / 255.0.0.0 / (IP / Netmask / Broadcast)

Copy to clipboard Close

iii) Show summary chart view:

The Summary dashboard displays the following components:

- Basic CPU%:** Line chart showing CPU usage for User, Sys, IOWait, and Steal. Includes a table with columns: Name, Last, Aver..., Maxi...

User	20.4	30.7	40.4
Sys	11.8	14.3	17.3
IOWait	0	0.00	0.44
Steal	0	0	0
User+Sys	32.3	45.0	56.0
User+Sys+Ste	32.3	45.0	56.0
Idle	67.7	55.0	67.7
- Basic Memory:** Line chart showing Usage%, Cached%, Buffers%, and Free% memory usage. Includes a table with columns: Name, Last, Aver..., Maxi...

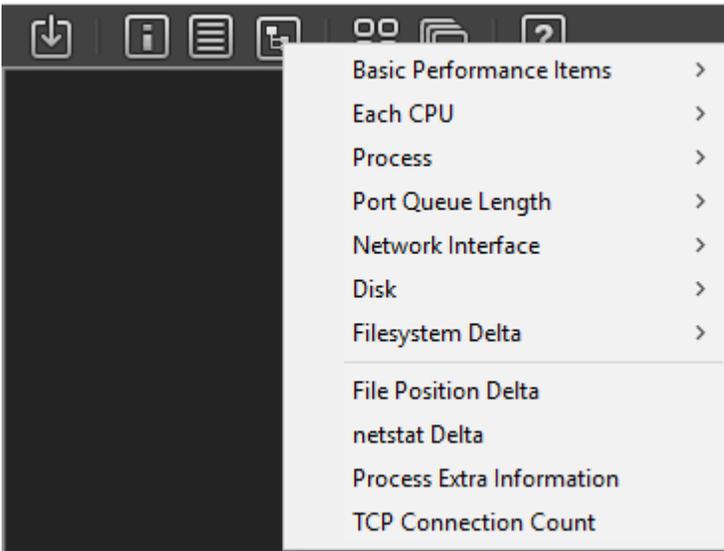
Usage%	69.8	69.8	69.9
Cached%	22.9	23.8	24.1
Buffers%	0.02	0.02	0.02
Free%	7.25	6.37	7.31
MemorySize	0.96G	0.96G	0.96G
- Disk Bytes per sec:** Line chart showing disk activity for Total, sda, and sda3. Includes a table with columns: Name, Last, Aver..., Maxi...

Total	0	58.7K	1.90M
sda	0	58.7K	1.90M
sda3	0	58.7K	1.90M
- NetI/F Bytes per sec:** Line chart showing network activity for Total and eno16777736. Includes a table with columns: Name, IP, Last, Aver...

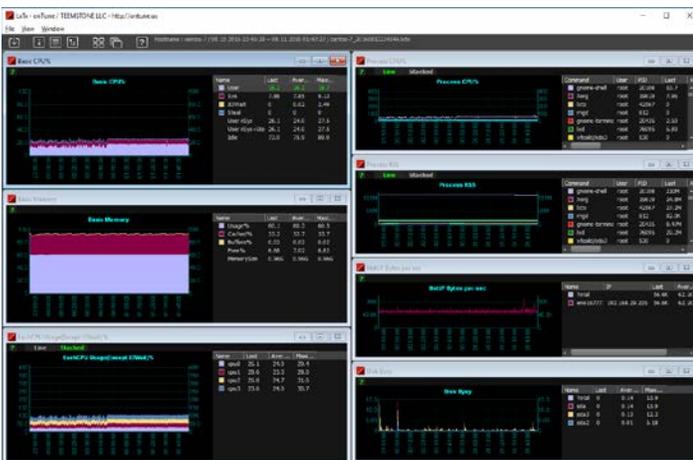
Total		5.99K	62.2K
eno16777736	192.168.29.205	5.99K	62.2K
- Process Extra Information:** Line chart showing process statistics for Process, Thread, Socket, Pipe, Anonymous, and File Opened. Includes a table with columns: Name, Last, Aver..., Maxi...

Process	448	448	448
Thread	616	615	616
Socket	674	674	674
Pipe	72.0	72.0	72.0
Anonymous	247	247	247
File Opened	437	438	442
- Process CPU%:** Line chart showing CPU usage for various processes.
- Process RSS:** Line chart showing Resident Set Size (RSS) for various processes.
- File Position Delta:** Line chart showing file position delta for various processes.
- Process Char/s:** Line chart showing character rate for various processes.
- TCP Connection Count:** Line chart showing TCP connection counts for various states.

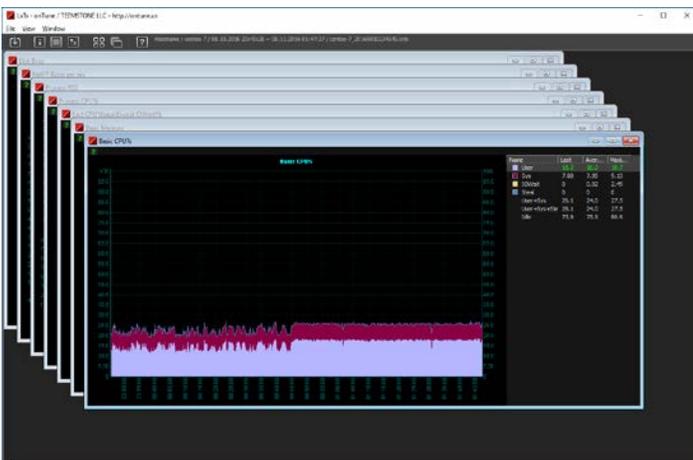
iv) Performance item selection: Popup menu below appears to let the user choose individual performance item.



v) Window arrange to tile: Charts will be tiled.

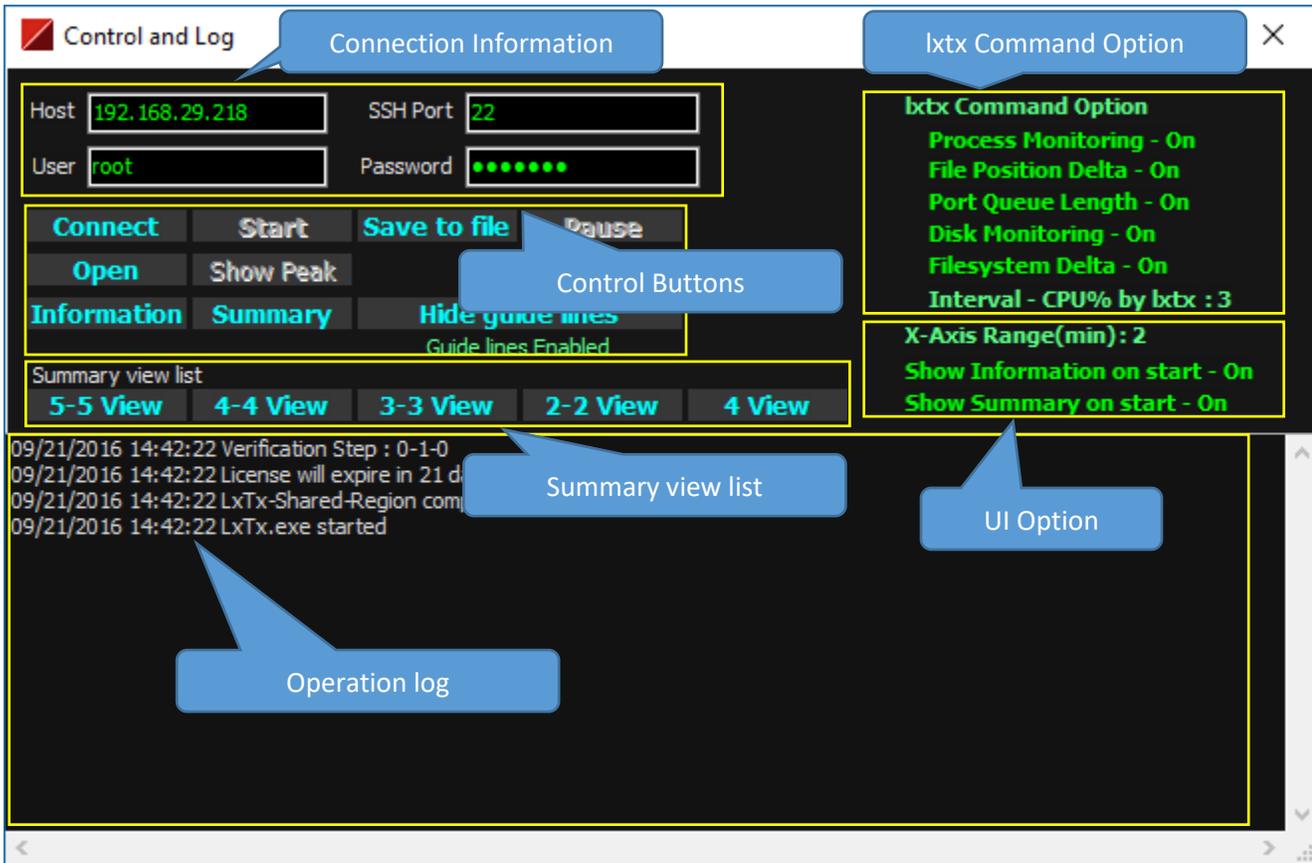


vi) Window arrange to cascade: Charts will be cascaded.



vii) Help: LxTxViewer manual (this document) is opened.

3. Control and Log

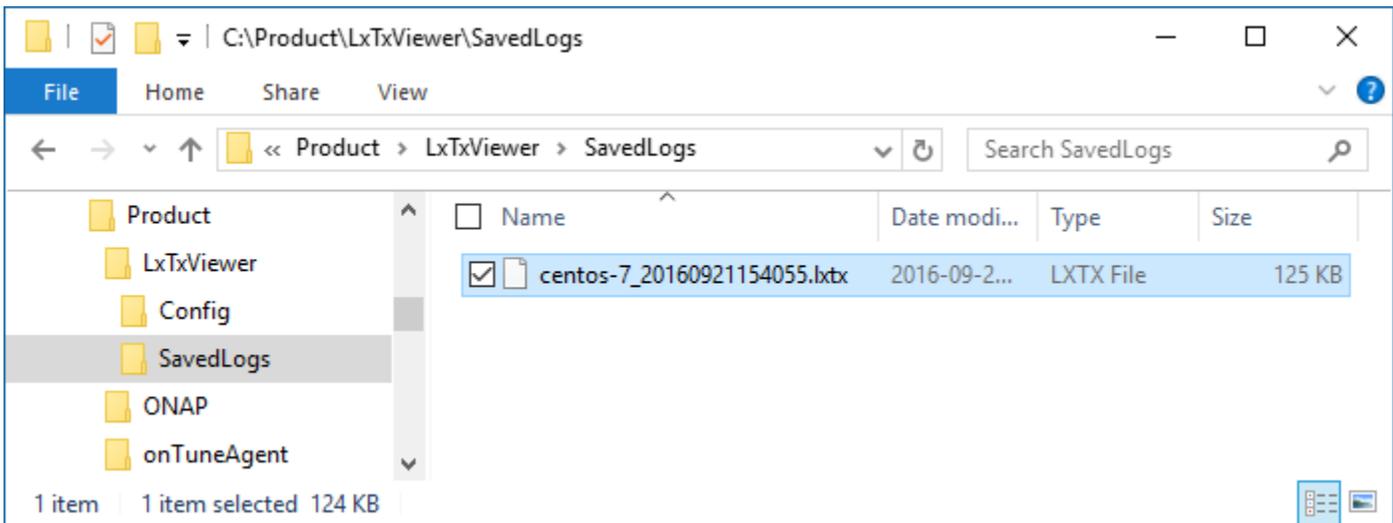


- Control Buttons

Connect: Toggle button to connect to the server described in the “Connection information” , or disconnect.

Start: Toggle button to start or stop lctx program in the linux server.

Save to file: Toggle button to save or stop monitoring data to file. File is saved in LxTxViewer\SavedLogs folder.



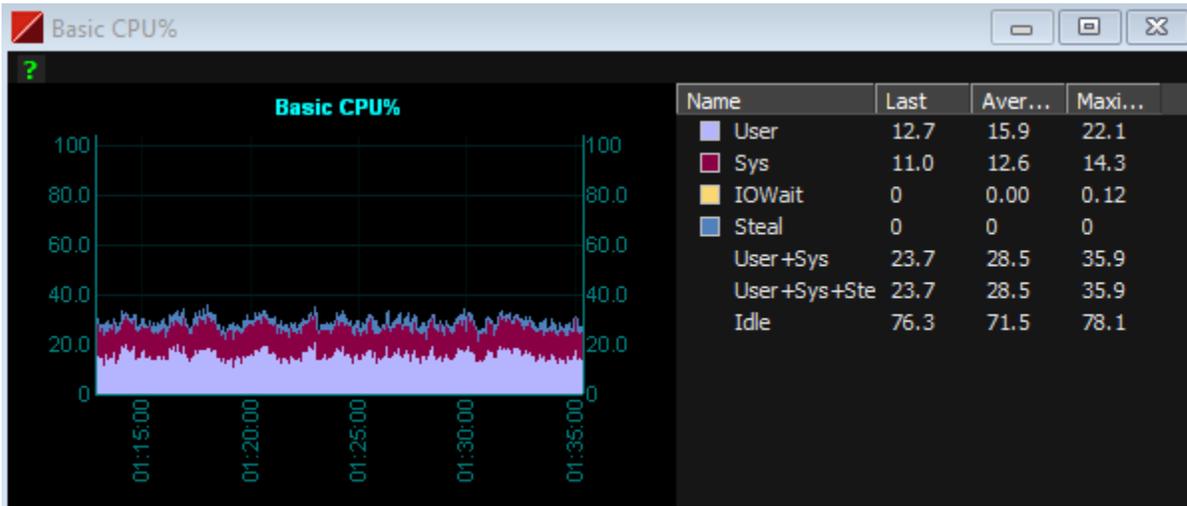
File is automatically split at approximately 15MB size.

Pause: Toggle button to pause/resume. “Save to file” is in effect while in “Pause mode”.

Open: Open saved file and show performance data in that file.

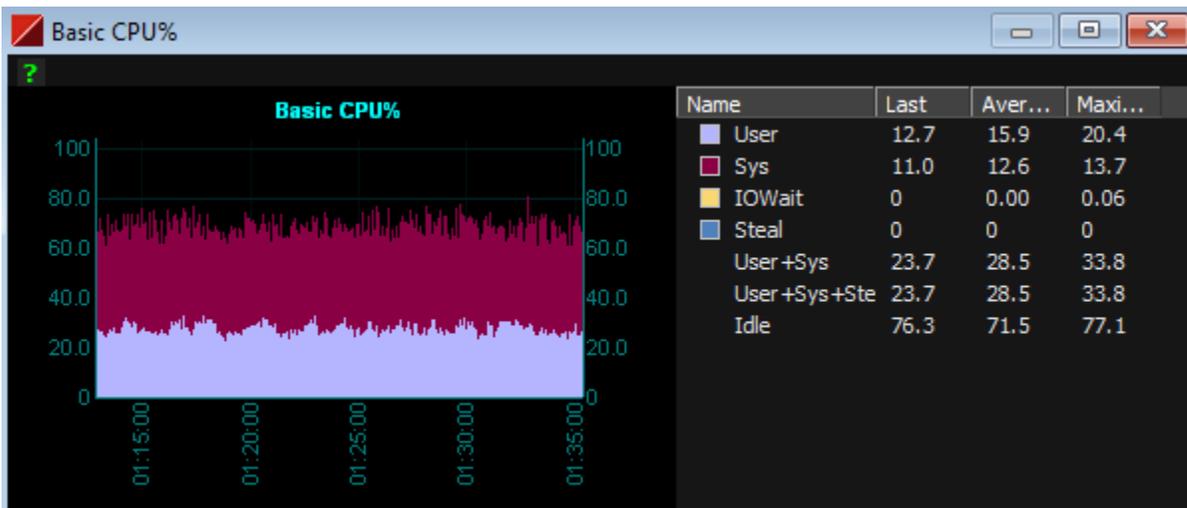
Show Peak: LxTxViewer uses scale factor to avoid unreadably dense trend line if there’s a lot of saved data.

The chart below uses scale factor 14, which means that 14 count of consequent data are averaged and displayed.



The scale factor can simplify dense trend line, but may hide peak data.

Show Peak shows a peak data per each averaged data as below:



This view helps user in selecting the peak point.

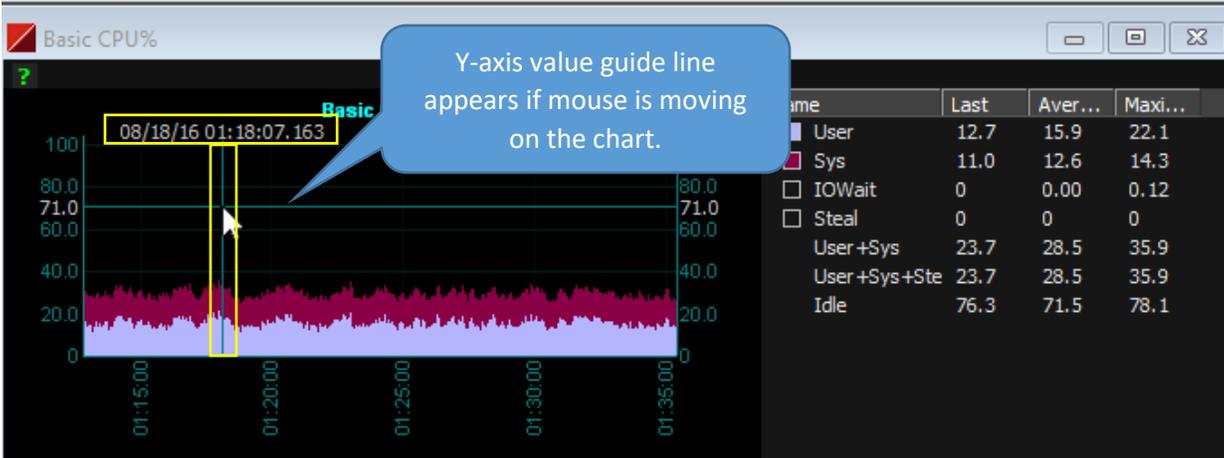
(user may also narrow the x-axis’s time line. Please refer to popup menu of chart.)

This view may be similar to a scale factor of 1.

Information: Same button as tool bar

Summary: Same button as tool bar

Hide guide lines: LxTxViewer shows simultaneous time guide-line for every chart as below: (Hides these.)

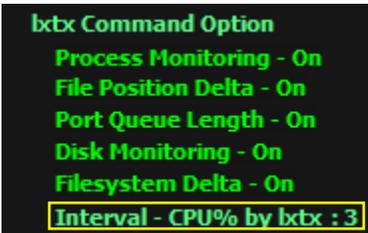


Connect Start Save to file Pause
Open Show Peak
Information Summary Hide guide lines
Guide lines Enabled

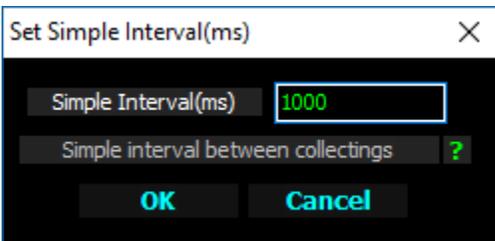
* **Guide lines Enabled:** Click this label to change to Enable/Disable. All guide lines disappear during Disable state.

- lxtx Command Option

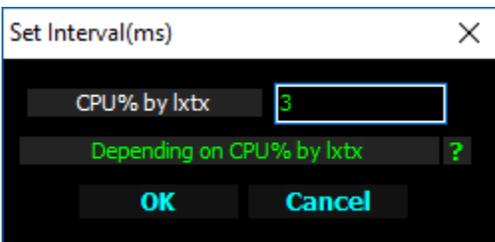
- i) Process Monitoring: Click on this label to turn on/off. Off means no process monitoring. (It may reduce majority of CPU consumption by lxtx in the linux server.)
- ii) File position Delta: Click on this label to turn on/off. Off means no File Position Delta data.
- iii) Port Queue Length: Click on this label to turn on/off. Off means no port queue length data.
- iv) Disk Monitoring: Click on this label to turn on/off. Off means no disk data.
- v) Filesystem Delta: Click on this label to turn on/off. Off means no Filesystem Delta data. Filesystem Delta shows how much change happens in each filesystem entry per second in terms of total size, free size, available size(to unprivileged user), total inode, and free inode.
- vi) Interval: Click on this label to change interval mode and value. There are two interval modes, "Simple interval" and "CPU% by lxtx". This value is used as monitoring interval of lxtx in linux server.



* "lxtx" means the performance monitoring program running in linux server.



* Simple interval: Specify fixed time interval between monitoring. Unit is milliseconds.

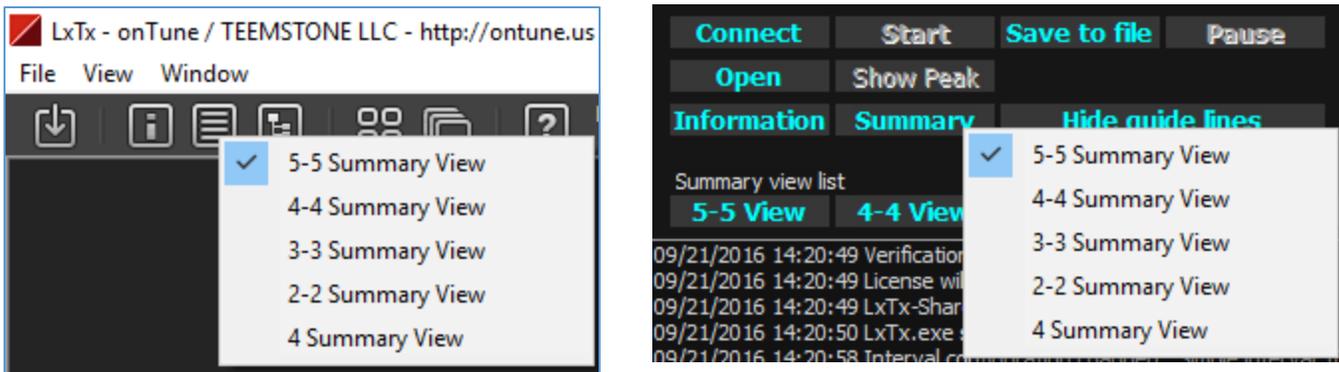


* CPU% by lxtx: lxtx adjusts interval to fit CPU usage% by lxtx to the value specified. lxtx increases its monitoring interval if CPU% became higher than the value, otherwise lxtx decrease its monitoring interval.

- UI Option

- i) X-Axis Range(min): X-axis time line range(End time - Start time) of charts.
- ii) Show Information on start: Information view will automatically appear on monitoring start or open saved file.
- iii) Show Summary on start: Summary view will automatically appear on monitoring start or open saved file.

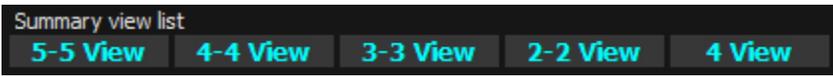
- Summary



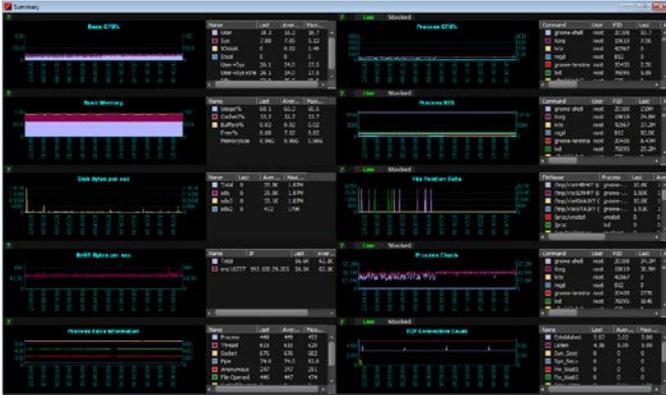
Summary buttons on tool bar, and “control and log” window have same function.

- Mouse right-click: Popup menu appears to let user select main summary view. The selected summary view will appear when summary button is clicked.
- Mouse left-click(normal click): Main summary view(selected as above) appears.

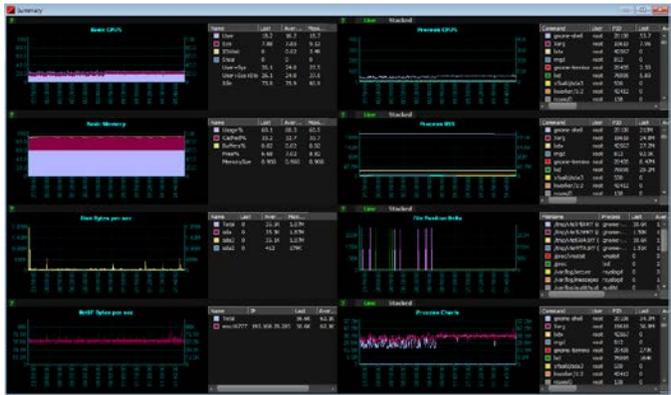
- Summary view list: User may open additional summary views.



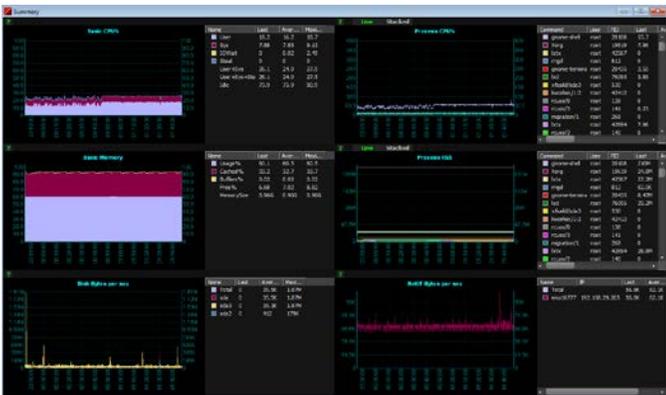
* 5-5 View:



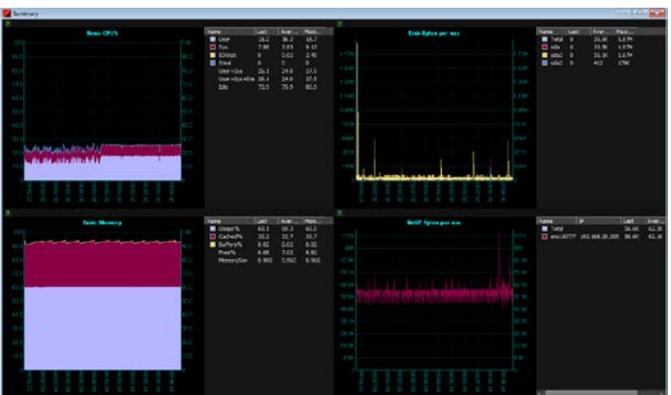
* 4-4 View:



* 3-3 View:



* 2-2 View:

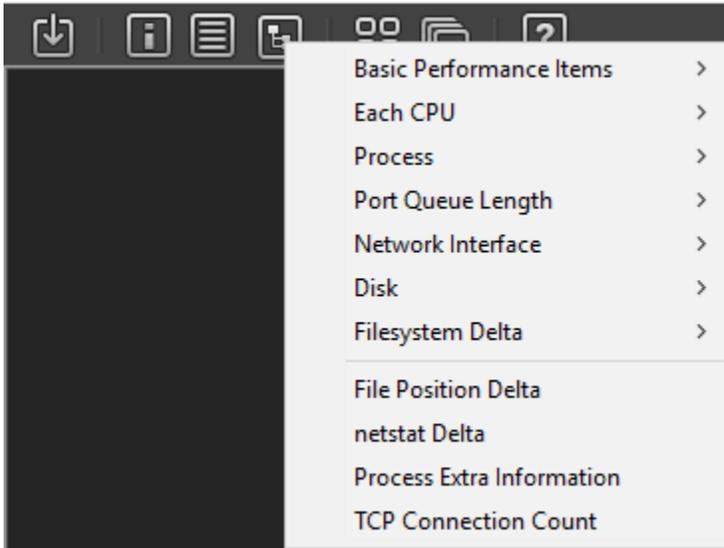


* 4 View



4. How to choose individual performance items

Click “Performance item selection” button on the tool bar.



Basic Performance Item (/proc/stat, /proc/meminfo, /proc/vmstat)

- CPU

CPU consists of USER, SYS, WAIT, IDLE, and STEAL

USER: including nice value.

SYS: including irq(Time servicing interrupts) and softirq(Time servicing soft irqs) values.

STEAL: This is the time spent in other operating systems when running in a virtualized environment. (from Linux 2.6.11)

- Queue

Running(RUN): Current number of threads in runnable state.

Blocked(BLCK): Current number of threads blocked waiting for I/O to complete.

- Kernel

Fork(FORK): Number of forks(process creations) per second.

Interrupt(INTR): Number of interrupts per second.

ContextSwitch(CTXT): Number of context switches per second.

- Memory

MemorySize(MEM): Total usable physical memory.

Usage%(MEMUSE): Current usage of physical memory by “(MemTotal - MemFree - Cached- Buffers)*100/MemTotal” among items of /proc/meminfo

Cached%(CACHE): In-memory cache for files read from the disk.

Buffers%(BUFFS): Relatively temporary storage for raw disk blocks.

Free%: (Total memory size - Usage - Cached - Buffers * 100) / (Total memory size)

SwapSize(SWP): Total size of available swap space.

SwapUsage(SWPUSE): Current usage of swap space by $“(TotalSwap - SwapFree)*100/TotalSwap”$

SwapHot(SWPHOT): Swap usage excluding SwapCached by $“(TotalSwap - SwapFree - SwapCached)*100/TotalSwap”$

SwapCached: Memory that once was swapped out, is swapped back in, but still also is in the swap file. (If memory pressure is high, these pages don't need to be swapped out again because they are already in the swap file. This saves I/O.)

- Virtual Memory

PgIn: Number of Bytes paged in per second. (Kbytes in vmstat command)

PgOut: Number of Bytes paged out per second. (Kbytes in vmstat command)

SwpIn: Number of pages swapped in per second. (From swap space to memory)

SwpOut: Number of pages swapped out per second. (From memory to swap space)

PgFree: Number of pages freed per second.

ScanK: Number of pages scanned by kswapd daemon per second by
 $“(pgscan_kswapd_dma+pgscan_kswapd_dma32+pgscan_kswapd_normal)/interval”$

ScanD: Number of pages scanned directly per second by
 $“(pgscan_direct_dma+pgscan_direct_dma32+pgscan_direct_normal)/interval”$

StealK: Number of pages placed on the free list by kswapd daemon per second by
 $“(pgsteal_kswapd_dma+pgsteal_kswapd_dma32+pgsteal_kswapd_normal)/interval”$

StealD: Number of pages placed on the free list directly per second by
 $“(pgsteal_direct_dma+pgsteal_direct_dma32+pgsteal_direct_normal)/interval”$

VmEff%: $(PgStlK+PgStlD) / (PgScanK+PgScanD)$, this shows how efficient steal and scan by virtual memory manager. Description from man page is below:

Calculated as $pgsteal / pgscan$, this is a metric of the efficiency of page reclaim. If it is near 100% then almost every page coming off the tail of the inactive list is being reaped. If it gets too low (e.g. less than 30%) then the virtual memory is having some difficulty. This field is displayed as zero if no pages have been scanned during the interval of time.

Rotated(Rotate): Pages rotated to tail of the LRU per second.

MajorFault(MajFlt): Number of major faults the system has made per second, those which have required loading a memory page from disk.

Process Performance Items (/proc/[PID]/stat, /proc/[PID]/status, /proc/[PID]/io, /proc/[PID]/cmdline)

CPU%: User%+Sys%. 100% means 1 core, and maximum is 800% if total core count is 8.

CPU-User%: Percentage of CPU used by the task while executing at the user level (application), with or without nice priority. Note that this field does NOT include time spent running a virtual processor.

CPU-Sys%: Percentage of CPU used by the task while executing at the system level (kernel).

Read Char per sec: characters read. The number of bytes which this task has caused to be read from storage. This is simply the sum of bytes which this process passed to read() and similar system calls. It includes things such as terminal I/O and is unaffected by whether or not actual physical disk I/O was required (the read might have been satisfied from pagecache).

Write Char per sec: characters written. The number of bytes which this task has caused, or shall cause to be written to disk. Similar caveats apply here as with read char.

Read SystemCall per sec: read syscalls. Attempt to count the number of read I/O operations, i.e. system calls such as read() and pread().

Write SystemCall per sec: write syscalls. Attempt to count the number of write I/O operations, i.e. system calls like write() and pwrite().

Read Bytes per sec: Number of bytes the task has caused to be read from disk per second.

Write Bytes per sec: Number of kilobytes the task has caused, or shall cause to be written to disk per second.

Minor Fault per sec: The number of minor faults the process has made which have not required loading a memory page from disk.

Major Fault per sec: The number of major faults the process has made which have required loading a memory page from disk.

Size: Virtual memory size.

Pinned(Pin): Pinned memory size. These are pages that can't be moved because something needs to directly access physical memory.

RSS: resident set size, the non-swapped physical memory that a task has used.

Data: Size of data segments.

Stack: Size of stack segments.

Lib: Shared library code size.

Swap: Swapped-out virtual memory size by anonymous private pages. shmem swap usage is not included.

Thread Count(THRD): Number of kernel threads owned by the process.

Network Interface

Read Bytes per sec: Total number of bytes incoming(received) per second.

Write Bytes per sec: Total number of bytes outgoing(transmitted) per second.

Read Packets per sec: Total number of packets incoming(received) per second.

Write Packets per sec: Total number of packets outgoing(transmitted) per second.

Read Errors per sec: Total number of bad packets received per second.

Write Errors per sec: Total number of bad packets transmitted per second.

Read Drops per sec: Total number of incoming(received) packets dropped per second.

Write Drops per sec: Total number of outgoing(transmitted) packets dropped per second.

Collisions per sec: Number of collisions per second while transmitting packets.

Disk (/proc/diskstat)

Busy: Percentage of elapsed time during which I/O requests were issued to the device (bandwidth utilization for the device). Device saturation occurs when this value is close to 100%.

Read Bytes per sec: Number of bytes read from the device.

Write Bytes per sec: Number of bytes written from the device.

Read Transfers per sec: Number of read transfers from the device.

Write Transfers per sec: Number of write transfers to the device.

Await: The average time (in milliseconds) for I/O requests issued to the device to be served. This includes the time spent by the requests in queue and the time spent servicing them.

Read Await: The average time (in milliseconds) for read requests issued to the device to be served. This includes the time spent by the requests in queue and the time spent servicing them.

Write Await: The average time (in milliseconds) for write requests issued to the device to be served. This includes the time spent by the requests in queue and the time spent servicing them.

Service Time: The average service time (in milliseconds) for I/O requests that were issued to the device.

Average Queue Length: The average queue length of the requests that were issued to the device.

Process Extra Information (/proc/[PID]/stat, /proc/[PID]/fd, /proc/[PID]/fdinfo)

Process: Total count of processes.

Thread: Total count of threads.

Socket: Total count of sockets which are opened by processes.

Pipe: Total count of pipes which are opened by processes.

Anonymous: Total count of anonymous inodes which are opened by processes.

File Opened: Total count of files which are opened by processes.

Port Queue Length (/proc/net/tcp, /proc/net/udp, /proc/[PID]/fd)

Receive Queue: Receive queue size in terms of kernel memory usage.

Transmit Queue: Transmit queue size in terms of kernel memory usage.

Process: Process which owns this port.

TCP Connection Count (/proc/net/tcp)

Established: Total number of TCP connections in Established state.

Listen: Total number of TCP connections in Listen state.

Syn_Sent: Total number of TCP connections in Syn_Sent state.

Syn_Recv: Total number of TCP connections in Syn_Receive state.

Fin_Wait1: Total number of TCP connections in Fin_Wait1 state.

Fin_Wait2: Total number of TCP connections in Fin_Wait2 state.

Time_Wait: Total number of TCP connections in Time_Wait state.

Close: Total number of TCP connections in Close state.

Close_Wait: Total number of TCP connections in Close_Wait state.

Last_Ack: Total number of TCP connections in Last_Ack state.

Closing: Total number of TCP connections in Closing state.

File Position Delta (/proc/[PID]/fd, /proc/[PID]/fdinfo)

Value(delta change between current and previous) indicating position of file opened by processes per second.

* This data show only the difference of a process' file descriptor's position between time interval.

* In case of sequential read or write, this data may correctly show file I/O. (although not guaranteed.)

netstat Delta (/proc/net/snmp, /proc/net/netstat)

Value(delta change between current and previous) of each item of netstat -s per second.

Filesystem (/etc/mtab, fsstatfs)

* There will be no changes (no delta data) if the file size is unchanged. (data in the file may change, e.g. DB data files.)

Total: Size of filesystem

Free: Free size of filesystem

Avail: Free size which is available to unprivileged user of filesystem

Total inode: Total file nodes capacity of filesystem

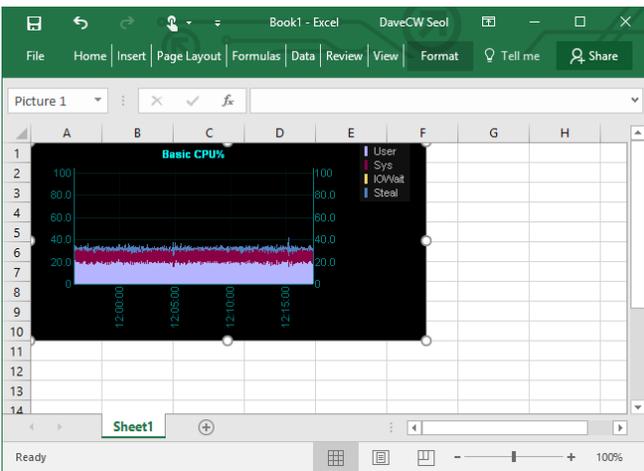
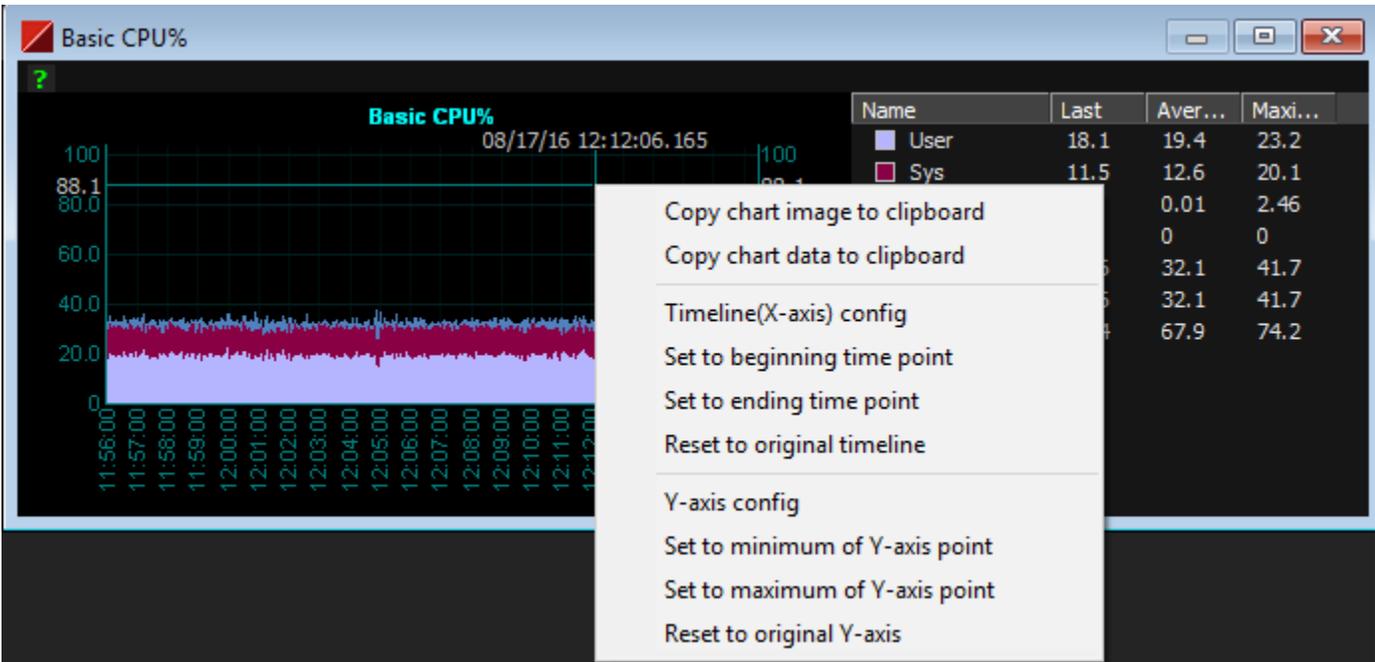
Free inode: Free file nodes count of filesystem

Use%: $100 - (\text{Free} / \text{Total}) * 100$

Use% (by avail): $100 - (\text{Avail} / \text{Total}) * 100$

Each delta value: $(\text{Previously gathered value} - \text{currently gathered value}) / \text{elapsed time} = \text{delta} / \text{second}$

5. Chart popup menu

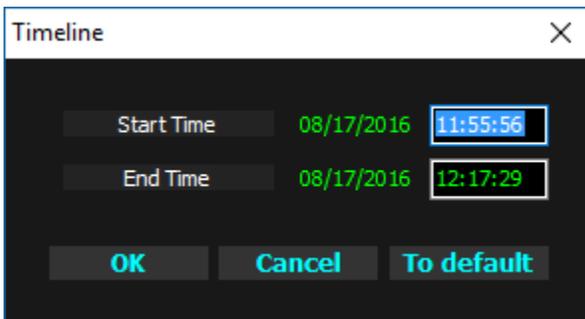


- Copy chart image to clipboard: Saves chart image to clipboard; allow user to paste in general documents like Excel or Word.

- Copy chart data to clipboard: Save entire raw data for every entry to clipboard, allow user to paste in general documents like Excel, Word, or notepad.

Basic CPU%										
	User	Sys	IOWait	Steal						
Average	19.43	12.65	0.01	0.00	32.00	32.00	67.91			
Minimum	14.78	10.00	0.00	0.00	0.00	25.00	56.32			
Maximum	23.21	20.09	2.46	0.00	41.68	41.68	74.20			
08/17/2016 11:55:58.735	22.75	13.28	0.00	0.00	0.00	0.00	36.04	36.04	63.96	
08/17/2016 11:56:00.765	17.75	13.07	0.00	0.00	0.00	0.00	30.82	30.82	69.18	
08/17/2016 11:56:02.792	22.42	12.62	0.00	0.00	0.00	0.00	35.04	35.04	64.95	
08/17/2016 11:56:04.832	20.66	13.31	0.00	0.00	0.00	0.00	33.98	33.98	66.02	
08/17/2016 11:56:06.851	19.21	12.35	0.00	0.00	0.00	0.00	31.56	31.56	68.44	
08/17/2016 11:56:08.895	19.83	12.82	0.00	0.00	0.00	0.00	32.65	32.65	67.35	
08/17/2016 11:56:10.935	19.31	12.81	0.00	0.00	0.00	0.00	32.11	32.11	67.89	
08/17/2016 11:56:12.955	18.89	13.66	0.00	0.00	0.00	0.00	32.56	32.56	67.44	
08/17/2016 11:56:14.980	20.53	12.78	0.00	0.00	0.00	0.00	33.31	33.31	66.69	
08/17/2016 11:56:17.016	18.37	12.61	0.00	0.00	0.00	0.00	30.98	30.98	69.02	
08/17/2016 11:56:19.035	19.96	12.54	0.00	0.00	0.00	0.00	32.50	32.50	67.50	
08/17/2016 11:56:21.043	19.24	12.67	0.00	0.00	0.00	0.00	31.91	31.91	68.09	
08/17/2016 11:56:23.062	20.61	12.59	0.00	0.00	0.00	0.00	33.20	33.20	66.79	
08/17/2016 11:56:25.085	19.43	12.48	0.00	0.00	0.00	0.00	31.91	31.91	68.09	
08/17/2016 11:56:27.113	19.93	12.95	0.00	0.00	0.00	0.00	32.88	32.88	67.12	
08/17/2016 11:56:29.127	18.59	13.09	0.00	0.00	0.00	0.00	31.68	31.68	68.31	
08/17/2016 11:56:31.157	18.05	12.44	0.00	0.00	0.00	0.00	30.49	30.49	69.51	
08/17/2016 11:56:33.159	21.78	13.16	0.00	0.00	0.00	0.00	34.94	34.94	65.07	
08/17/2016 11:56:35.169	18.52	12.52	0.00	0.00	0.00	0.00	31.04	31.04	68.96	
08/17/2016 11:56:37.191	20.39	13.04	0.00	0.00	0.00	0.00	33.43	33.43	66.57	
08/17/2016 11:56:39.212	18.57	12.19	0.00	0.00	0.00	0.00	30.76	30.76	69.24	
08/17/2016 11:56:41.247	18.28	12.89	0.00	0.00	0.00	0.00	31.17	31.17	68.83	
08/17/2016 11:56:43.274	20.04	13.03	0.00	0.00	0.00	0.00	33.07	33.07	66.93	
08/17/2016 11:56:45.300	20.52	12.85	0.00	0.00	0.00	0.00	33.37	33.37	66.63	
08/17/2016 11:56:47.308	20.12	13.20	0.00	0.00	0.00	0.00	33.33	33.33	66.67	
08/17/2016 11:56:49.304	20.06	12.25	0.00	0.00	0.00	0.00	32.31	32.31	67.69	
08/17/2016 11:56:51.307	21.18	13.15	0.00	0.00	0.00	0.00	34.33	34.33	65.67	
08/17/2016 11:56:53.314	18.45	12.18	0.00	0.00	0.00	0.00	30.63	30.63	69.37	
08/17/2016 11:56:55.338	19.34	12.25	0.00	0.00	0.00	0.00	31.59	31.59	68.41	
08/17/2016 11:56:57.375	20.74	12.59	0.00	0.00	0.00	0.00	33.33	33.33	66.67	
08/17/2016 11:56:59.489	21.68	13.04	0.00	0.00	0.00	0.00	34.72	34.72	65.28	
08/17/2016 11:57:01.495	19.33	12.84	0.00	0.00	0.00	0.00	32.18	32.18	67.82	
08/17/2016 11:57:03.556	18.29	13.14	0.00	0.00	0.00	0.00	31.43	31.43	68.57	
08/17/2016 11:57:05.593	20.37	12.80	0.00	0.00	0.00	0.00	33.17	33.17	66.83	
08/17/2016 11:57:07.570	17.95	12.06	0.00	0.00	0.00	0.00	30.01	30.01	69.99	

- Timeline(X-axis) config: User may adjust timeline range of X-axis.

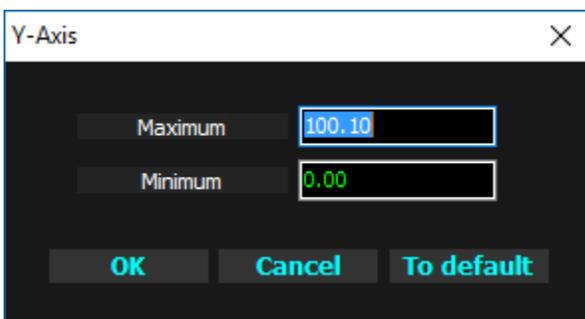


The screenshot shows a dialog box titled "Timeline" with a close button (X) in the top right corner. It contains two rows of input fields. The first row is labeled "Start Time" and has a date field containing "08/17/2016" and a time field containing "11:55:56". The second row is labeled "End Time" and has a date field containing "08/17/2016" and a time field containing "12:17:29". At the bottom of the dialog, there are three buttons: "OK", "Cancel", and "To default".

Click on the date label to change the date. "To default" button is the same as "Reset to original timeline", below.

- Set to beginning time point: Mouse-point time in chart will be start of the chart.
- Set to ending time point: Mouse-point time in chart will be end of the chart.
- Reset to original timeline: Recover timeline from the changes.

Y-axis config: User may adjust Y-axis range.

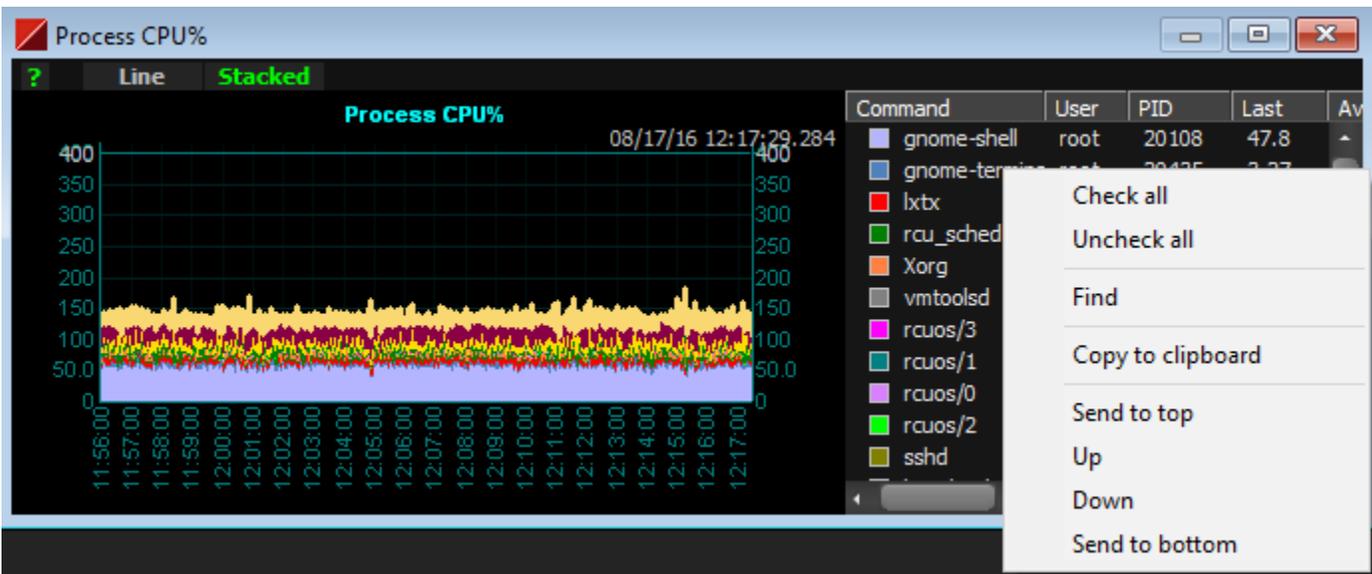


The screenshot shows a dialog box titled "Y-Axis" with a close button (X) in the top right corner. It contains two rows of input fields. The first row is labeled "Maximum" and has a text field containing "100.10". The second row is labeled "Minimum" and has a text field containing "0.00". At the bottom of the dialog, there are three buttons: "OK", "Cancel", and "To default".

"To default" button is the same as "Reset to original Y-axis", below.

- Set to minimum of Y-axis point: Mouse-point value in chart will be minimum(base) of the chart.
- Set to maximum of Y-axis point: Mouse-point value in chart will be maximum of the chart.
- Reset to original Y-axis: Recover Y-axis from the changes.

6. Chart item popup menu

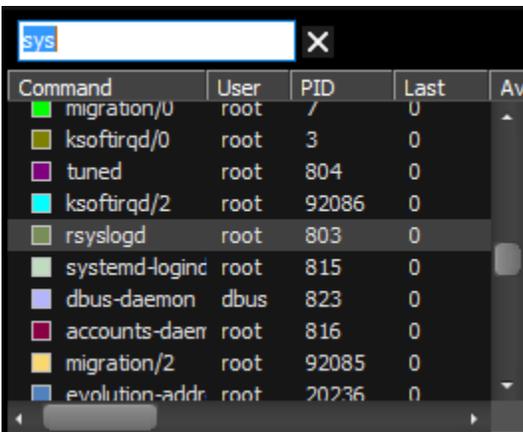


- Check all: every chart item is checked.

- Uncheck all: every chart item is unchecked. Chart lines corresponding to unchecked items will disappear from the chart.

* Double-clicking on a chart item, or clicking on a color box of the chart item entry toggles check / uncheck.

- Find: Search for input text. Search uses input text as sub-string of a pattern. Case insensitive.



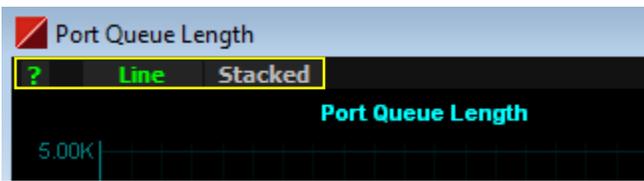
- Copy to clipboard: Saves chart item list contents to clipboard, allows user to paste in general documents such as Excel, word, or notepad.

- Send to top, Up, Down and Send to bottom: Moves selected item. Chart line order is influenced by this operation.

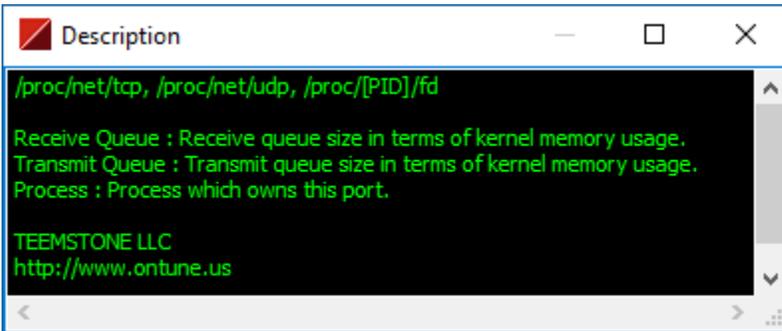
* "Basic performance item" has only "Find" and "Copy to clipboard" because chart items are fixed.

* "EachCPU", "Process Extra Information" and "TCP Connection Count" items have only "Check", "Uncheck", "Find" and "Copy to clipboard" because the item order follows CPU index or a fixed order.

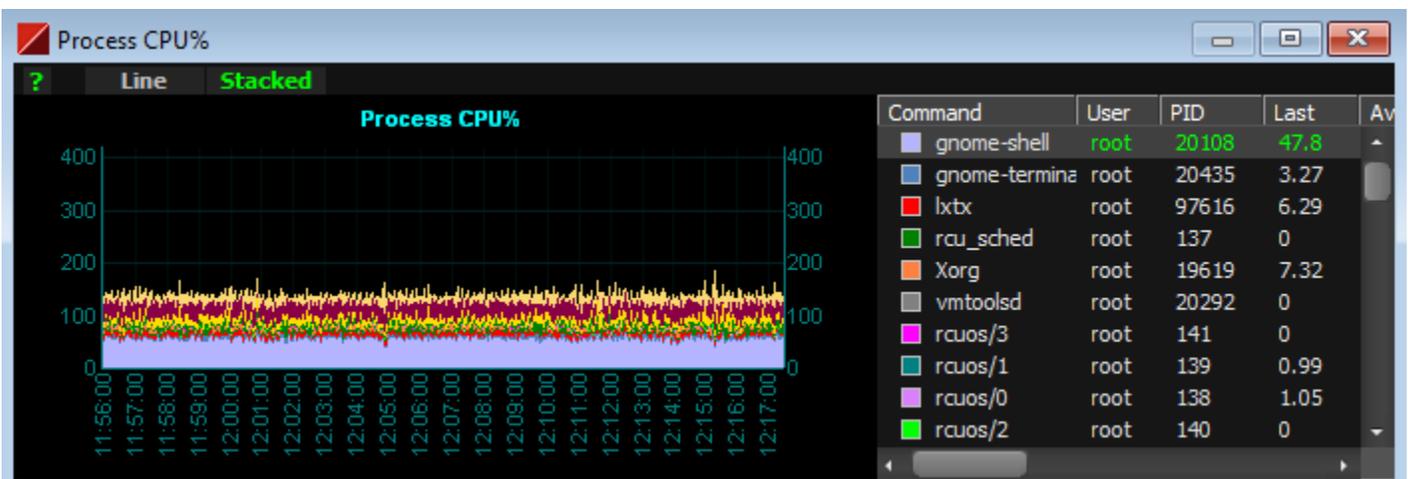
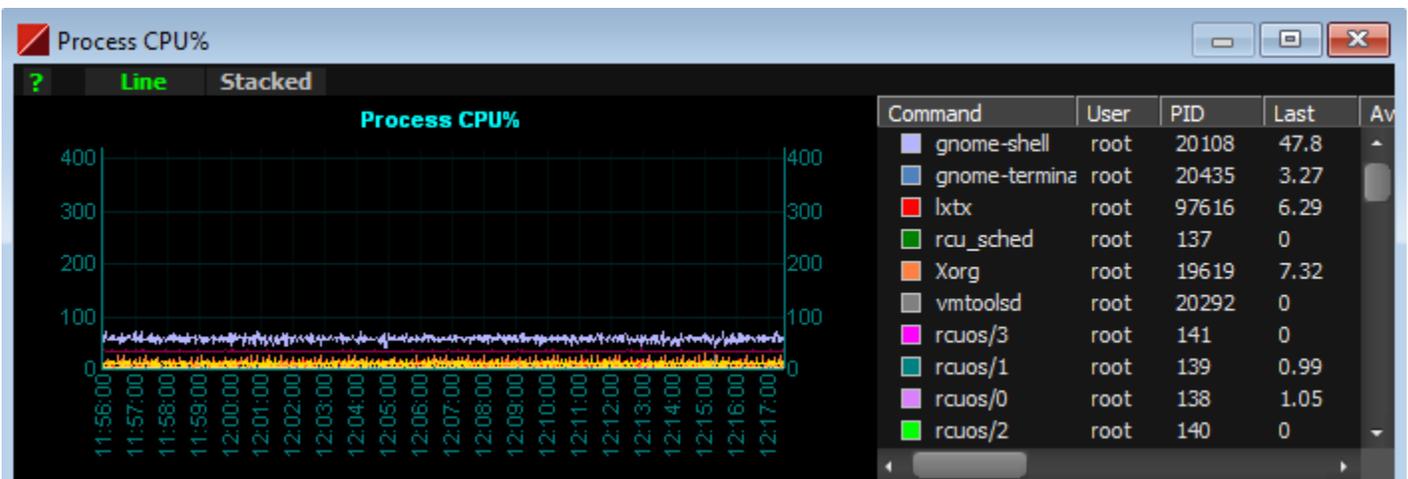
7. Tips



- “?”: Help description about the selected item, as shown below:

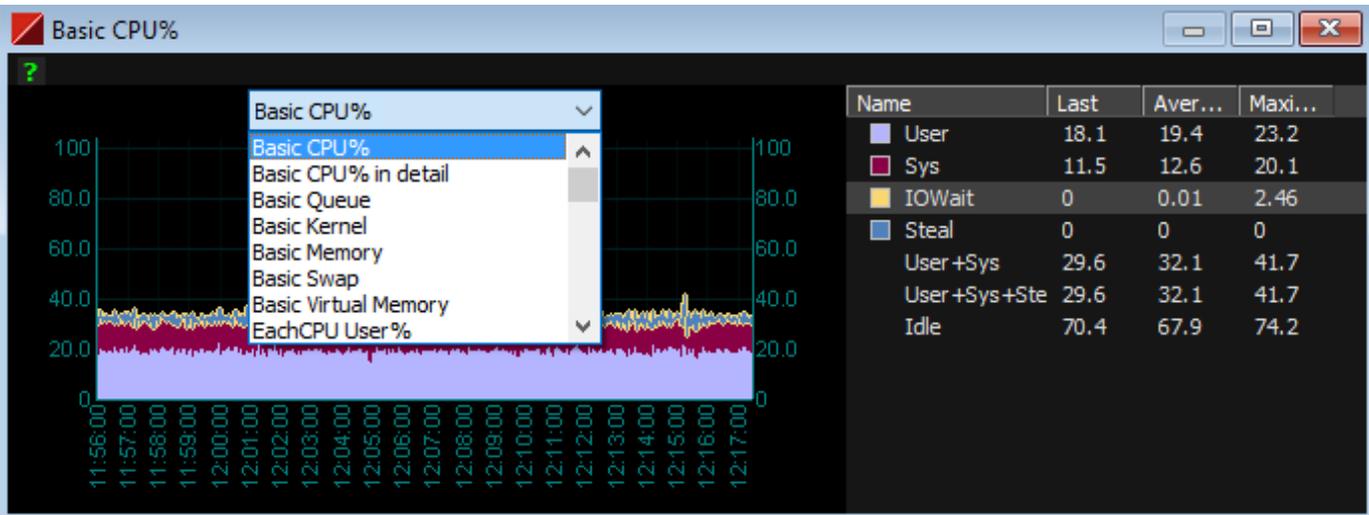


- Line / Stacked: User may switch the chart line between line and stacked area, as shown below:

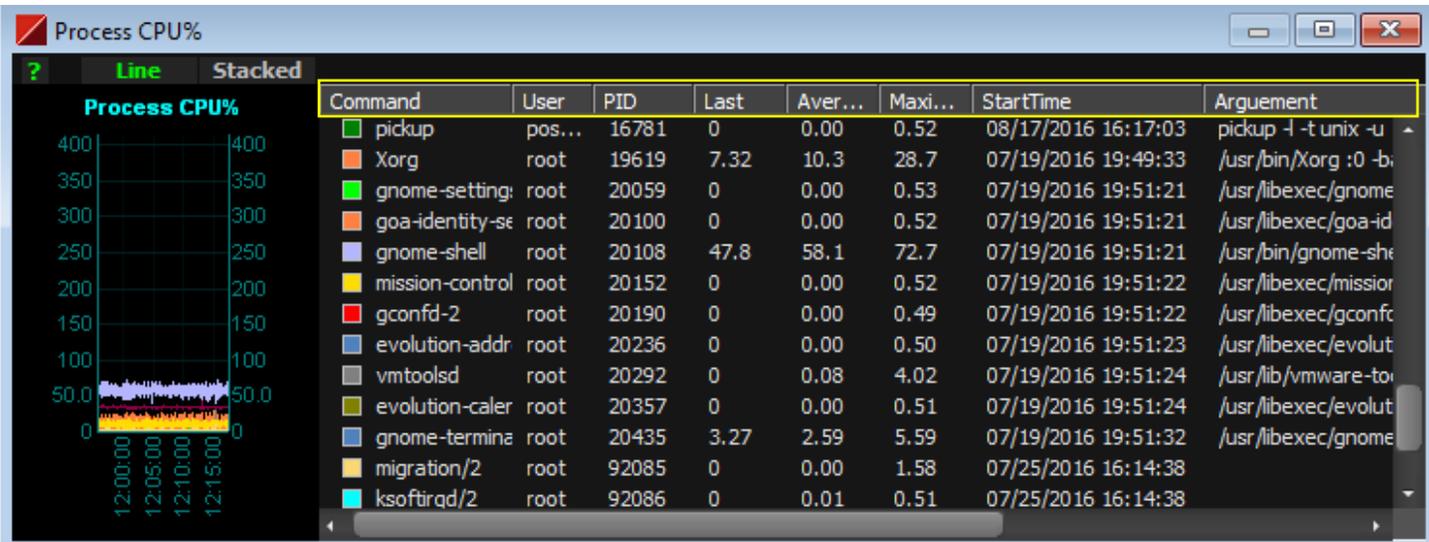


* “Basic performance item” does not have the Line/Stacked buttons because those items are fixed.

- Click on chart title to change contents.

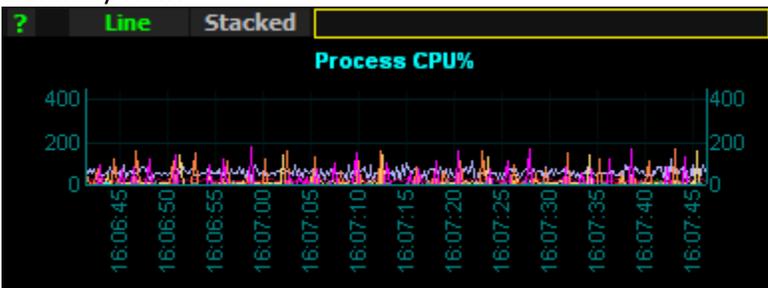


- Reorder by mouse-clicking on the header



Items are reordered in the order of the selected column when the header is clicked.

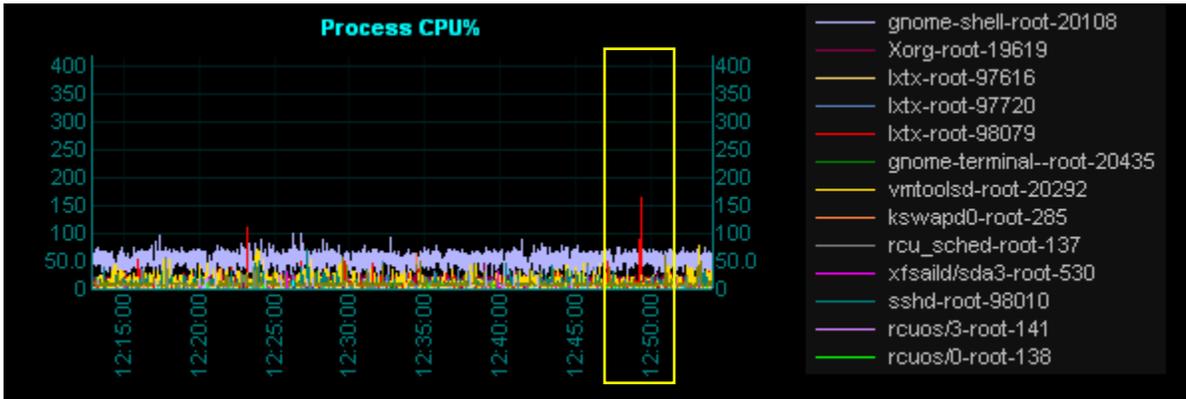
- Double clicking on a part identified by the yellow box below will enlarge the corresponding chart. This also works in Summary view.



8. Scale factor

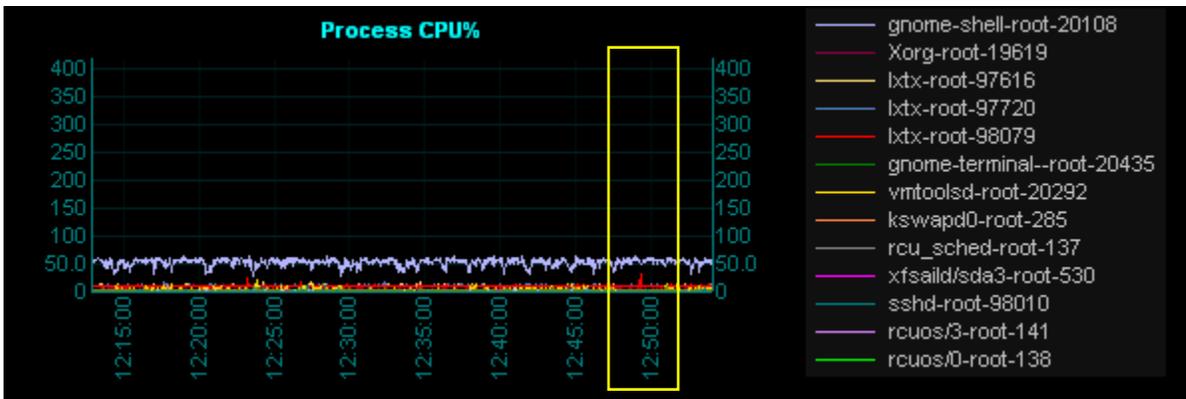
Scale factor is applied in the case of “Open” mode to avoid unreadably dense chart trend line if there’s plenty of saved data. Scale factor is automatically chosen to fit the situation, and adjusted even when user changes the timeline.

* Scale factor: The Chart below shows much too fine data to be able to determine if the chart displays a lot of data:



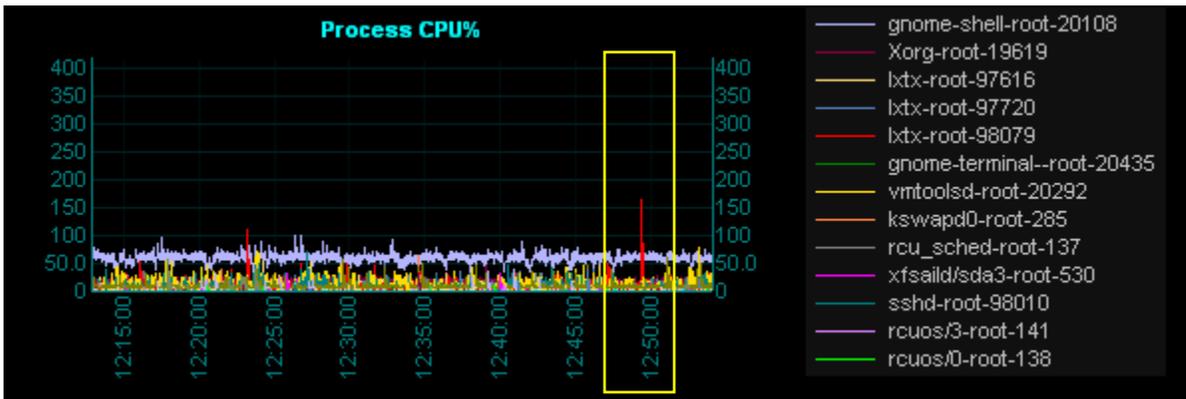
Without scale factor, too much fluctuation makes it difficult for the user to figure out.

In the Chart below, scale factor of 7 is applied, meaning that the chart shows the average of count 7 data.

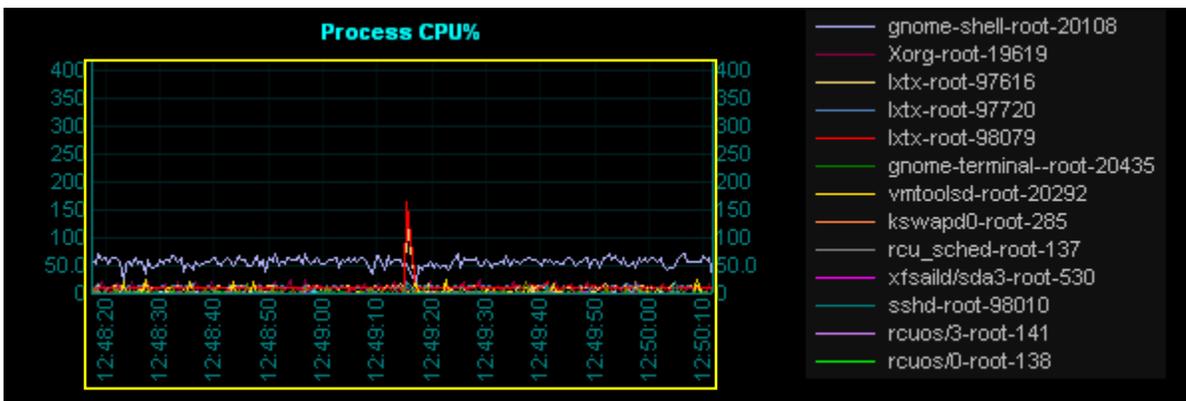


However, the chart can't show peak data, even though the view is not very complicated.

For this shortcoming, “Show Peak” button on “Control and Log” is used to reveal peak points of every single average point, as below:



The User can then narrow time range of chart to focus on peak time, using popup menu of the chart.



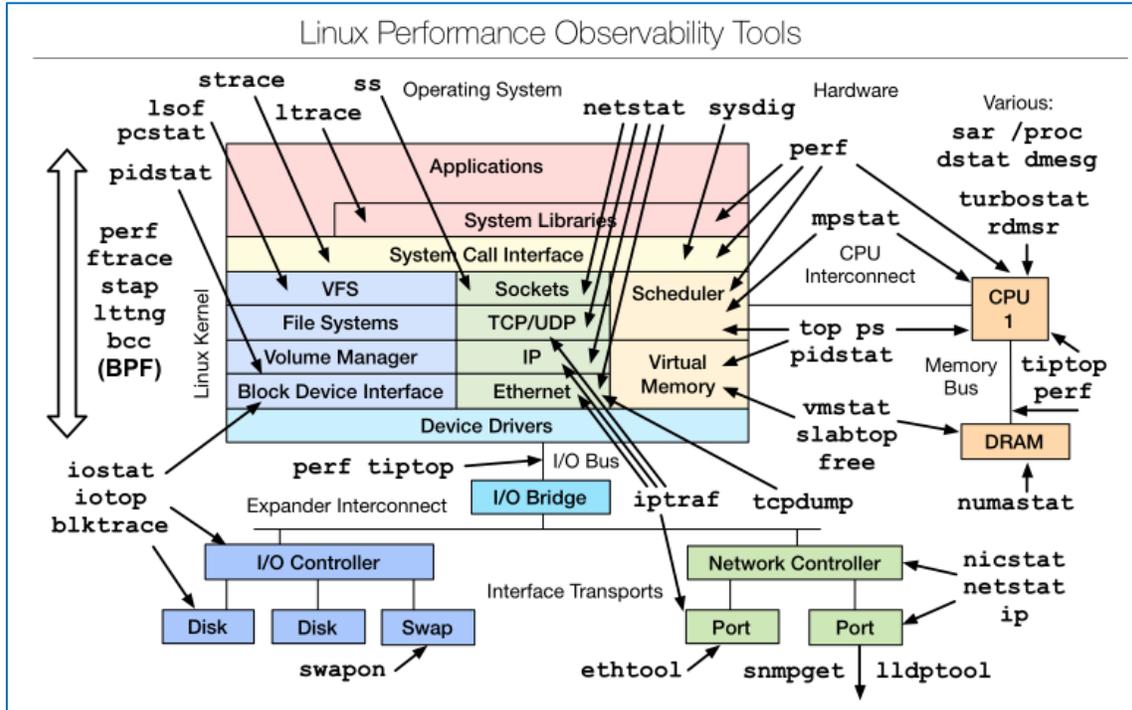
The above chart’s scale factor is 1. (automatically adjusted to 1 from 7)

Scale factor is automatically decreased if the user reduces time range via the popup menu. You may identify the scale factor used in the Log window, as below:

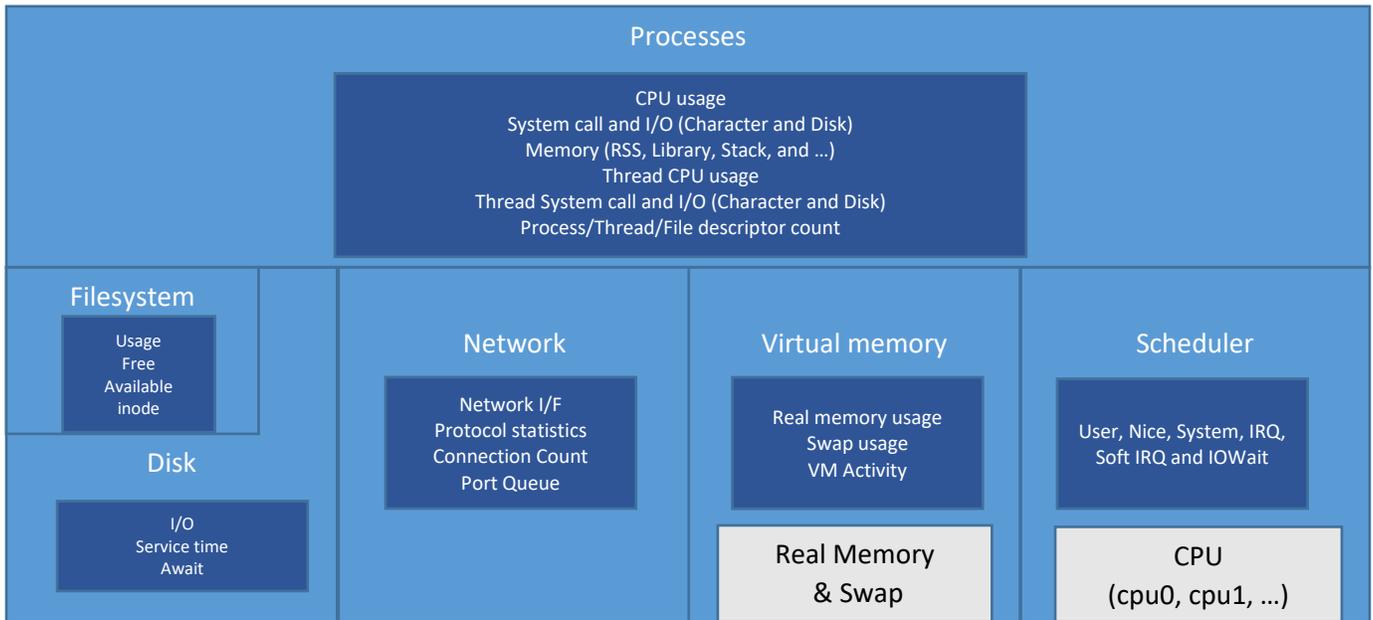
```
08/15/2016 11:41:15 LxTx.exe started
08/15/2016 11:41:21 Opening C:\Project\Linux\LxTx\SavedLogs\centos-7_20160812121256.ltx
08/15/2016 11:41:24 Time range is set to 08/12/2016 12:12:55 ~ 08/12/2016 12:54:03
08/15/2016 11:41:24 Scale Factor 7 is used to reduce data
08/15/2016 11:41:24 Scale Factor 7 is used to reduce data.(Orinal data count : 4391, Reduced data count : 628)
08/15/2016 11:48:08 Time range is set to 08/12/2016 12:39:23 ~ 08/12/2016 12:54:03
08/15/2016 11:48:08 Scale Factor 5 is used to reduce data.(Orinal data count : 1561, Reduced data count : 313)
08/15/2016 11:48:12 Time range is set to 08/12/2016 12:47:23 ~ 08/12/2016 12:54:03
08/15/2016 11:48:12 Scale Factor 2 is used to reduce data.(Orinal data count : 708, Reduced data count : 354)
```

9. ltxx

- The infographic below is the well-known linux performance analysis chart.



- The chart below describes items provided by ltxx.



Trace and certain other items are not supported by ltxx. However, ltxx provides the majority of items sufficient for users to analyze linux.

lctx runs in /tmp directory via ssh connection with LxTxViewer.exe. User can also execute /tmp/lctx manually through telnet or ssh session.

```
[root@centos-7 tmp]# ./lctx -h
```

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Version : 1.0.6

Usage : ./lctx [-c Number of updates(count)] [-s Interval of updates(seconds)] [-i Interval of updates(milliseconds)] [-a : Turn on all monitoring items with default value except -S, -m, and -t] [-Z : LxTx mode] [-b : Basic performance items On] [-C Threshold of process CPU%(unit is 0.001%)] [-T Threshold of thread CPU%(unit is 0.001%)] [-R Threshold of process RSS(unit is KB)] [-g Length of process command column] [-p Number of process entries] [-k : Process creation/termination log On] [-f : Delta of file position On] [-F : List all files] [-S : List all sockets] [-o Number of port queue entries] [-n Number of network interface entries] [-d Number of disk entries] [-m : Delta of filesystem On] [-t : Delta of protocol statistics On]

[-H : Time header Off]

[-c Number of updates(count)] [-s Interval(seconds)] [-i Interval(milliseconds)]
Default value - Count : Unlimited / Interval : 2 Seconds

[-b : Basic performance items On]
Show CPU, Memory, Swap and Virtual memory activities

[-C Threshold of process CPU%(unit is 0.001%)] [-T Threshold of Thread CPU%(unit is 0.001%)] [-R RSS Threshold(KB)]
CPU Threshold, CPU Threshold of Thread and RSS Threshold are used as a threshold for selection to display.
Default value - Prcoess CPU% Threshold : 1 -> 0.001%(List all if -1) / Thread CPU% Threshold : 1 -> 0.001%(Disabled if 0) / RSS Threshold : 262144 -> 256MB.
-p option is applied with default value 24 if -C, -T or -R is used

[-p Number of process entries]
Define how many process entries is displayed. No process collection when 0 is used. Default value is 24.
* All processes are displayed if -R is 0 and -p is big enough.

[-k : Process creation/termination log On]
-p must be greater than 0. Default is 24 if not specified
* It won't be displayed if creation and termination of a process happen within the interval, even if -k is used

[-f : Delta of file position On | -F : List all files]
Delta of file position monitoring On if -f used
List all files opened by processes if -F used (fd is listed when position change detected if -F is not used)

-p must be greater than 0. Default is 24 if -p is not specified

[-S : List all sockets]
List all sockets opened by processes if -S used

-f(or F) is required for this option, and -p must be greater than 0. Default is 24 if -p is not specified

[-g Command column length of processes]
Arguments are displayed together if they exist, otherwise only command is displayed
Default value is 64.(Command only if 0)

[-o : Number of port queue entries]
Define how many tcp/udp port queue entries is displayed. No port collection when 0 is used. Default value is 4.

[-n : Number of network interface entries]
Define how many network interface entries is displayed. No network interface collection when 0 is used. Default value is 4.

[-d : Number of disk entries]
Define how many disk entries is displayed. No disk collection when 0 is used. Default value is 8.

[-m : Delta of filesystem On]
Delta of filesystem monitoring On if -m used

[-t : Delta of protocol statistics On]
Delta of protocol statistics monitoring On if -t used

[-a : Turn on all monitoring items with default value except -S(sockets), -m(delta of protocol statistics), and -t(delta of filesystem)]
-p 24(24 Process entries) -k(Process creation/termination) -f(Delta of file position) -o 4(Port queue) -n 4(Network I/F) -d 8(Disk)

Example) In order to list every process entry : `./ltx -p 1000000 -R 0 -T 0 -i 0 -c 1`

- p 1000000 : Big enough entry count to display every process entry
- R 0 : Process RSS threshold is 0KB. This means every process will be displayed because process's RSS is at least 0KB
- T 0 : No thread information
- i 0 : Interval is 0ms in order to display immediately
- c 1 : Count is 1

Example) In order to monitor only top 10 processes and top 4 disks every single second : `./ltx -p 10 -T 0 -d 4 -i 1000`

- p 10 : 10 entry count to display top 10 processes
- T 0 : No thread information
- d 4 : 4 entry count to display top 4 disks
- i 0 : Interval is 1000ms in order to display every single second

Example) In order to monitor processes consuming 10% CPU or more : `./ltx -C 10000`

- C 10000 : Since unit is 0.001%, 10000 means 10%

Below is simple example screen by `./ltx -a`. (-a option is used)

```

root@centos-7:/usr/new
TIME : 16.09.06 16:08:19.398 [1475192495/43]
USER  SVS  IRQ  S-IRQ  WAIT  ILLD  STEAL  RUN  BLCK  FORK  INTR  CXTX
9.93  14.0  0  1.14  0  75.6  0  5  0  0  7.46K  7.74K
MEM MEMUSE  BUFFS  CACHE  SWAP SWPOSS SWPHOT  PgIn  PgOut  SwpIn  SwpOut  PgFree  ScanR  Scand  StealK  Scald  VmEffK  Rotate  MajFlt
0.96G  61.4k  0  31.5k  3.87G  17.6k  16.5k  0  9.7M  0  74.7K  2.46K  0  2.46K  0  100  0  0  0  0

Total Process Count : 489, Thread Count : 727, Socket Count : 593, Pipe Count : 115, ANON Count : 365, File Count : 592, Read/Write SysCall by monitored processes: 59.3K/ 4.20K
PID  PPID  USER  S  CPU  MSR  SVS  CHDR  SYSC  BYTES  MajFlt  START TIME  Size  Fin  RSS  Data  Stack  Lib  Swap  TRSD  Command
28254  1783  root  S  20.1  3.82  16.2  22.7M  4.25K  0  0  16.09.06 16:07:05  134M  0  6.24M  2.27M  136K  9.93M  0  1  sshd: root@notty
2052  2052  root  R  10.5  10.0  0.48  474  14.8  0  0  16.08.31 11:49:52  224M  0  21.2M  63.8M  136K  35.4M  11.7M  5  /usr/bin/Xorg :0 -background none -verbose -auth /run/gdm/auth-f...
2276  2276  R  10.5  10.0  0.48  474  14.8  0  0  16.08.31 11:49:52  224M  0  21.2M  63.8M  136K  35.4M  11.7M  5  /usr/bin/Xorg :0 -background none -verbose -auth /run/gdm/auth-f...
28262  28254  root  S  5.73  0.48  3.26  22.0M  2.26K  11.3M  0  16.09.06 16:07:06  52.6M  0  3.22M  1.61M  136K  6.41M  0  1  /usr/libexec/openssh/ssh-server
--> File : fd 3(Delta Rate : 11.3M / Flags : 0100001) owned by sftp-server[28262/28254] /usr/new/3.5gb
28245  11993  root  R  5.73  1.43  4.30  406K  2.01K  0  0  16.09.06 16:08:12  40.8M  0  32.4M  34.4M  136K  1.08M  0  1  ./ltx -a
10121  1  root  S  3.26  4.30  0.96  630K  7.33K  70.7K  0  16.08.31 15:42:14  616M  0  5.36M  224M  136K  23.2M  3.10M  4  /usr/libexec/gnome-terminal-server
--> File : fd 22(Delta Rate : 30.0K / Flags : 0100002) owned by gnome-terminal-[10121/1] /tmp/vse01C7MY (deleted)
--> File : fd 23(Delta Rate : 4.24K / Flags : 0100002) owned by gnome-terminal-[10121/1] /tmp/vse93E7MY (deleted)
--> File : fd 24(Delta Rate : 26.4K / Flags : 0100002) owned by gnome-terminal-[10121/1] /tmp/vse018VMY (deleted)
--> File : fd 25(Delta Rate : 3.76K / Flags : 0100002) owned by gnome-terminal-[10121/1] /tmp/vse877VMY (deleted)
10121  1  10121  S  5.26  4.30  0.96  630K  7.33K  70.7K  0  16.08.31 15:42:14  616M  0  5.36M  224M  136K  23.2M  3.10M  4  /usr/libexec/gnome-terminal-server
137  2  root  S  2.39  0  2.39  0  0  0  0  16.08.31 11:49:22  0  0  0  0  0  0  0  1  rcu_sched
8742  1808  root  S  1.42  0.48  0.94  347K  1.80K  0  0  16.08.31 14:50:15  596M  0  3.52M  988K  136K  1.97M  11.1M  9  ./ontuned -c -x -m TeemStone
8801  8742  S  0.48  0  0.48  3.64K  4.78  0  0  16.08.31 14:50:15  596M  0  3.52M  988K  136K  1.97M  11.1M  9  ./ontuned -c -x -m TeemStone
8803  8742  S  1.91  0.48  1.43  340K  1.78K  0  0  16.08.31 14:50:16  596M  0  3.52M  988K  136K  1.97M  11.1M  9  ./ontuned -c -x -m TeemStone
140  2  root  S  0.96  0  0.96  0  0  0  0  16.08.31 11:49:22  0  0  0  0  0  0  0  1  rounte/2
141  2  root  S  0.96  0  0.96  0  0  0  0  16.08.31 11:49:22  0  0  0  0  0  0  0  1  rounte/3
138  2  root  S  0.48  0  0.48  0  0  0  0  16.08.31 11:49:22  0  0  0  0  0  0  0  1  rounte/0
139  2  root  S  0.48  0  0.48  0  0  0  0  16.08.31 11:49:22  0  0  0  0  0  0  0  1  rounte/1
840  1  root  S  0.48  0  0.48  3.73K  3.82  0  0  16.08.31 11:49:32  18.8M  0  440K  336K  136K  4.26M  176K  1  /usr/sbin/irqbalance --foreground
2251  2  root  S  0.48  0  0.48  0  0  0  0  16.09.06 05:11:18  0  0  0  0  0  0  0  1  kvorker/u25610

TCP - ESTAB:4 / LISTEN:7 / SYN_S:0 / SYN_R:0 / F_WAIT:0 / F_WAIT:0 / TIME_WAIT:0 / CLOSE : 0 / CLOSE_WAIT:0 / LAST_ACK:0 / CLOSING:0 / NA:0
SL F Local Remote STATE RX_Que TX_Que RETRNSMT UID TIMEOUT
9 T 192.168.29.205:22 192.168.29.201:55915 ESTABLISH 0 1112 0 0 0 4757247 sshd: root@notty[28254/1783]
7 T 192.168.29.205:40349 192.168.29.106:18893 ESTABLISH 0 0 0 0 0 136707 ontuned[8742/1808] wmaster[26113/8742]
2 T 0.0.0.0:6001 0.0.0.0:0 LISTEN 0 0 1000 0 22210 /usr/bin/Xvnc :1 -desktop centos-7:1 (austin) -auth /home/austin...[3205/1]
1 T 0.0.0.0:5901 0.0.0.0:0 LISTEN 0 0 1000 0 22215 /usr/bin/Xvnc :1 -desktop centos-7:1 (austin) -auth /home/austin...[3205/1]

I/F name IFAAddress RBytes WBytes RPkts WPkts RErr WErr RDrop WDrop Coll
Total 7.74 0 10.6M 0 23.4 0 65.1 65.1 3.31 1.86 8 0
eth0 7.74 0 10.6M 0 23.4 0 65.1 65.1 3.31 1.86 8 0
sda1 7.74 0 10.6M 0 23.4 0 65.1 65.1 3.31 1.86 8 3
sda1 0 0 0 0 0 0 0 0 0 0 0 8 1
sda2 0 0 0 0 0 0 0 0 0 0 0 8 2
sdb 0 0 0 0 0 0 0 0 0 0 0 8 16
sdb1 0 0 0 0 0 0 0 0 0 0 0 8 17
sdb2 0 0 0 0 0 0 0 0 0 0 0 8 18
    
```

Thank you

спасибо

grazie

danke

gracias

tak

teşekkür ederim

dank u

merci

감사합니다

tack

תודה

謝謝

cám ơn

mahalo

Հնորհակալ եմ

děkuji

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d'akujeme

hvala

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ありがとう

dziękuję

köszönö

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