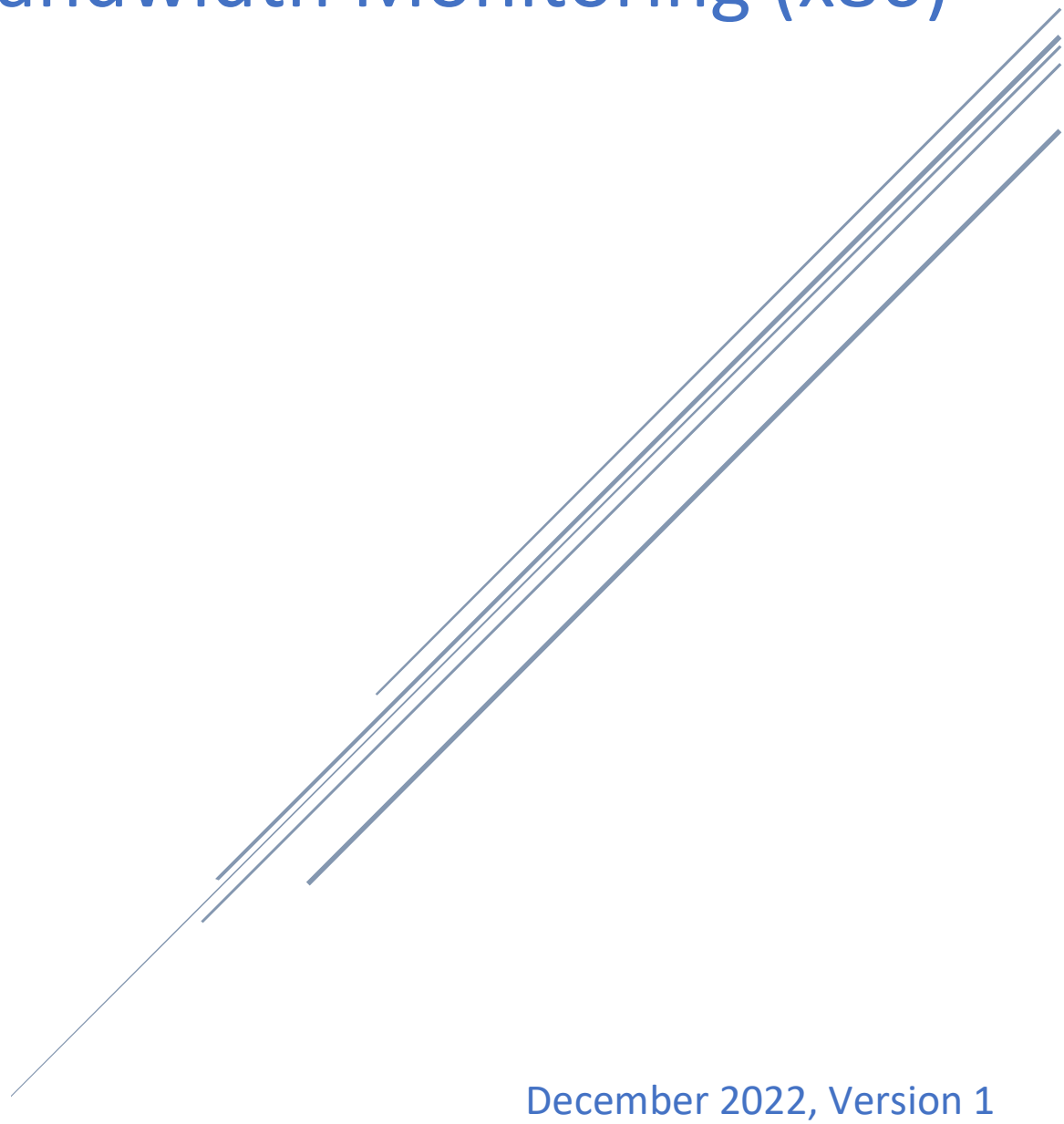
VSI OpenVMS LAN Driver Bandwidth Monitoring (x86)



December 2022, Version 1

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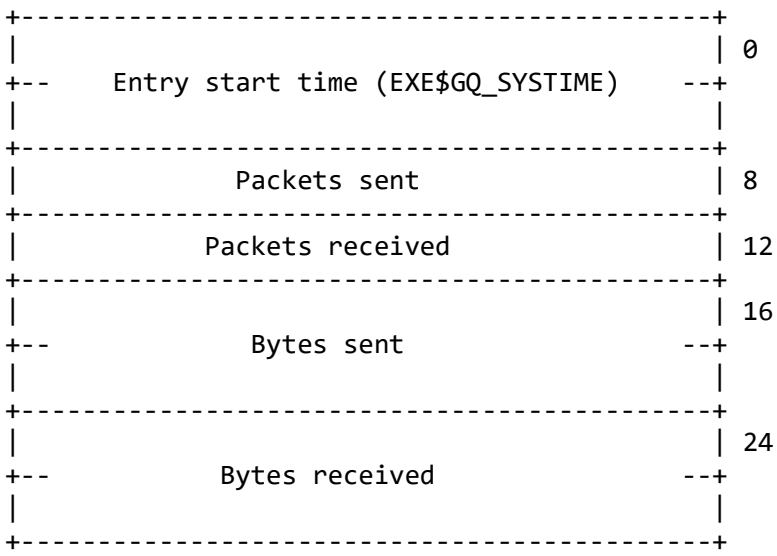
What

Once a second, the LAN driver records the packets and bytes sent and received over the last second and recording an entry in an S2-space buffer. Each 32-byte entry is called a bucket and looks like so:



Once a second, the packets and bytes are calculated for the one-second period which is close to but not exactly 1 second.

There is a threshold value below which is considered noise and not worth tallying explicitly. The threshold can be zero bytes but is 10000 bytes by default. This value can be set via LANCP. Zero bytes are significant, more so than 10000 bytes in one second. If the link goes down or there is a network problem, seeing zero bytes is significant.

To maximize the time coverage of a given size buffer and minimize the size of the buffer needed, zero-byte entries are coalesced, as well as entries with less than threshold bytes. Coalescing is done by not advancing to the next 32-byte bucket so that time is accumulated. When the bandwidth data is analyzed, the multi-second buckets may be converted into one-second buckets by apportioning the packets and bytes to one-second buckets.

The default size of the bandwidth buffer is 64k bytes, or 2048 buckets, enough for 0.6 hours minimum. With coalescing, that number may be much greater. This value can be set via LANCP and by setting LAN_FLAGS system parameter bits.

Why

A system manager may get a system crash or force a crash dump or just has listing of counters data after a system issue and asks what happened. Looking at a 6-month tally, for example, of the LAN device counters, you can calculate an average utilization value. But knowing the device averaged 135 bytes/second for 6 months is not very useful if the 10 second period that caused an issue was a time of network saturation or network outage. System managers can ask the network manager for insight, but switches may collect counters only infrequently or not at all.

The bandwidth monitoring answers the question about network utilization, without much detail, just packets and bytes, but with a short time period that makes it clear if there are issues. There might be periods of network saturation or periods with no activity.

The size of the buffer can be adjusted to collect a minimum of 82 hours of data, extended by use of a threshold value or seeing zero-byte entries. A system manager could run a batch job once a day to collect the data and restart monitoring.

How

To display bandwidth data:

```
LANCP SHOW DEVICE /BANDWIDTH [devname]
   [/DUMPFILE=filespec]    Writes data to a dump file
   [/INPUTFILE=filespec]   Reads data from a dump file
   [/EXPANDED]             Shows data expanded to one-second buckets
   [/SUMMARY]              Show summary data
   [/SINCE[=timespec]]     Show data since time
   [/DURATION[=timespec]]  Show data for time duration starting at /SINCE
   [/LAST[=timespec]]      Show data for last time duration
   [/REVERSE]              Displays data latest to oldest
   [/OUTPUTFILE=filespec]  Redirects output to an output file
```

Additional qualifiers allow you to select certain entries:

```
   [/1MB]                  Show 1Mb and larger entries
   [/10MB]                 Show 10Mb and larger entries
   [/100MB]                Show 100Mb and larger entries
   [/1GB]                  Show 1Gb and larger entries
   [/2GB]                  Show 2Gb and larger entries
   [/5GB]                  Show 5Gb and larger entries
   [/10GB]                 Show 10Gb and larger entries
   [/[NO]ZERO]             Show ZERO entries
```

To display bandwidth summary data included in the configuration display:

```
LANCP SHOW CONFIGURATION /BANDWIDTH [devname]
```

To display bandwidth settings:

LANCP SHOW BANDWIDTH

To display permanent device database settings:

LANCP LIST BANDWIDTH
LANCP LIST DEVICE /BANDWIDTH [devname]

To override default bandwidth settings:

LANCP SET DEVICE /[NO]BANDWIDTH=(HOURS=n,THRESHOLD=nbytes,RESTART,DEFAULT) devname

LANCP DEFINE DEVICE /[NO]BANDWIDTH=(HOURS=n,THRESHOLD=nbytes) devname
[HOURS=n] Specifies size of the buffers in hours (3600 buckets per hour)
[THRESHOLD=nbytes] Specifies the threshold value
[RESTART] Restarts monitoring, discarding existing data
[DEFAULT] Restarts monitoring with default settings, discarding existing data

To override default size of the bandwidth buffer for all LAN devices, set the LAN_FLAGS system parameter as follows.

The default size is 2048 buckets, 64k bytes. The maximum size is 81.92 hours (9 megabytes of buffer space), settable only by LANCP command. The time without compression is with a threshold value of zero bytes. The time with compression is a wild guess for a threshold value greater than zero bytes.

Bits <9:11> is the number of megabytes of bandwidth buffer requested as follows

LAN_FLAGS	Buckets	MBytes	Bytes	TimeNoCompress	TimeCompressed
0x00000000	2048	1/16	65536	0.6 hrs	1 day
0x00000200	32768	1	1048576	9.1 hrs	6 days
0x00000400	65536	2	2097152	18.2 hrs	12 days
0x00000600	98304	3	3145728	27.3 hrs	18 days
0x00000800	131072	4	4194304	36.4 hrs	24 days
0x00000A00	163840	5	5242880	45.5 hrs	30 days
0x00000C00	196608	6	6291456	54.6 hrs	36 days
0x00000E00	229376	7	7340032	63.7 hrs	42 days

To save bandwidth data for later analysis:

LANCP SHOW DEVICE /BANDWIDTH /DUMPFILE=filespec /OUTPUTFILE=nl: devname

and later:

LANCP SHOW DEVICE /BANDWIDTH /INPUTFILE=filespec devname

To extract bandwidth data from a crash dump:

SDA> LAN BANDWIDTH /DUMPFILE[=filespec] /DEVICE=devname

To turn off bandwidth monitoring:

LANCP SET DEVICE/NOBANDWIDTH devname
LANCP SET DEVICE/NOBANDWIDTH/ALL

Some examples:

ftp some files
LANCP SHOW DEVICE/BANDWIDTH/LAST
LANCP SHOW DEVICE/BANDWIDTH/LAST/NOZERO
LANCP SHOW DEVICE/BANDWIDTH/1MB

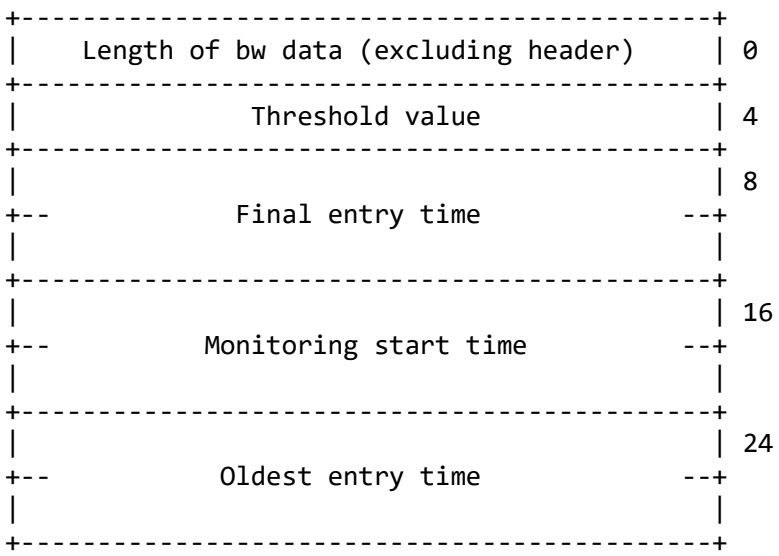
```
L6K7> mc lancp show dev/band/last eia
L6K7 Device Bandwidth EIA0 (4-DEC-2022 22:52:18.82):
 4-DEC-2022 22:51:18.93 to  4-DEC-2022 22:52:18.82 (00:00:59.88)
2048 buckets, buckets < 10000 bytes coalesced (threshold)
                          Duration           PkXmt      PkRcv     BytXmt     BytRcv  MBaud  Code
 4-DEC-2022 22:51:18.93 :     4.16 : EIA0        0          0          0          0      0  Zero
 4-DEC-2022 22:51:23.09 :     1.04 : EIA0        0          1          0         81      0  <1Mb
 4-DEC-2022 22:51:24.13 :     5.20 : EIA0        0          0          0          0      0  Zero
 4-DEC-2022 22:51:29.33 :     1.04 : EIA0        0          1          0         81      0  <1Mb
 4-DEC-2022 22:51:30.37 :     5.20 : EIA0        0          0          0          0      0  Zero
 4-DEC-2022 22:51:35.57 :     1.04 : EIA0        0          1          0         81      0  <1Mb
 4-DEC-2022 22:51:36.61 :     5.20 : EIA0        0          0          0          0      0  Zero
 4-DEC-2022 22:51:41.81 :     1.04 : EIA0        0          1          0         81      0  <1Mb
 4-DEC-2022 22:51:42.85 :     4.16 : EIA0        0          0          0          0      0  Zero
 4-DEC-2022 22:51:47.01 :     1.04 : EIA0      293        844      16144    1205485      9  1Mb
 4-DEC-2022 22:51:48.05 :     1.04 : EIA0       61        168       3354     238800      2  1Mb
 4-DEC-2022 22:51:49.09 :     3.12 : EIA0        0          0          0          0      0  Zero
 4-DEC-2022 22:51:52.21 :     2.08 : EIA0        0          5          0        589      0  <1Mb
 4-DEC-2022 22:51:54.29 :     1.04 : EIA0        0          0          0          0      0  Zero
 4-DEC-2022 22:51:55.33 :     9.36 : EIA0        0         12          0       1385      0  <1Mb
 4-DEC-2022 22:52:04.69 :     1.04 : EIA0        0          0          0          0      0  Zero
 4-DEC-2022 22:52:05.73 :     1.04 : EIA0        0          1          0         81      0  <1Mb
 4-DEC-2022 22:52:06.77 :     5.20 : EIA0        0          0          0          0      0  Zero
 4-DEC-2022 22:52:11.97 :     1.04 : EIA0        0          1          0         81      0  <1Mb
 4-DEC-2022 22:52:13.01 :     4.16 : EIA0        0          0          0          0      0  Zero
 4-DEC-2022 22:52:17.17 :     1.65 : EIA0        0          1          0         81      0  <1Mb

L6K7> mc lancp show dev/band/last/1mb eia
L6K7 Device Bandwidth EIA0 (4-DEC-2022 22:52:11.75):
 4-DEC-2022 22:51:12.69 to  4-DEC-2022 22:52:11.75 (00:00:59.05)
2048 buckets, buckets < 10000 bytes coalesced (threshold)
                          Duration           PkXmt      PkRcv     BytXmt     BytRcv  MBaud  Code
 4-DEC-2022 22:51:47.01 :     1.04 : EIA0      293        844      16144    1205485      9  1Mb
 4-DEC-2022 22:51:48.05 :     1.04 : EIA0       61        168       3354     238800      2  1Mb

L6K7> mc lancp show dev/band/sum eia

L6K7 Device Bandwidth EIA0 (8-DEC-2022 18:15:35.10):
 8-DEC-2022 13:22:38.59 to  8-DEC-2022 18:15:35.10 (04:52:56.51)
2047 buckets, buckets < 10000 bytes coalesced (threshold)

                              High Points For Each Interval
Start Time                 --Interval---          PkXmt    PkRcv     BytXmt     BytRcv  MBaud
 8-DEC-2022 14:40:17.59       1.00   1s  EIA0         0        3          0       1071      0
 8-DEC-2022 18:02:38.59      10.00  10s  EIA0         0       12          0       2187      0
 8-DEC-2022 14:41:17.59      60.00   1m  EIA0         0       64          0       4428      0
 8-DEC-2022 13:44:22.59     600.00  10m  EIA0         2      263        308      19515      0
 8-DEC-2022 13:42:40.59    3600.00   1h  EIA0        12      973       1848      84915      0
 8-DEC-2022 13:26:39.59   14400.00   4h  EIA0        48     1767       7392     179564      0
 8-DEC-2022 13:22:38.59          17577s  EIA0        58     1940       8932     203464      0
```

/SUMMARY converts the raw data displayed by SHOW DEVICE/BANDWIDTH into 1-second buckets, then calculates a running total for each interval, then displays the maximum values for each interval. /SINCE, /DURATION, /LAST allow you to describe the time period to look at when calculating the running totals. The interval is the size of the window to look at the data. For example, the 1h interval is the 1-hour period that recorded the largest bandwidth over the period selected (as measured from second to second across the entire period).

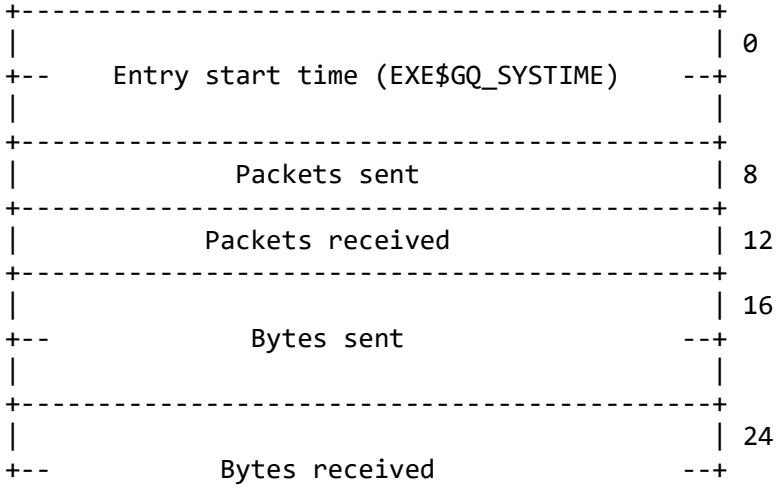
More

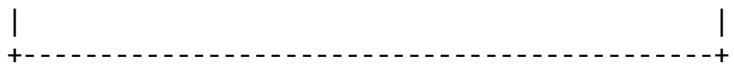
To do your own analysis of the data, just write a program to read the dump file and have at it. The dump file is a 32-byte header entry followed by a number of bandwidth entries:

Bandwidth header:



Bandwidth entries (in order from oldest to newest):





Performance

Collecting this data involves 26-35 macro32 instructions once a second along the usual cache side effects. It is very difficult to measure any performance impact due to natural variation in performance test results. For example, any interrupt mitigation differences between tests overwhelms any measurement of the bandwidth monitoring overhead).

Anyone concerned with the overhead can simply turn it off:

MC LANCP SET DEV/NOBANDWIDTH/ALL