#### *General Performance by Symptom (perfmon and trace)*

##### Memory

***Memory: Pages/sec:*** The rate at which pages are read from or written to disk to resolve hard page faults. This counter is a primary indicator of the kinds of faults that cause system-wide delays. It is the sum of Memory\Pages Input/sec and Memory\Pages Output/sec. It is counted in numbers of pages, so it can be compared to other counts of pages, such as Memory\Page Faults/sec, without conversion. It includes pages retrieved to satisfy faults in the file system cache (usually requested by applications) non-cached mapped memory files. (Hard Page fault). A high reading may be symptom of system memory under stress.

***Memory: Available MBytes:*** A reading of less than 96MB is a symptom of memory pressure and a performance hit to the server.

***Page Life Expectancy:*** Capture and this needs to be baselined.

This is probably the most popular performance counter when it comes to memory in SQL Server. It represents the number of seconds a page will stay in the buffer pool without the references. If I’d have to choose one counter, this metric is the one that all SQL Server monitoring tools should be able to track. So, essentially, we want the page to stay in the buffer for as long as possible because it will lead to high performance. This is simply because if a request comes in for that page, it can be read from the cache rather than searching on the disk and ultimately reduce I/O. As for the expected value, this is a tricky one. You’ll probably read online that it should be more than 300. This is an old rule, when SQL Server memory could maximum be 4 GB. **These days, we can have much more RAM than that and this metric is basically memory dependent. Therefore, one of the most known memory formulas that can be found to calculate your PLE value online is the amount of allocated memory to SQL Server divide by 4 and multiply that number with** 300. For example, if 16 GB is allocated to SQL Server it should look like this 300 \* (16/4) = 1.200. So, this number is your base and if our PLE value is below this number that would be a good indication that SQL Server does not have enough memory to keep pages in the buffer long enough. By the way, this will directly affect buffer cache hit ratio. Therefore, those two are the most important SQL Server monitoring tools and commonly used counters to discover memory pressures.

For more information about monitoring two types of counters above, see the [SQL Server memory performance metrics – Part 4 – Buffer Cache Hit Ratio and Page Life Expectancy](https://www.sqlshack.com/sql-server-memory-performance-metrics-part-4-buffer-cache-hit-ratio-page-life-expectancy/) article.

***SQL Server: Buffer Manager: Buffer Cache Hit Ratio:*** Total amount of dynamic memory the server is using for the dynamic SQL cache Anything above 90% is acceptable, however this ideally should be as near to 99% as possible depending on the system, namely if OLTP. Anything less than 90% may be indication of memory pressure.

##### Disk I/O

To evaluate whether you have a disk array resource bottleneck, you will utilize both of these counters to efficiently diagnose. Alerts should also be in place to notify an engineer of low disk space available, which can be a contributor to this issue as well.

You should utilize both of these counters in unison. If you have a sustained % Disk Idle Time of < 45% and an average disk queue length of greater than 2 per physical disk (spindle), then you can be confident you are experiencing an I/O bottleneck.

***Physical Disk: Disk Reads/sec:*** The rate at which bytes are transferred from the disk during read operations. Growth of your baseline over time is symptomatic of memory pressure; this should be no higher than 85%.

***Physical Disk: Disk Writes/sec:*** The rate at which bytes are transferred to the disk during write operations. Growth of your baseline over time is symptomatic of memory pressure; this should be no higher than 85%.

***Physical Disk: % Disk Time:*** The percentage of elapsed time that the selected disk drive was busy servicing read or writes requests. Spikes are common. Results of >55% over a period of time warrants investigation.

***Physical Disk: Avg. Disk Queue Length:*** The average number of both read and writes requests that were queued for the selected disk during the sample interval. Results of > than 2 x number of physical disks in volume is not optimal.

***Physical Disk: % Free Space:*** The amount of free space available on physical disk. This should be no less than 5%

***Logical Disk: % Free Space:*** The amount of free space available on logical disk. This should be no less than 5%.

##### CPU Utilization

***Processor: Processor Time % (\_Total):*** The percentage of elapsed time that the processor spends to execute a non-Idle thread. This counter is the primary indicator of processor activity, and displays the average percentage of busy time observed during the sample interval. >80% % over a period of time may be an indicator of a CPU bottleneck. Spikes are common.

***System: Processor Queue Length*:** The number of threads in the processor queue. >2 per CPU is indication of a possible CPU bottleneck.

##### Network Structure and Bandwidth

***Network Interface: Bytes Received/sec:*** The rate at which bytes are transferred from the disk during read operations. a lot higher compared to a baseline. A substantial sudden baseline increase may be indication of an external attack; investigation is required.

***Network Interface: Bytes Sent/sec:*** The rate at which bytes are sent over the network adapter. A sudden increase over baseline may be indication of a large volume of data being accessed. If you cannot explain the sudden increase, investigation is required.

***Network Interface: Bytes/sec:*** This is the level rate as to traffic that is passed over the network. A substantial sudden baseline increase may be indication of an external attack; investigation is required. (ex. DOS – denial of service – attack)

***Network Interface: Output Queue Length:*** Number of packets sent over the network adapter that had to wait for transmission. A non-zero value would indicate a faulty NIC or excessive use for current NIC capabilities.

##### User Connections

***SQL Server: General: User Connections:*** This will show the number of user connections, not the number of users concurrently connected to SQL Server. A number of 255 is extraordinary and should be looked at for a corrective action.

 select \* from sys.dm\_os\_performance\_counters

Select avg(current\_tasks\_count),   
  avg(runnable\_tasks\_count),  
  avg(pending\_disk\_io\_count),  
  getdate() as reportdate  
  from sys.dm\_os\_schedulers where scheduler\_id < 8 and is\_online = 1  
  
Select \* from sys.dm\_os\_memory\_brokers  
Select \* from sys.dm\_os\_memory\_allocations