Rule DAS131: PEND DELAY TIME WAS CAUSED BY CHANNEL ACTIVITY

Finding: CPExpert has determined that the excessive PEND time was caused by utilization of the channels to the device.

Impact: This finding may have a MEDIUM IMPACT or HIGH IMPACT on the performance of the device.

Logic flow: The following rules cause this rule to be invoked:

DAS100: Volume with the worst overall performance
DAS130: Major cause of I/O delay was PEND time

Discussion: PEND time is the time from the issuance of the SSCH instruction until the device is selected by the control unit. This time is caused by queuing for the path (wait for channel, wait for director port, wait for control unit, wait for device, or wait for other reasons).

With modern fixed block architecture (FBA) devices, the PEND time ends when the physical positioning commands are presented to the *logical volume control block* within the control unit. The PEND time is caused by queuing for the path (wait for channel, wait for director port, wait for control unit, or wait for device, or wait for "other" reasons)[1].

The PEND time due to channel busy means the channel that was selected for the I/O operation was busy with another I/O operation from another system image in the same CEC. Since the channel was busy, the SSCH instruction could not result in device selection, and a PEND condition existed.

SMF Type 74 records do not contain the PEND time caused by channel busy[2]. However, CPExpert calculates an estimated PEND for channel busy based on I/O configuration information.

[1] PEND time is significantly reduced with FICON channels. FICON channels can have multiple I/O operations concurrently active, which reduces the potential PEND time caused by channel busy. There is no port busy time with FICON switches, and control unit time is significantly reduced. This statement regarding PEND time is not necessarily correct if a large number (more than 5) I/O operations are concurrently executing on a FICON channel. Dr. H. Pat Artis and Mr. Robert Ross have presented the results of research indicating that performance can degrade significantly when more than 5 I/O operations (Open Exchanges) are concurrently active on a FICON channel (see "Understanding FICON Channel Path Metrics"at www.perfassoc.com).

[2] MXG contains a variable AVGPNCHA, which is titled 'AVG (MS)*PEND DUE TO*CHANNEL BUSY'. However, the AVGPNCHA variable is simply created from the AVGPNDIR titled 'AVG (MS)*PEND DUE TO*DIRECTOR PORT' variable. MICS does not contain a "PEND CAUSED BY CHANNEL BUSY" variable.

When CPExpert creates the model of the I/O configuration, it retains information about each path to a device. Included in this path information is the physical path busy at the CEC level, for each path. Consequently, CPExpert has an overall view of all physical paths to the device, and can calculate overall channel activity for all channels to the device.

Rule DAS131 is produced when the calculated PEND time due to channel busy accounts for more than one-third of the device PEND time. This output will be produced for all channels sets (by CEC serial number) that are used to reference the logical volume experiencing high PEND time.

The following example illustrates the output from Rule DAS131:

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RULE DAS131:  LARGE PEND TIME DELAY WAS CAUSED BY CHANNEL BUSY.

   A significant amount of the PEND time delay was caused by high channel
   utilization for the channels connected to VOLSER CICS11.  This volume
   was referenced by the indicated channels.

                          AVERAGE PHYSICAL CHANNEL BUSY FOR CHPIDS:
   MEASUREMENT INTERVAL      3D   59   67   72   7F   99   A7   B4
    8:30- 8:45,22OCT2001     19   18   84   33   53   42   31   23
```

Suggestion: If an important device is experiencing delays because of high PEND caused by channel utilization, you should consider the following alternatives:

- **Redistribute data sets**. The high PEND time might be solved by redistributing high activity data sets among different volumes on different paths.

  If SMF Type 42 (Data Set Statistics) are available, CPExpert will identify data sets on the logical volume that have heavy I/O activity. However, please keep in mind that the PEND time is caused by channel activity. The I/O activity of the particular volume experiencing high PEND time might not be (and probably is not) the cause of high PEND time. Consequently, examining the results for the Type 42 (Data Set Statistics) for the volume might not yield satisfactory results.

- Move the logical volume to a different controller referenced by different channels.

- If redistributing the data sets or moving the volume is not feasible, perhaps more channels can be assigned to the logical control unit through which the device is referenced.

