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**Rule DAS230: PENDING TIME WAS MAJOR CAUSE OF I/O DELAY**

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**Finding:** CPEXpert has determined that excessive PENDING time was a major cause of delay in DASD response for 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:  
DAS200: Volume with the worst overall performance

**Discussion:** PENDING time is the time from the issuance of the StartSubChannel (SSCH) instruction until the device is selected by the control unit and physical positioning commands (such as seek and set sector, or define extent) are transferred to the device.

With modern fixed block architecture (FBA) devices, the PENDING time ends when the physical positioning commands are presented to the *logical volume control block* within the control unit. The PENDING 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)<sup>1</sup>.

PENDING is measured by the channel subsystem. After IOS issues the Start Subchannel command, the channel subsystem may not be able to initiate the I/O operation if any path or device busy condition is encountered:

C The channel selected for the I/O operation could be busy with another I/O operation from another system image in the same CEC. This time is not reflected in the SMF data.

C The director port could be busy with another I/O operation<sup>2</sup>. This time is reflected in SMF data as SMF74DPB.

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<sup>1</sup>PENDING time is significantly reduced with FICON channels. FICON channels can have multiple I/O operations concurrently active, which reduces the potential PENDING time caused by channel busy. There is no port busy time with FICON switches, and control unit time is significantly reduced. This statement regarding PENDING 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](http://www.perfassoc.com)).

<sup>2</sup>Director port busy can occur only on an ESCON channel. The use of buffer credits on a FICON native channel eliminates director port busy.

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C The control unit could be busy with another I/O operation from another system. This time is reflected in SMF data as SMF74CUB.

C The device could busy with I/O from another system. This time is reflected in SMF data as SMF74DVB.

There can be “other” PEND time not reflected in the above descriptions. For many systems, “other” PEND time is zero or very small. For some systems, the “other” PEND time is dramatically large (often, 75% or more of the average response time).

**Suggestion:** Please refer to Rule DAS130 for further information about PEND time.