

KIT Service Incident Report

Description

Files on nine tapes were found to be unreadable. After further investigations, we believe we have identified the possible cause:

One specific STK T10000C tape drive showed transient issues when writing to tape, but it did not report any critical errors. We discovered strong relations of similar read errors in the past to this very tape drive between July and December 2016. Unfortunately, we cannot tell whether this error happened for other tapes, too, before or after this date.

Impact

1857 Files are lost for LHCb, 1786 for ATLAS, 643 for CMS and 14 for ALICE

Time line of the incident

| | |
|----------------|---|
| Sep 2016 | 2 cartridges with lost files (TA1820, TA244) |
| Feb 2017 | 2 cartridges with lost files (TA2110, TA2112) |
| Mar 2017 | 1 cartridge with lost files (TA2416) |
| Jun 2017 | 1 cartridge with lost files (TA0348) Oracle data recovery fails Deep investigations found correlation with a specific drive |
| Jul - Oct 2017 | Verify whether involved volumes are still readable and found these nine tapes |
| Nov 2017 | Data recovery turned out to be impossible, subsequently declared all files lost. |

Analysis

The analysis by Oracle's experts identified three problems:

1. Tape margin error
Tape cartridges are not readable anymore due to damaged margin. The origin might be a mechanical shock at transport, e.g. cartridge had fallen on the floor.
2. Inefficient Tape Write
The tape drive has written the data with insufficient magnetisation. Only this particular drive could read back the data again, but other drives are likely to fail. Unsurprisingly, the tape drive in question had been exchanged due to other errors on 17.02.2017.

3. Stuck roller

One of the five rollers is outworn and prone to stall. Consequently, the tape is stressed more during operation than under normal conditions.

As mentioned in (2), the broken tape drive has been replaced; hence, we cannot carry out any more investigations with it. We have read the data archived by this defective T10000C drive with an optimised T10000D drive. That (latter) drive runs with a special firmware providing enhanced features for reading.

Follow up actions

All drives were updated to a brand new firmware, which should prevent these errors in the future.

According to our records, the broken drive had mounted 1080 different tape cartridges 3892 times. We will double-check that all these tapes can be read successfully by other drives besides the optimised T10000D drive, which naturally is a long lasting process. Two drives will be set apart to carry out this task on their own.

Summary

Upon analysing several tape cartridges with partially unrecoverable content, we were able to identify a correlation between these tapes and one specific tape drive. Read access to these tapes (with a different drive) frequently ended with the I/O error FSC 37F6 (Fault Symptom Code, Read Error). A total of 67 cartridges showed this problem. Checking all of them, 58 tapes proved to be a wrong positive and all their content was entirely readable. The data on the remaining nine tapes was no longer retrievable and we had to declare their files lost.

At this point, we still cannot guarantee that there are not even more files lost due to this malfunction. The only option we have right now is to mount all suspicious cartridges to determine if they are readable or not. This is an ongoing endeavour.