

Service Incident Report

Preliminary on April 20, 2010. Final prepared on June 15, 2010.

1 Executive Summary

On April 16, 2010 at 23:48 PT, Audience Science contacted 3PAR Customer Service to report that none of the hosts attached to InServ 1201812 could see their volumes. 3PAR Customer Services remotely logged into the InServ and confirmed none of the hosts could see the volumes. The 3PAR Customer Service Escalation Support and 3PAR Engineering teams were immediately engaged. Analysis determined that the InServ had failed to recover cleanly from a double node failure. A disk drive was identified to be reporting errors. It was then spun down and logically removed from the system. 3PAR initiated a power failure recovery process and when it completed on April 17, 2010 at 04:05 PT all volumes were back online.

2 Incident Tracking Information

Customer Name/ Location: Audience Science / Seattle, Washington			
Incident Description: Hosts lost access to volumes			
Service Request:	166542	SN:	1201812
SR Severity:	1	Model:	T400
		SW Version:	2.3.1 GA
SR Creation Date:	April 16, 2010 @ 23:48 PT	Eng Tracking Number:	51041
3PAR Contact:	Mike Mowen	Customer Contact:	Nate Amsden
Title/Role:	Technical Support Mgr.	Title/Role	

3 Case Symptoms

- 3PAR Customer Service received automated alerts from InServ 1201812 indicating the system was attempting a power fail recovery process.
- Audience Science notifies 3PAR Customer Services that all hosts have lost access to the InServ.

4 Business Impact to the Customer

As a result of this incident none of the affected hosts were able to connect to the InServ during the incident period.

5 Service Event Summary

On April 16, 2010 at 23:33 PT, 3PAR Customer Service received a Real-time Alert Process (RAP) notification indicating that InServ serial number 1201812 had crashed and was attempting to recover automatically, but had failed the recovery process. A second RAP indicated that the InServ would require a powerfail recovery and one volume (id 63) could potentially lose data.

At 23:48 PT, Audience Science called 3PAR Customer Service to report that none of the hosts attached to InServ 1201812 could see their volumes. 3PAR immediately started analyzing the events from the system to find out if the InServ encountered a power failure because the initial RAP alert indicated symptoms of power failure recovery. The customer informed 3PAR that no power failure condition had occurred.

3PAR Customer Services remotely logged into the InServ and observed that the 'showhost' command indicated none of the hosts are logged into 3PAR ports and hence hosts are not seeing the volumes.

3PAR Customer Services immediately engaged the Escalation Support team, who performed additional analysis and determined that the 3PAR System Manager process was not running, but was awaiting manual intervention to initiate a power fail recovery procedure. The power fail recovery process is only invoked after an InServ has experienced a total outage. The 3PAR Customer Services Duty Manager was contacted at 00:14 PT. Based on the state of the InServ and the impact it on Audience Science's operations, the 3PAR Engineering team was engaged at 00:37 PT.

3PAR Engineering remotely accessed the InServ, and began reviewing logs, various system files, and analyzing the current state of the InServ. 3PAR Engineering was working to determine if any other VV's may have been affected. Only VV id 63 was determined to be suspect. As part of the analysis work being performed, 3PAR Engineering recommended that 3PAR Customer Services run a series of diagnostics against all physical drives installed in the InServ, to determine if any drives were in a failed state. At approximately 01:56 PT the drive diagnostic process was initiated, and at approximately 02:28 PT the process was completed. From the diagnostics it was determined that drive PD94 was reporting errors. PD94 was then spun down and logically removed from the system.

As a result of the analysis performed, 3PAR Engineering recommended that 3PAR Customer Service initiate the power fail recovery process manually. This process would require that the system be rebooted 2 times, and system checks would be performed after each reboot. The total estimated time to perform the power fail recovery process was 40 minutes. The power fail recovery was started at 03:20 PT and completed successfully at 04:05 PT. Once completed, all volumes were back online and accessible by the hosts. Based on the available InServ data, all volumes had passed the 3PAR consistency checks. 3PAR recommended that the customer perform local system checks on all volumes, including volume id 63.

The conference bridge concluded at 04:10 PT, after the customer recommended the call can be shutdown as additional assistance was no longer required from 3PAR. The customer then began the process of starting internal data consistency checks.

6 Root Cause / Failure Analysis

Root cause has been identified as a single disk drive (PD94) having a very rare read inconsistency issue. As the first node read the invalid data, it caused the node to panic and invoke the powerfail process. During the node down recovery process another node panicked as it encountered the same invalid data causing a multi-node failure scenario that lead to the InServ invoking the powerfail process.

During the escalation troubleshooting period on April 16 and while PD94 was still in the system, 3PAR Engineering used a command called "pd diag", which writes specific patterns of data on the drive in a special area. 3PAR Engineering observed the drive read back data that was different then what was expected for a logical block address. After the test completed, the drive was removed and returned to 3PAR for failure analysis.

After PD94 was returned, 3PAR's drive failure analysis team re-read the data in the special area where 'pd diag' wrote specific data, and again verified that what was written to the media is what 3PAR expected (was written by 3PAR tool) confirming the failure analysis that the data inconsistency developed during READ operations. In addition, 3PAR extracted the 'internal HDD' log from this drive and had Seagate review it for anomalies. Seagate could not find any issues with this drive based on log analysis.

Furthermore, the write functions were thoroughly tested and worked reliably. The drive is running the latest firmware (AF1) from the drive manufacture. The drive passed all other diagnostic tests.

This is the first drive failure scenario of a read data inconsistency issue 3PAR has seen with near line drives running the most current firmware. Because 3PAR was unable to reproduce the failure and the drive manufacture cannot identify any anomalies, 3PAR will continue to monitor other drive failure failures in order to capture and implement corrective actions.

7 Service Restoration

InServ serial number 1201812 recovered after the power fail recovery process was manually initiated and successfully completed at 04:05 on April 17, 2010.

8 Analysis of Systems, Processes, and Service Execution

This service event was initiated by the unscheduled outage of InServ 1201812. A review of the service response for this event shows that all 3PAR systems, processes, and personnel reacted correctly and quickly in support of Audience Science.

- Automated systems provided real-time alerts
- 3PAR Customer Service engaged within minutes and began troubleshooting activities
- 3PAR correctly applied and followed standard operating procedures and applied the "Outage Checklist" to this event
- 3PAR Customer Service initiated a conference bridge with Audience Science
- The 3PAR Customer Services Duty Manager was engaged after the outage was confirmed, and participated on the conference bridge
- 3PAR Escalation Support and Engineering were engaged quickly, reviewed the log files, and remotely accessed the InServ for real-time problem analysis
- 3PAR Executive Management were updated through out this service event

9 Event Chronology

Date	Time	Event
April 16, 2010	23:33:PT	3PAR received RAP alert indicating the InServ will require powerfail recovery and there is a volume that will lose data.
April 16, 2010	23:48 PT	Customer called 3PAR Support to inform none of the hosts see volumes. 3PAR Technical Support logged in and observed that showhost indicated none of the hosts are logged into 3PAR ports and hence hosts are not seeing the volumes.
April 17, 2010	00:05 PT	Escalation Support engaged.
April 17, 2010	00:37 PT	Engineering Support engaged
April 17, 2010	00:45 PT	3PAR Engineering remotely accessed the InServ, and began reviewing logs, various system files, and analyzing the current state of the InServ. 3PAR Engineering was working to determine if any other VV's may have been affected. Only VV id 63 was determined to be suspect. As part of the analysis work being performed, 3PAR Engineering recommended that 3PAR Customer Services run a series of diagnostics against all physical drives installed in the InServ to determine if any drives were in a failed state.
April 17, 2010	01:56 PT	The drive diagnostic process was initiated.
April 17, 2010	02:28 PT	The drive diagnostic process was completed.
April 17, 2010	02:40 PT	From the diagnostics it was determined that drive PD94 was reporting errors. PD94 was then spun down and logically removed from the system.

Date	Time	Event
April 17, 2010	03:20 PT	The power fail recovery process was started.
April 17, 2010	04:05 PT	The power fail recovery process completed successfully. Once completed, all volumes were back online
April 17, 2010	04:10 PT	The conference bridge concluded after the customer recommended the call can be shutdown as additional assistance was no longer required from 3PAR.

10 Corrective Actions / Follow-Up Actions

Action	Owner	Proposed Date	Actual Date
Perform failure analysis on PD94 to determine root cause of failure	3PAR QA	April 30, 2010	Done May 11, 2010
Perform failure analysis on InServ code level 2.3.1 to determine why system didn't automatically recover	3PAR Engineering	April 30, 2010	Done. April 30, 2010. No Issues.
Determine if there is any correlation between this incident and SR# 166398, which the customer opened and reported data inconsistencies after a different drive was replaced.	3PAR Engineering	April 30, 2010	Done. April 30, 2010. Not related.
Update and finalize Service Incident Report with all failure analysis data and corrective actions.	3PAR Mike Mowen	May 4, 2010	Done June 15, 2010
Send customer final version of Service Incident Report and review with customer.	3PAR Mike Mowen	May 4, 2010	Done June 15, 2010

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