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Purdue Pharma L.P.: Surviving Media Disaster with RMAN

PURDUE

"Our RMAN backup strategy helped us survive a major media failure, and database recovery completed 80% faster than our previous methods. Switching to RMAN from operating system backup methods was definitely the right decision for us!"

-- Siva Muthuraman
Senior DBA
Purdue Pharma L.P.

Corporate Profile: Purdue Pharma L.P.

- Industry-leading pioneer of research into the treatment of persistent pain
- Provides prescription and OTC medicines to 48,000 retailers and hospitals
- http://www.purduepharma.com/

Oracle Database Backup and Recovery Solution

- Oracle Recovery Manager (RMAN)
- 125 databases with total size of 1TB
- Well-proven solution for restoring and recovering database from major media loss

OVERVIEW

Purdue Pharma L.P. ("Purdue") runs SAP Manufacturing and Financial Applications, which serve the entire company, on Oracle databases, deployed on an HP-UX infrastructure. In the past year, Purdue migrated from using OS-based backups of the databases to a centralized, automated, and more reliable approach with RMAN. Purdue utilizes RMAN to manage the database backups of 125 Oracle databases, representing 1 TB worth of data.

This profile details how Purdue used RMAN to survive a major media loss, affecting 200 GB+ across 6 critical databases.

INTRODUCTION

Purdue is known for its pioneering research on a principal cause of human suffering: chronic pain. Purdue is a leader in the development of long-acting medicines and, in particular, controlled-release opioid analgesics to relieve pain for both cancer patients and patients with moderate to severe chronic pain. Together with The Purdue Frederick Company and other independent associated companies, Purdue has been dedicated to serving both physicians and patients with innovative prescription and non-prescription products for more than 50 years.

BACKUP STRATEGY

The database infrastructure consists of 125 Oracle databases ranging from version 8.1.7 to 9.2.0.4, running on 45 HP-UX servers. The Oracle software and database files on all these servers are attached to a SAN, configured as 7+1 RAID.

Weekly online, full RMAN backups to tape are run on all the databases with the Tivoli Data Protector for Oracle (TDP) module. Tivoli Storage Manager (TSM) is used as the enterprise backup solution for the filesystem. All backups are identified by unique tag names. The Oracle homes themselves are backed up to tape with a standard TSM backup.

System Configuration

HP RP8400 running HPUX 11.11
- **45 servers**
- **8 GB RAM per server**
- **6 CPUs per server**

Oracle9i Database Release 9.2.0.4, Oracle8i Database Release 8.1.7
- **125 instances**
- **30-40 GB per instance**
- **100+ concurrent users**

ATL P3000 tape library with 16 drives

Storage Area Network (SAN) configured as 7+1 RAID

Backup Strategy for Database
- **Weekly, online full backups**
- **Backed up to tape using Tivoli Data Protector for Oracle (TDP)**
- **Control file autobackup enabled**
- **Daily Backup and Cleanup of Archived logs**

Protection and Backup of Catalog Database
- **Standby database protects catalog database**
- **Daily backup of catalog database**

When the Purdue DBA team started testing with RMAN, they immediately experienced the following benefits:

- *Backups with RMAN took approximately 50% less time than operating system backups.* This reduces the time spent performing the backups and frees up the DBAs for more important tasks.
- *DBAs do not have to continually review and maintain operating system scripts for the hundreds of datafiles across all the databases.* RMAN's tight integration with Oracle only requires one command to backup the entire database.
- *Eliminates the overhead of generating additional redo during online database backup.* RMAN validates at the database block level and does not require placing each tablespace into hot backup mode.

DOCUMENT AND TEST RECOVERY SCENARIOS

Once the RMAN support was in place, the Purdue DBA team proceeded to thoroughly document and test all possible recovery scenarios, from the individual datafile to the entire database, for all databases. These procedures also included the steps for initially restoring and recovering the catalog database prior to database recovery. It was this document and RMAN that saved their enterprise from permanently losing critical manufacturing and financial data after an unexpected storage failure.

SUDDEN STORAGE FAILURE...NOW WHAT?

Without warning the SAN experienced an internal failure and eight physical drives (104 logical volumes) were lost. The first step was to find out which servers and databases were affected.

Assessing the Damage

The DBA team began to receive calls that applications were getting block corruption errors. Realizing that the problem wasn't isolated to non-database files, the DBAs ran DBVERIFY on all the database files. The entire SAN infrastructure was also rebooted to ensure that all disk errors were identified.

The investigation found that one entire file system was lost, resulting in the loss of files that were a part of six different databases, with more than 200 GB of data. On a few servers, the Oracle home directory and binaries were also missing. This was a dire situation, and a perfect opportunity to put RMAN to the test.

The Oracle home directory and binaries were first restored from TSM backups on tape. Next, RMAN was used to restore and recover each of the six affected databases.

RMAN RESTORE AND RECOVERY STRATEGY

Different RMAN recovery strategies were employed to fully recover each of the six affected databases.

The DBA team developed a set of RMAN scripts to perform various types of recovery:

- Control file
- Data file
- Log sequence-based
- Tag name-based
- Full database
- Previous incarnation

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This flexibility of recovery would not have been possible with operating system backups, which had no knowledge of which files were needed, associated together as a backup unit, or even guaranteed to be block-level validated. RMAN takes care of all these tasks for the entire restore and recovery process.

Control File and Data File Recovery

The first database had lost 3 index data files and all control files. A control file was first restored from the latest backup. The datafiles that were reported as corrupt from running the DBVERIFY were then restored. The last step was to recover the database. The RECOVER DATABASE command looked for the archived logs on the local disk, and if any were not available, they were automatically restored from tape. All we had to do was run the appropriate scripts, sit back, and monitor the log files.

Log Sequence-based Recovery

The second database had one corrupted data file. A log sequence-based recovery was performed. The last log sequence number before the database was corrupted was retrieved from the alert log and specified as part of the recovery script. It worked like a charm, and we were able to easily recover the database.

Tag Name-based Recovery

The third database needed to be restored to the backup *prior* to the latest backup to be in sync with the application state. Log sequence-based recovery was initially attempted. However, this option did not work because there was an insufficient number of log switches performed between the backups, and it could not get us the exact point in time we wanted. The only option, in this case, was to restore the database using the tag name for the needed backup. Again, this worked smoothly.

Full Database Recovery

The fourth database required a full database recovery. The initial approach taken was to perform three separate restores, in parallel:

- Restore all the system datafiles
- Restore the datafiles holding application data

- Restore the index datafiles

After the restores were running for three hours, we realized that each restore was reading every backup piece in order to find a particular datafile. For example, while one session examined a backup piece, the other session was in a media wait since it needed the same backup piece used by the other session.

The previous restores were cancelled and a RESTORE DATABASE was issued. The database was restored and recovered (including applying the archived logs) in just one hour.

Previous Incarnation Recovery

The fifth database to be recovered was another interesting challenge. After restoring and opening the database with RESETLOGS, there were still some corrupt datafiles in the database. The solution was to go back to a previous incarnation and restore the database. We followed the RMAN documentation to reset the database to the previous incarnation and started the restore. To our delight, it worked as advertised! RMAN went to the previous incarnation, restored the datafiles, and recovered the database.

Catalog Archived Logs

An additional task, after performing recovery, was to catalog the archived logs generated after the backup, so that RMAN knew of their existence. Once the archived logs were cataloged, complete recovery could proceed on the affected databases.

LESSONS LEARNED

- It is a good idea to issue RESYNCs of the controlfile with the catalog database periodically throughout the day. This applies especially to databases that generate a large number of archived logs throughout the day.
- The latest media manager module should be verified and installed. A prior version of our module could not restore 2 GB backup pieces, and this was not discovered until the media failure occurred. Fortunately, we had tested a newer version of the module, which did not have this restriction, only a week before. We immediately installed it and used it to complete the restores from tape.
- Develop and fully test specific recovery scripts for your environment. Document the recovery steps as a "cookbook" that can be referenced during a real recovery.
- After a database has been recovered as a new incarnation, run a full backup of the database. This will allow recovery, starting with the new incarnation.

- Running a RMAN VALIDATE of the database after it was recovered was very useful. This provided a quick check that all the database blocks were, in fact, free from corruption.

CONCLUSION

Even though we made regular backups of all databases, the success of our backups hinged on how successfully we were able to restore and recover the databases in the most dire of situations – total media failure. RMAN succeeded on all counts, in all types of media recovery that were needed. Though it was a tough decision to let go of our regular OS backups and switch to RMAN, now that we have survived a real disaster, we are confident that RMAN can measure up to and take on all data recovery challenges.

For More Information

- Oracle9i Recovery Manager User's Guide
- Tuning Oracle Recovery Manager
- RMAN Backup and Recovery Optimization
- RMAN Performance Testing at Sun Customer Performance Center: 1 TB/hr Backup & Restore
- HP & RMAN Performance Benchmarking: 3 TB/hr Backup, 1 TB/hr Restore

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Purdue Pharma L.P.: Surviving Media Disaster with RMAN
April 2005
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