HP StorageWorks XP Disk Array and Mainframe white paper

ADABAS database backup and recovery

Preface

In today's fast-moving online transaction environment, many businesses use applications that require access to databases to make critical information for enterprise applications instantly available. It is therefore important that backup strategies for ADABAS data changes be available. Recovering ADABAS databases to a specific point in time requires the data to be separately recovered from different logs and different utilities with possibly complex recovery procedures.

This paper describes the general recovery procedures for ADABAS databases and the benefits that enhanced storage products such as the HP StorageWorks XP family may have to simplify the handling and to improve database availability and data integrity.

Requirements for a modern database backup technology

An "ideal" backup solution combines the advantages of both disk and magnetic tape in a backup architecture and takes into consideration the possibilities of the modern storage technology.

The newest idea in the design of modern data backup architecture is Enhanced Backup Solutions (EBS). In commonly employed data backup procedures, all processes—backup, storage, restore—run over the same data backup device (usually a tape library). The so-called "enhanced" architecture separates the production data and the backup applications from the archive system.

Disk arrays improve the backup and restore functions and can help to meet the goals of the data backup measures (that is, with HP StorageWorks XP Business Copy). The existing tape library can be further utilized for normal archiving and disaster recovery procedures because of the lower costs and the exchangeability of the medium.

Most database systems have interfaces that can control disk system functions such as data replication (for example, Business Copy). These functions can be divided into two procedures:

- Data duplication, a "shadow-copy" (Full Copy)
- A copy of the changes (differential copy) made from the original (FlashCopy)

These procedures are manufacturer specific and are realized through technically different means. For the user these differences are superficial because the processes to fulfill the backup and recovery requirements on the database system are running in the background.

The demands for the availability of the applications have risen dramatically. Most computer centers are running 24 x 365. Precautions and measures must be taken not just to the operating system (SYSPLEX, GDPS) but also to the storage subsystem (Continuous Access, Business Copy, and so on).

To meet these demands, it is necessary to have a thorough understanding of the different storage platforms. The HP StorageWorks XP Family not only offers basic functionality, but also extended functionality that can improve the availability of the data and the applications, that is, the copying of dependent volumes at defined time intervals (point-in-time copy).

These functions are dependent upon their availability in the database structure.

Description of the copy functions

The terminology from the IBM environment cannot be used to describe the ADABAS database function.

The concept of this database is different from DB2 and IMS and the recommended procedure for backup and recovery from IBM is not useable. The major difference is that ADABAS databases can be combined over heterogeneous platforms.

Figure 1 and Figure 2 provide a possible scenario and Figure 3 describes a cluster solution on z/OS platforms.

The ADABAS database software uses independent functions and utilities to solve this challenge.

Following is an overview of ADABAS database backup and recovery scenarios and the utility functions for z/OS, which will help in finding the best solution for your business processes. Available and useful functions of modern storage systems can help to improve backup and restore functionality. HP also offers the necessary in-house consultation and can tailor the best solution for each customer.

Figure 1. Operating structure of the ADABAS system

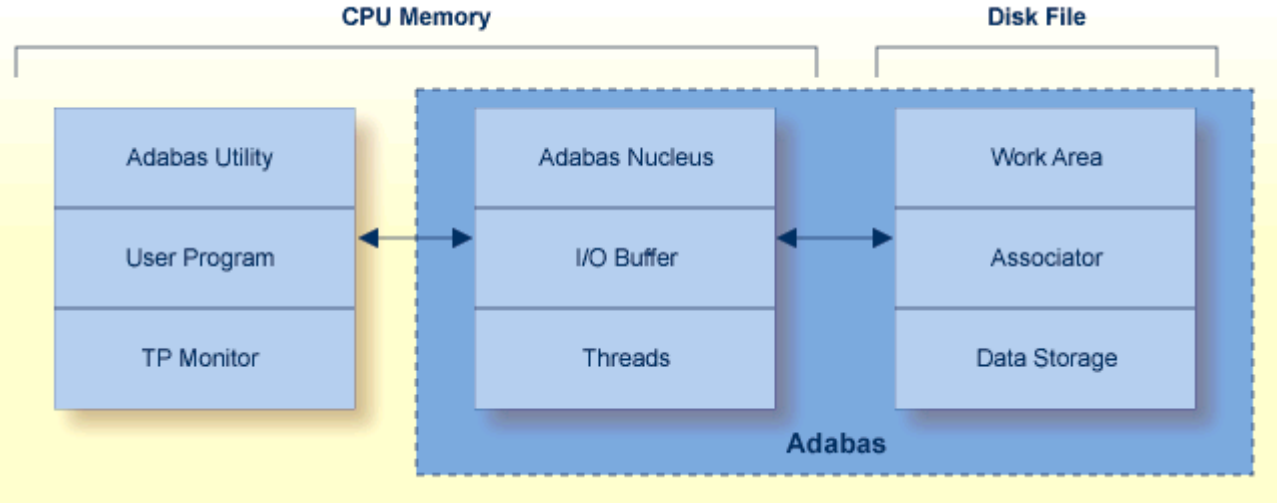


Figure 2. Entire network multi-system processing tool

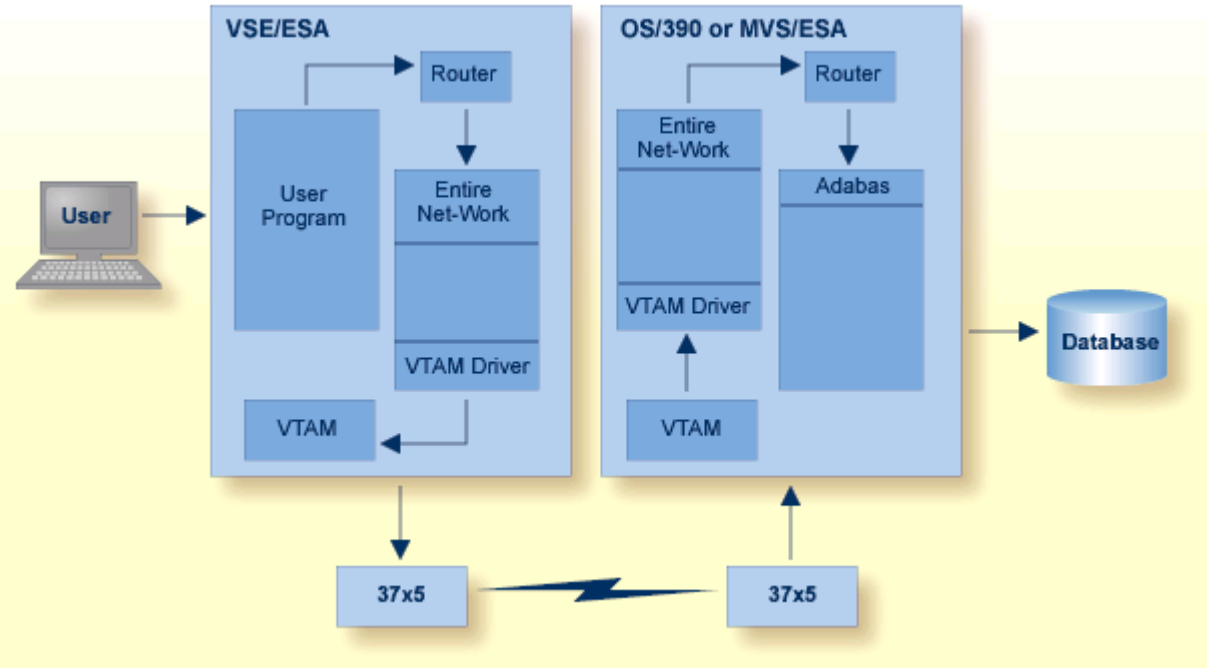
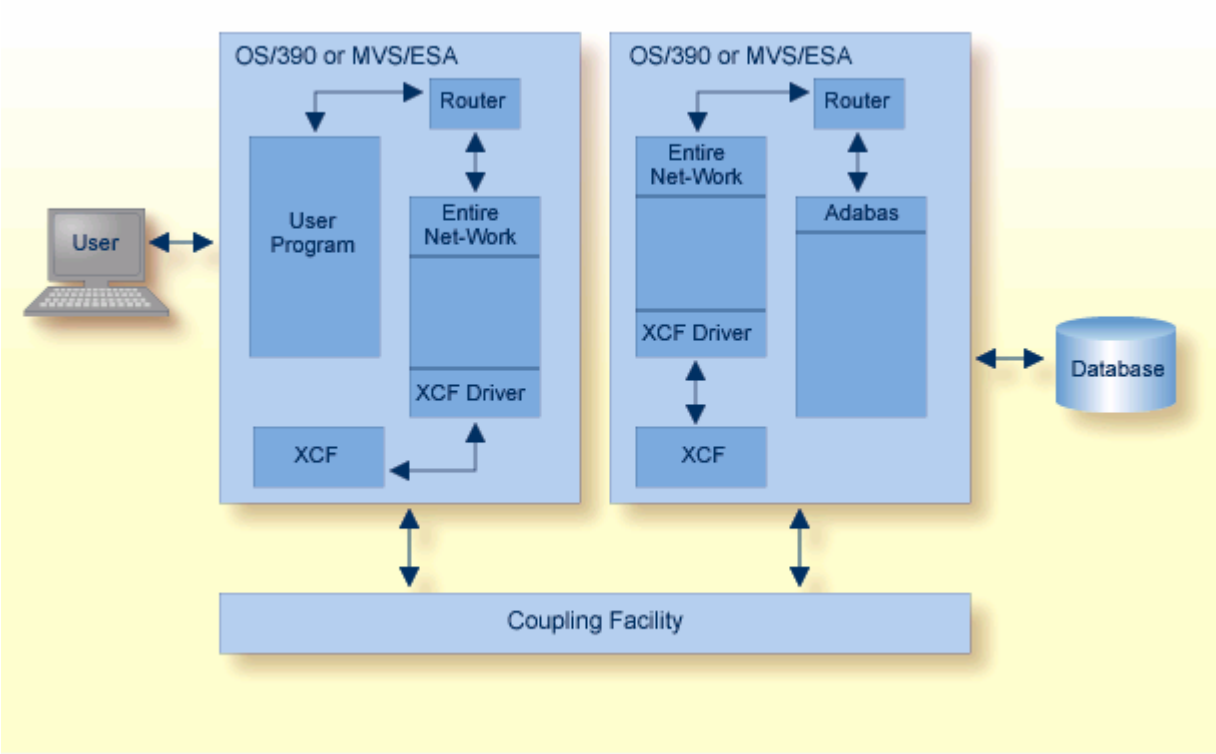


Figure 3. Cluster services with other ADABAS products (ADABAS online system communicates with all nucleuses within the Sysplex cluster.)



The following describes several situations for recovery due to hardware or software malfunction.

ADABAS hardware or operating system failure

After any failure that causes the ADABAS nucleus to terminate abnormally, an automatic procedure is executed when ADABAS is reactivated to bring the database to a physically and logically valid status. All partially executed update commands are reset; all incomplete transactions are backed out.

The automatic procedure comprises three steps: repair the database, auto-restart, and auto-backout:

- Database repair modifies the database to the status it would have had if a buffer flush had just been completed at the time of failure. That is, all blocks in the database are at a status that enables the nucleus to perform normally.
- Auto-restart backs out updates of single update commands that were partially executed when the system failed. It resolves internal inconsistencies in the database and ensures physical integrity.
- Auto-backout, which is performed only for ET logic users, backs out updates of user transactions, which were partially executed when the system failed. ADABAS performs an internal backout transaction (BT) followed by auto-restart, and then informs the user that the last transaction has been backed out.
- The auto-backout routine is executed at the end of an ET session that was terminated with HALT. It is also executed automatically at the beginning of the next ADABAS session to remove any updates performed within transactions that did not complete successfully.
- After auto-backout execution, the database contains updates only from logically complete transactions.

Note:
ET users can manually back out an incomplete transaction at any time by issuing the BT command.

If an ADABAS hardware or operating system failure results in physical damage to the database, it may be necessary to recreate the database using the **ADASAV** and **ADARES** utilities.

Power failure

Depending on the hardware, a power failure during an I/O operation may damage the ADABAS blocks that were being processed. This damage cannot be detected during auto-restart and therefore can result in later problems such as unexpected response codes or lost database updates.

If the ADARUN IGNDIB=YES parameter is set, the auto-restart routine checks whether a buffer flush was active when the session interruption occurred. If a buffer flush was in process, the auto-restart shuts down and ADABAS alerts the user to the potential problem and includes a list of the files being updated when the buffer flush was in process. The DBA must then determine whether a power failure occurred.

If the cause of a session interruption:

- **Is** a power failure, Software AG strongly recommends recovering the affected files using the **ADASAV** and **ADARES** utilities.
- Is definitely **not** a power failure and the integrity of the information on the output hardware can be guaranteed, the database can be reactivated immediately. Database recovery is not necessary.

If you read all this, then it seems that modern disk technology cannot help to recover from a malfunction. This is not true!

You must ask yourself: "What can be done to improve the current recovery process?" The answer to this question can be found in the ADABAS software itself. A part of the utility function can be used more effectively with functions like HP StorageWorks XP for FlashCopy Mirroring or HP StorageWorks XP Business Copy.

One of these functions is the ADABAS Delta Save Facility. You can use this function to make periodical backups. HP StorageWorks External Storage XP technology can be used to reduce the storage cost. For a full backup you can hold the original database for few seconds and split up all associated data for a full restore with Business Copy. This mechanism reduces the I/O overhead on the original database.

HP offers various services for mainframe and open-systems platforms and the knowledge to find the right solution for your requirements. HP can help to implement the best solution for your ADABAS database.

Appendix—Functional overview of the ADABAS utilities for recovery

ADASAV

The ADASAV utility saves and restores the contents of the database, specific files, or a file to or from a sequential dataset.

ADASAV should be run as often as required for the number and size of the files contained in the database, and the amount and type of updating.

For large databases, ADASAV functions may be run in parallel for the various disk packs on which the database is contained. Special ADASAV functions are available for use with the ADABAS Delta Save Facility.

For more information, see the ADABAS Delta Save Facility documentation.

ADABAS Delta Save Facility

The ADABAS Delta Save Facility (DSF) offers significant enhancements to ADASAV utility processing by backing up only the changed (delta) portions of ADABAS databases. It reduces the volume of save output produced and shortens the duration of save operations; this increases database availability. By allowing more frequent save operations to be performed, it also reduces database recovery time.

The ADABAS DSF provides for:

- More frequent saves without interrupting database availability
- Enhanced 24x7 operation
- Full offline saving parallel with the active database
- Short REGENERATE duration during recovery

ADABAS DSF achieves these objectives by saving only those Associator and Data Storage blocks that have changed (delta portion) since the last save operation. The result of this operation is called a **delta save tape.** Because a much smaller volume of output is written to delta save tapes, contention for secondary (tape, cassette, and so on) storage is reduced.

ADABAS DSF can:

- Maintain a log of changed database blocks (RABNs)
- Create and merge interim "delta" save tapes while the database remains online, if required
- Consolidate delta save tapes with the most recent database save tape to create a current full save tape
- Restore the database from the most recent full save tape and all subsequent delta save tapes

ADABAS DSF is intended for ADABAS sites with one or more large, heavily updated databases that need to be available most of the time. It is particularly beneficial when the volume of data changed on a day-to-day basis is considerably smaller than the total database volume.

The demonstration or full version of ADABAS online system is required to use DSF. For more information, see the ADABAS Delta Save Facility documentation.

SAVE: Save Database (Full Backup)

The ADASAV SAVE (database) function saves the contents of the database to a sequential dataset. It saves all blocks that are in use in the database. The SAVE (database) function may be executed with the ADABAS nucleus active or inactive.

If executed while the ADABAS nucleus is

- **Active,** the RESTONL function must be used to later restore the database.
- **Inactive,** the RESTORE function must be used to later restore the database.

In both cases, it is possible to restore just one or a few files from the database saved on the SAVE dataset. For the complete ADABAS documentation available from Software AG, visit www.softwareag.com.

For more information

- HP StorageWorks XP Disk Arrays
  http://h18006.www1.hp.com/storage/xparrays.html
- HP StorageWorks XP Business Copy
  http://www.hp.com/products1/storage/products/disk_arrays/xpstoragesw/business/index.html
- HP StorageWorks XP for FlashCopy Mirroring
  http://h18006.www1.hp.com/products/storage/software/fcmxp/index.html
- HP StorageWorks XP External Storage
  http://h18006.www1.hp.com/products/storage/software/extstxp/index.html
- Software AG
  www.softwareag.com

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