

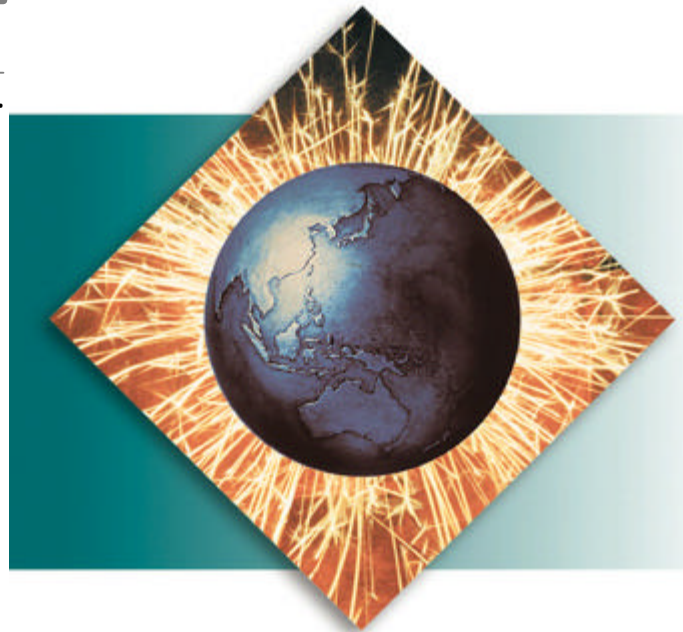


IBM DB2 Universal Database for OS/390 Utilities

Technical Summary

IBM DB2® Universal Database™ for OS/390® Version 6 delivers the most dramatic improvements in utilities ever. Continuing with the strategy that guided improvements in DB2 for OS/390 Versions 3, 4 and 5, DB2 Universal Database for OS/390 Version 6 delivers utilities that address your key database management requirements.

IBM defines core utilities as those that you must have to maintain your data. These include utilities such as LOAD, COPY, REORG, RUNSTATS and RECOVER. The best-of-breed utilities available in DB2 Universal Database for OS/390 ensure the highest level of data integrity, performance, availability, function and value. Since the core utilities are included at no extra charge with your base DB2 license, IBM offers the most cost-effective solution.



Defining priorities

The implementation of large objects (LOBs) in DB2 Universal Database for OS/390 Version 6 required innovative internal storage structures, which in turn called for utility enhancements to the LOAD, COPY, REORG, RECOVER, RUNSTATS and CHECK utilities. In addition to the 4KB and 32KB page sizes previously offered, DB2 Universal Database for OS/390 now offers 8KB and 16KB page sizes, as well as storage structure options to improve data sharing performance. These additions required enhancements to the COPY and RECOVER utilities.

IBM periodically surveys DB2 customers to understand and prioritize their requirements. In 1995, customers identified Online REORG as the highest priority utility. Online REORG was

delivered in June 1997 with the general availability of DB2 for OS/390 Version 5. In 1996, the key customer requirement was the ability to alter the partitioning of tables. The first phase of this enhancement is being delivered in DB2 Universal Database for OS/390 Version 6. This includes the ability to alter the values bounding each partition and rebalance the data in the partitions with the REORG utility.

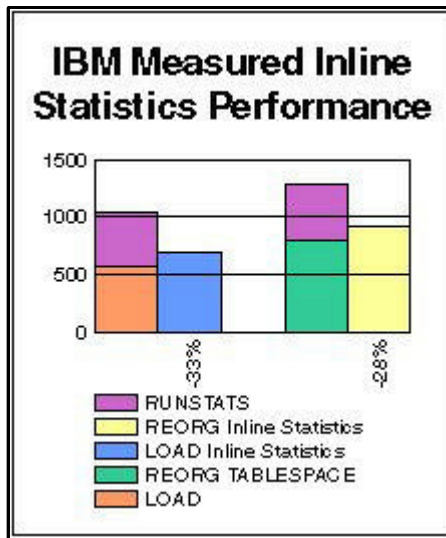
Other high-priority utility requirements such as the ability to determine if REORG should be run, COPY/RECOVER Indexes, Discard During REORG and performance improvements have been implemented. If an unnecessary reorganization can be avoided, data availability is improved (even more than Online REORG) as no outage occurs for a reorganization that does not take place. Recovering an index from a backup copy is faster than scanning the data to rebuild an index, so you can resume your business operations faster in case of an outage. Performance improvements are achieved by parallel processing, exploiting the multiple processors available in most enterprise servers.

Altering Partitioned Tables

Prior to DB2 Universal Database for OS/390 Version 6, the method to rebalance partitions required dropping and recreating the tablespace, table, views and authorizations. Now, you can use the SQL ALTER INDEX statement to change the values of partition boundaries. Only the partitions affected by the boundary change will be placed in a REORG Pending state. The REORG TABLESPACE utility is enhanced to operate on a range of partitions so you don't have to reorganize the entire tablespace. RECOVER of the tablespace is also enhanced to take advantage of the partition range inline copies which can now be created by REORG.

The COPY Utility

Creating backup copies is like paying insurance premiums-you hope you never have to take advantage of the insurance coverage but, in the meantime, you want it to cost as little as possible. In DB2 for OS/390 Version 3, the COPY utility had full partition independence. In Version 4, an architectural change provided performance improvements measured up to 10 times faster for full image copies and up to 16 times faster for incremental image copies. Also in Version 4, COPY provided for exploitation of DFSMS and disk hardware with the CONCURRENT option. DB2 for OS/390 Version 5 provided for full copies to be taken inline by LOAD and REORG. In Version 5, unnecessary copies can be avoided with the CHANGELIMIT option. In DB2 Universal Database for OS/390 Version 6, you can make full image copies of indexes. You can also copy a list of tablespaces and indexes with a single COPY statement and perform those copies in parallel. Laboratory test have measured improvements of up to four times for elapsed time when parallelism degree is equal to 10.

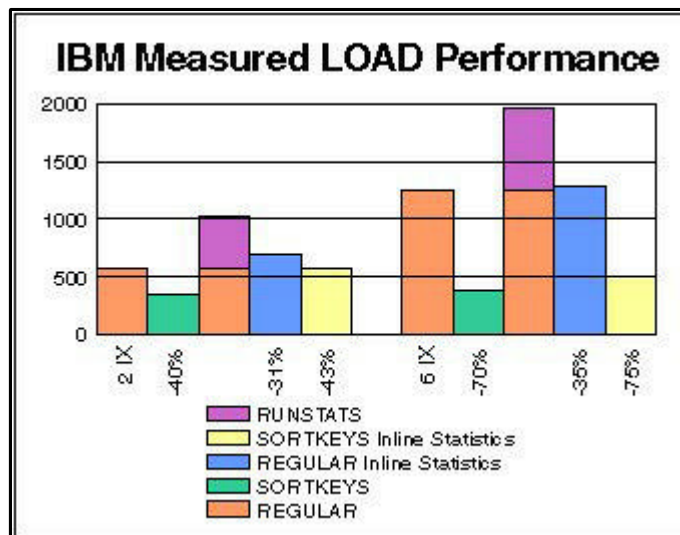


The LOAD Utility

Efficient loading of data into DB2 tables from flat files is becoming increasingly important as more and more companies rely on DB2 Universal Database for OS/390 for data warehousing, data mining and other business intelligence applications.

DB2 for OS/390 Version 3 provided LOAD partition independence with some restrictions. Those restrictions were removed in Version 4. Improved internal processing in Version 4 provided performance improvements measured up to 31 percent faster in CPU time and up to 25 percent in elapsed time. DB2 for OS/390 Version 5 provided further CPU time improvements of up to 17 percent. Piping of index keys and elimination of work files in Version 5 provided improvements in elapsed time up to 23 percent.

In DB2 Universal Database for OS/390 Version 6, the indexes can be built in parallel and you can collect statistics inline during the LOAD, resulting in a six-fold improvement in elapsed time for a tablespace with six indexes.



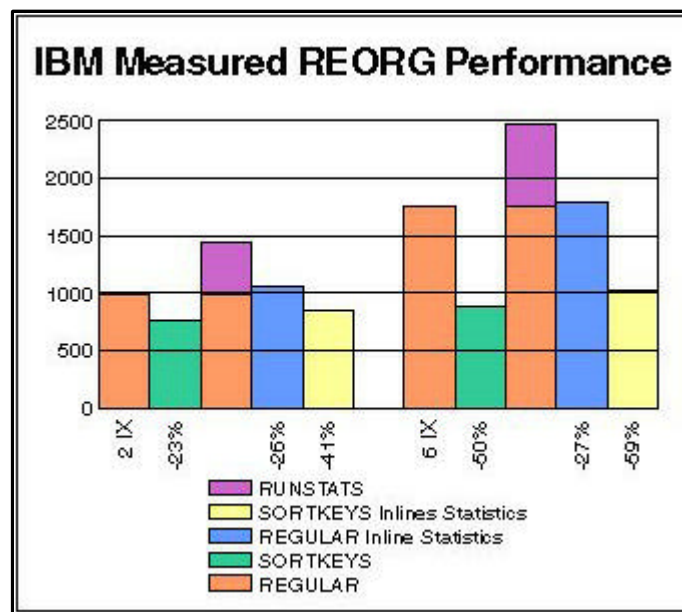
The REORG Utility

Reorganization of data restores the order of the data (improving query and data manipulation performance) and storage efficiencies. Reorganization is needed in the following instances:

- Updates of variable-length records that created overflow records
- Insufficient or depleted free space decreases clustering
- High delete workload profiles which results in empty pages and may accompany table space end extension.

With DB2 Universal Database for OS/390 Version 6, reorganization is needed to rebalance partitions.

DB2 for OS/390 Version 3 provided REORG partition independence with some restrictions. Version 4 removed those restrictions. Improved internal processing in DB2 for OS/390 Version 4 provided up to 24 percent improvement in CPU time. Version 4 also introduced reorganization of the DB2 catalog. DB2 for OS/390 Version 5 provided online reorganization of indexes or table spaces and full copies inline with REORG processing. Piping of index keys and elimination of work files in Version 5 provided improvements measured up to 10 percent in CPU time and up to 20 percent in elapsed time.

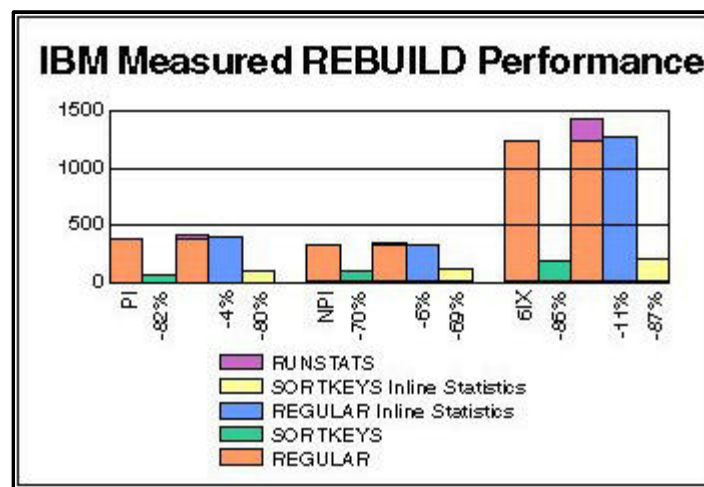


In DB2 Universal Database for OS/390 Version 6, the indexes can be built in parallel and you can now collect statistics inline during REORG, resulting in a two-and-a-half-fold improvement in elapsed time for a tablespace with six indexes. You can also discard selected rows during reorganization, unload data in external format three to seven times faster than the DSNTIAUL sample program, and avoid unnecessary reorganizations.

The REBUILD Utility

REBUILD INDEX (formerly called RECOVER INDEX) creates deferred indexes and rebuilds indexes by scanning the data and extracting the keys. In DB2 for OS/390 Version 4, REBUILD INDEX improvements included restartability and elimination of work files, resulting in improvements of up to 11 percent in CPU time and up to 20 percent in elapsed time.

In DB2 Universal Database for OS/390 Version 6, the indexes can be rebuilt in parallel and you can collect statistics inline during REBUILD, improving performance up to five times for a partitioning index, more than three times for a non-partitioning index and almost eight times for six indexes.



The RUNSTATS Utility

The RUNSTATS utility computes statistics on a specified tablespace or index(es) and stores them in the DB2 system catalog. Some statistics are used by the DB2 access path optimizer; others are used by the database administrator to monitor space usage for capacity planning and to determine if reorganization is needed.

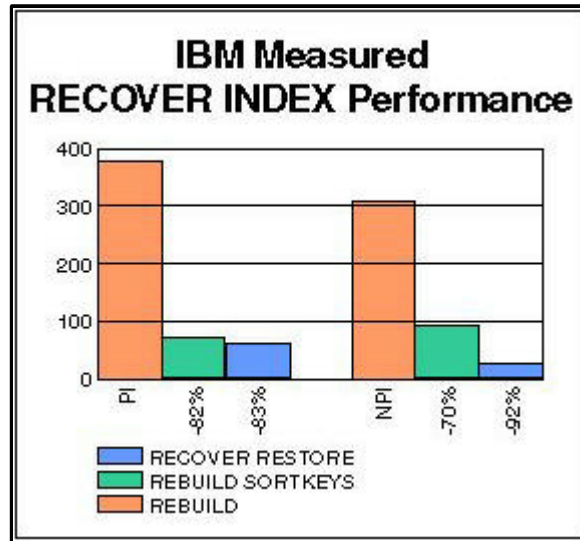
Partition independence in DB2 for OS/390 Version 3 introduced partition-level statistics. DB2 for OS/390 Version 4 provided improvements of up to 30 percent in both CPU time and elapsed time. DB2 for OS/390 Version 5 provided the collection of key column correlation statistics, with more than 10 values when columns have non-uniform distributions. An option in Version 5 to sample the data provided improvements of up to 50 percent in CPU time and up to 28 percent in elapsed time. In DB2 Universal Database for OS/390 Version 6, you can now add inline collection of statistics to LOAD, REORG or REBUILD INDEX, which eliminates a separate pass over the data, while adding only an insignificant difference in elapsed time.

Recovery Utilities

Recovery utilities include RECOVER, MERGECOPY, QUIESCE and REPORT. RECOVER restores data from the backup copy made by COPY and then applies logged changes to

completely restore the data to the current point-in-time. MERGECOPY is used for merging full image copies with subsequent partial image copies to create a new logical full image copy.

In DB2 for OS/390 Version 3, the recovery utilities provided full partition independence. In Version 4, RECOVER provided for exploitation of DFSMS and disk hardware with copies made using the CONCURRENT option. Version 4 also improved the handling of copies for off-site recovery. With Version 5, RECOVER can use inline copies from LOAD or REORG.



In DB2 Universal Database for OS/390 Version 6, you can recover indexes from backup copies, recover multiple tablespaces and indexes in parallel, recover tablespaces and indexes with a single-read pass of the log, and benefit from five to nine times faster log apply processing. You can also QUIESCE TABLESPACESET. Even without recovery parallelism, index recover is almost 6 times faster than before for a partitioning index (slightly faster than parallel index rebuild) and more than 12 times faster than before for a non-partitioning index (4 times faster than parallel index rebuild).

With DB2 Universal Database for OS/390 Version 6, IBM gives you the fourth consecutive release with significant improvements in DB2 utilities. To find out how IBM utilities will perform on your database, we recommend the following test: First, obtain some performance predictions with DB2 Estimator (available for download at www.ibm.com/software/db2os390/estimate/). Next, run benchmarks in your environment and measure the performance improvements for yourself.

Obtaining DB2 Utilities

DB2 Utilities are complemented by several features and tools offered with DB2 Universal Database Server for OS/390 Version 6:

- [DB2 Administration Tool](#)
- [DB2 Buffer Pool Tool](#)

- [DB2 DataPropagator™](#)
- [DB2 Extenders™](#)
- DB2 Management Tools Package
 - [DB2 Control Center](#)
 - [DB2 Estimator](#)
 - [DB2 Installer](#)
 - [DB2 Visual Explain](#)
- [DB2 Performance Monitor](#)
- [Net.Data®](#)
- [QMF Family](#)
- [QMF for Windows](#)
- [QMF High Performance Option](#)

Connecting to DB2

[IBM DB2 Connect™](#) enables remote access to data stored in DB2 Universal Database for OS/390 from UNIX®, Windows and OS/2 applications.

To find out more

If you'd like to learn more about DB2 Utilities, contact your IBM marketing representative or visit our Web site at www.ibm.com/software/db2os390/.



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