Pervasive Database File Rebuilding

A White Paper From

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The Pervasive PSQL database engines has a long history, starting with the Btrieve database engine. Over time, the file structure of the underlying files has changed slightly with some releases, even though the application programming interface (API) has remained the same. This has allowed the older applications to work on newer engines without modification, and has been a great benefit for Pervasive developers everywhere.

The current PSQL engines can read files in ALL file formats, going back as far as Btrieve v3! As such, you are not required to upgrade your files when you upgrade your database engine. In fact, you can continue to run the old file format for whatever period of time you wish, until you are certain that there will be no need to ever go back to the previous database version. This makes it far superior to those OTHER databases that require a full rebuild and have an extensive recovery process if you ever need to roll back to the older version.

However, the newer database file formats do provide some important benefits:

- **Features**: Newer formats provide additional features that may be required for some applications, like VATs.
- **Stability**: Newer formats are typically more stable on the newer engines, since they are better tested.
- **Performance**: Newer formats can provide additional performance benefits over older versions. This is especially true of the upgrade from the older formats to 6.x format, and again in the upgrade to the 8.x format, which provides an additional performance boost on database writes.
- **Maximum File Size**: The 5.x and 6.x database formats supports at most a 4GB file size. The 7.x and 8.x formats allow files to grow to a logical 64GB in size, depending on the page size of the file. It does this through the use of 2GB extents, that have names like *filename.^01*. The 9.0 format supports a maximum file size of 128GB, and the 9.5 file format supports a maximum file size of 256GB.
- **Page Size**: Most older engines support file page sizes between 512 and 4096. However, the 9.0 file format supports an 8K page, and the 9.5 format supports a 16K page, allowing the OS reads and writes to be more efficient, too.

Of these items, there is one critical issue: Stability. Pervasive Software has determined that the 5.x file format, which is really unstable on modern caching operating systems, should not be used any longer. As such, they changed the Pervasive PSQL v9 and newer database engines to support reading of 5.x (or older) files only, and these engines do NOT allow you to write to these files. As such, you WILL need to rebuild any 5.x or older files to 6.x or newer to run on these new engines.

To take advantage of the other benefits, you may need to rebuild your files. Of course, before you start, you should contact your application vendor to verify that they will support you if you have the newest files! If they are not using the same database engine, they may have problems reading the data if you ever needed to send them the files for help.

Important Note*: The rebuild process defined here is* *****NOT***** *for corrupted database files! If you suspect that one or more of your database files are damaged, which can be evidenced by Status 2, Status 54, or System Errors being reported in the Pervasive Event log, then you should use the File Recovery Process instead. Failure to observe this caveat can result in a failed rebuild, or in substantial loss of data in extreme cases.*

Rebuilding your databases perform several key steps. As we have already seen, the rebuild process can update the file format to a newer format, which can provide several benefits. However, even if you are not changing formats, the rebuild process can often shrink your database files, providing a way to reclaim disk space after a mass purge (delete) of records. (Btrieve files never shrink on their own, so this is an important step if you periodically archive data.) Additionally, the process can re-write your indices to make them more compact (and thus increase efficiency). Finally, the rebuild process can re-order the data physically in your file, to store the data physically by a given index. While this is not a true *clustered index* like other database engines, it can reorder the data in the physical order by that key at least until the data starts changing again.

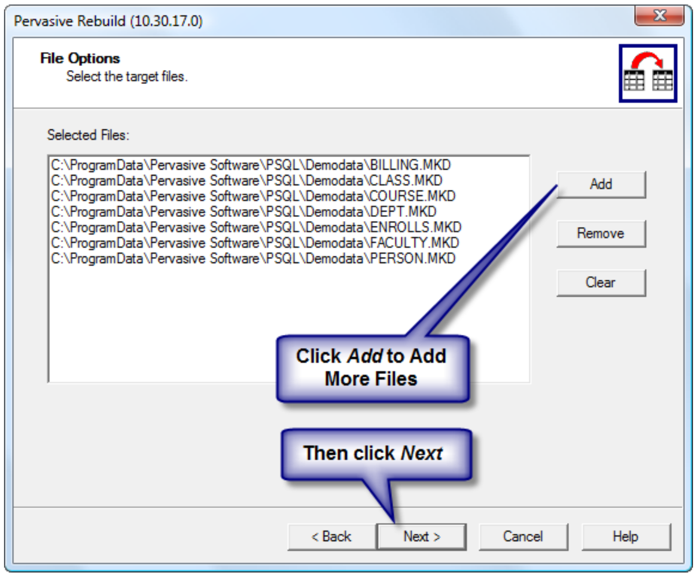
There are three primary tools for rebuilding files, the Rebuild Utility (a GUI utility shipping with all products above Pervasive.SQL V7, BREBUILD (shipping with NetWare and older DOS engines), and RBLDCLI (a command line utility that ships with Pervasive.SQL V8.5 or newer). The instructions for running all three can be found in the product manuals for your database engine. Users of Pervasive.SQL 2000i and above can look in the **Advanced Operations Guide** under the chapter entitled *Converting Pervasive.SQL Data* or *Rebuilding Data Files*.

Using the Graphical Rebuild Utility

The GUI-based Rebuild Utility (also known as the Rebuild Wizard in Pervasive.SQL V8.5 and newer) is the easiest way to rebuild files if you are not familiar with command-line applications, because it uses the standard Windows graphical user interface to select files and options.

There are a few different versions of this tool, depending on your exact version of PSQL, so your screen shots may differ slightly. If in doubt, you can always refer to your online product manuals for current information for your release.

1. Make sure that all users are out of the database files and that all files are closed in the Pervasive Monitor. If in doubt, reboot the database server! If any users are in the system, then the rebuild process will fail.
2. From the **File Options** screen, click the *Add* button to add files to the list to be processed.



Pervasive Rebuild (10.30.17.0)

File Options
Select the target files.

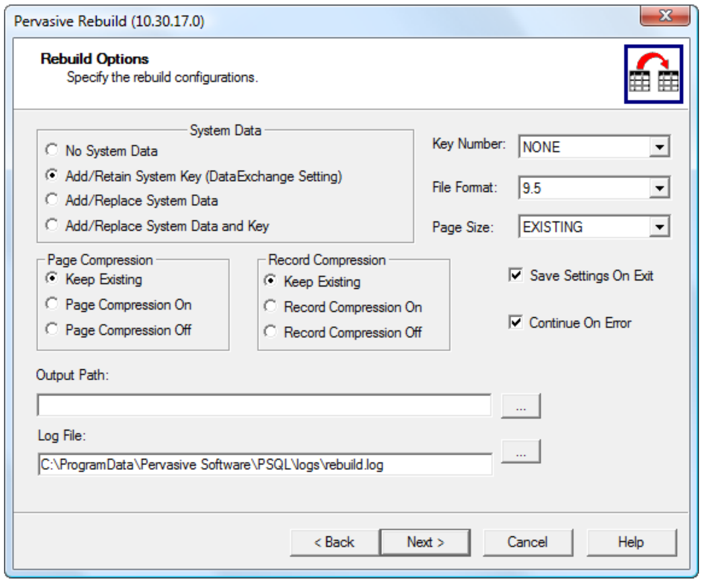
Selected Files:

C:\ProgramData\Pervasive Software\PSQL\Demodata\BILLING.MKD
C:\ProgramData\Pervasive Software\PSQL\Demodata\CLASS.MKD
C:\ProgramData\Pervasive Software\PSQL\Demodata\COURSE.MKD
C:\ProgramData\Pervasive Software\PSQL\Demodata\DEPT.MKD
C:\ProgramData\Pervasive Software\PSQL\Demodata\ENROLLS.MKD
C:\ProgramData\Pervasive Software\PSQL\Demodata\FACULTY.MKD
C:\ProgramData\Pervasive Software\PSQL\Demodata\PERSON.MKD

Click *Add* to Add More Files

Then click *Next*

3. Then, click Next to go to the Rebuild Options dialog box.



Pervasive Rebuild (10.30.17.0)

Rebuild Options
Specify the rebuild configurations.

System Data
- No System Data
- [✓ Add/Retain System Key (DataExchange Setting)]
- Add/Replace System Data
- Add/Replace System Data and Key

Key Number: NONE
File Format: 9.5
Page Size: EXISTING

Page Compression
- [✓ Keep Existing]
- Page Compression On
- Page Compression Off

Record Compression
- [✓ Keep Existing]
- Record Compression On
- Record Compression Off

[✓ Save Settings On Exit]
[✓ Continue On Error]

Output Path:

Log File: C:\ProgramData\Pervasive Software\PSQL\logs\rebuild.log

4. Verify the various options:
   - **System Data**: The *Add/Retain System Key* option must be selected if you are planning to use DataExchange, Pervasive's replication solution. Otherwise, this is optional.

    - **Page Compression**: The default is fine here, unless you want to enable or disable page compression. Note that many file recovery tools will not be able to recover page-compressed files.
    - **Record Compression**: The default is fine here, unless you want to enable or disable record compression. Record compression can save space for some tables, but at the cost of performance.
    - **Output Path**: Leave this blank to update the files in place. Set this directory if you want to rebuild them into a new location.
    - **Log File**: This is the log file for the rebuild. The default is fine, unless you want a specific log written.
    - **Key Number**: Leave to *NONE* for the best performance. Data files for some applications MAY require using a specific key. Check with your vendor for details. You can also specify a key to create a psuedo-*clustered index*.
    - **File Format**: Select the new file format in which you want the resulting files. Remember that older engines cannot read newer files, but newer engines can read all older files.
    - **Page Size**: Leave at *Existing* if you trust the original application developers, or change to 4096, 8K, or 16K for the best performance in many cases.
    - **Save Settings On Exit**: Saves these settings for the next time you run the Rebuild program.
    - **Continue on Error**: If doing one file, set to *No*. Otherwise, set this to *Yes* to have the system work on the next file if an error occurs. Be sure to check the log file after a run to make sure that all files were converted properly.
5. Click *Next* to start the rebuilding process. Each selected database file will be rebuilt with the settings you specified.
6. Finally, check the rebuild log file for any errors. If there were no problems, allow users back into the application and enjoy the performance gains and disk savings of newly rebuilt files!

Using the Command Line Rebuild Utility

On NetWare servers, the command-line application for rebuilding files program is called BREBUILD.NLM, and it runs directly on the database server. The base command is LOAD BREBUILD <filespec>, and you will add the following options as needed.

Database engines starting with Pervasive.SQL V8.5 also include a command-line tool called RBLDCLI, that provides the same functionality from Windows servers or even from Windows workstations. (Note that while rebuilding CAN be done from a workstation, we recommend always doing it at the server for best performance.)

With these command-line utilities, there is no graphical interface to select files and options. Instead, this is all done via command line options. You can see a complete list of options by just running "rbldcli" by itself from a Command Prompt window, but we'll like the more critical options for you here:

- -c: This flag continues with the next file if an error occurs. We recommend using this every time you rebuild files, unless you plan to watch it run to completion.
- -p####: If the -p option is specified by itself, the optimal page size is selected. If you specify a new page size (the number after the "p"), then the specified page size will be used. If omitted, the existing page size is used in the new file.
- -k##: Use the -k option to rebuild files on a given key.
- -f#: Specifies the file version to which you want the files rebuilt.. For example, specify –f7 to force the files into the 7.x format, -f9 to force a 9.0 format, and -f95 to force a v9.5 file format.

Note that the command line applications also take a “filespec” – an indication of the files to rebuild that can include wildcards. This means that you can do an entire directory in one simple command like this:

```
rbldcli -c -f95 *.*
```

Remember that NetWare servers have no concept of a current directory, so you need to specify the entire path from the volume, as in the following example:

```
LOAD BREBUILD -p -c VOL1:APPS\DATA\*.BTR
```

Be sure to check the SYS:SYSTEM\BREBUILD.LOG file when finished to verify that all files rebuilt successfully.

Optimizing the Rebuild Time

The file rebuilds **must** be done during system downtime, since all users must be out of the files for the rebuild to be successful. Large files on slower servers will take a long time to rebuild, as will huge files on even the fastest server. There is no way to tell how long a process is going to take in advance, as it varies based on MANY factors. Luckily, you do NOT need to rebuild all files at the same time, since the engine supports accessing mixed file formats freely. You can run some tests on backup copies of your files, but remember that the larger a file is, the longer the time will be, and it can be exponetially longer on some systems.

To optimize the system for rebuilding, you want to split your system memory about 50/50 between the database cache and free memory. This means that on Pervasive.SQL 2000i or lower, your database cache should be set to a reasonable limit, such that there is sufficient free memory left over afterwards. On Pervasive.SQL V8 and above, you should *also* disable the Level 2 (L2) cache by setting the Maximum Memory Size down to 0%. Remember to change any settings back when you are done, and that you must restart the engine to allow the change to take effect.

Of course, if you would rather a professional handle this task for you, please contact Goldstar Software for help!