White Paper

Performance Optimization - Page Size Tuning

Audience

Developers, Architects

Subject

Porcedures for changing the index PAGE_SIZE

configuration keyword

FairCom®

1. Index Page Size

FairCom Database Engine has a default page size for its b-tree indexes. Each page holds one or more index entries.

Changing the index page size is a major maintenance task and should be done carefully after a full, reliable backup. The procedures below represent the best practices for this operation.

Background

Operating systems have a default file block size they read and write data in. Most recent Windows operating systems are 4K. Other operating systems will vary. Setting the index page size to match the OS or multiples of OS file block size can improve I/O performance.

FairCom Database Engine supports setting `PAGE_SIZE` from 512 bytes up to a maximum of 64K (65,536).

Recommendations

You should set your c-tree server `PAGE_SIZE` to at least the OS file block size, nothing smaller. For example, if you set c-tree's `PAGE_SIZE` to 2K, then on Windows you are reading 4K at the OS level and throwing away 2K every time.

For most applications, 8K is a fairly good general rule of thumb. If you are looking to fully optimize your application, and if your files are fairly large (see below), you might gain performance by increasing this setting, in multiples of your operating system page size value.

It is difficult to define "fairly large files" because of all the different ways c-tree provides for accessing your files. The best method for tuning this value is to try a few different sizes with your precise application and a copy of your data. For example, increase from 8K to 16K and if your performance increases, then try 32K. Once your performance starts dropping, then scale back in smaller increments looking for the sweet spot for your application.

Rebuilding Files

Recommendation: If you are considering changing your `PAGE_SIZE` setting, be sure to rebuild ALL of your index files.

If you are reducing your `PAGE_SIZE` setting, and you miss rebuilding an index, and its value is set larger than your current `PAGE_SIZE` setting, then you will get an error 40 (**KSIZ_ERR**, Index node size too large) when this file is opened and it will need to be rebuilt to resolve this error.

Recommendation: Experiment on *copies* of your data and server folder. When you are confident with the results, back up your source data and then change it.

Procedures

> **Warning**: Changing the `PAGE_SIZE` (`https://docs.faircom.com/doc/ctserver/page-size-config.htm`) is a major maintenance task and should be done carefully and with a full reliable backup. Practice on a copy of your data and server folder until you are confident with the results.
>
> Notice that a file created with a larger `PAGE_SIZE` cannot be opened by a server with a smaller `PAGE_SIZE`.

Follow these procedures to rebuild the affected files:

1. Shut down the FairCom DB server, start it again, then shut it down again to be sure all logs are flushed and a clean final checkpoint has been written.
2. Make a good backup of your databases and your server folder.

   > Move this copy to a different machine from your live server. Keep a clean copy in case you need to start over.

3. Edit *ctsrvr.cfg* and add the `PAGE_SIZE` keyword if it is not already there:

   `PAGE_SIZE 32768`
   - The size should be a power of 2. The maximum page size is 64k (65536).
   - The current default in V12 and later is 32767.
4. Go to the FairCom server's *data* directory.
5. Delete all log and start files (i.e., all files that start with "*L00…*", "*S00…*", "*D00…*"). With a clean shutdown you should not have any "*I00…*" files in the directory.
6. Rebuild the three superfiles used by the server using the **ctscmp** utility including the *<sect>* parameter:
   - Remember that the sect size is the page size/128. For example, if your page size is 32768, use a sect size of 256.

   `./ctscmp <server directory>/data/ctdbdict.fsd 256`

   `./ctscmp <server directory>/data/ctreeSQL.dbs/SQL_SYS/ctreeSQL.fdd 256`

   `./ctscmp <server directory>/data/FAIRCOM.FCS 256`
7. Delete the current index files for your data files.
8. Rebuild the indexes for your data files using the **ctrbldif** utility including the *-<sectors>* parameter:

   `./ctrbldif (server directory)/data/ctreeSQL.dbs/MyData.dat -256`
9. Restart the server and verify no errors were logged in *<faircom>/data/CTSTATUS.FCS*.
10. Connect to your data files and verify no errors were returned.

See also:

- *ctscmp* (*https://docs.faircom.com/doc/cmdline/31096.htm*)
- *ctrbldif* (*https://docs.faircom.com/doc/cmdline/31093.htm*)
- *PAGE_SIZE* (*https://docs.faircom.com/doc/ctserver/page-size-config.htm*)

Copyright Notice

Open Source Components

Like most software development companies, FairCom uses third-party components to provide some functionality within our technology. Often those third-party components are selected because they are a standard in the industry, they offer specific functionality that is easier to license than to develop and maintain in the long run, or they provide a proven and inexpensive solution to a particular business need. Examples of third-party software FairCom uses are the OpenSSL toolkit that provides Transport Layer Security (TLS) for secure communications and the ICU Unicode libraries to provide wide character support (think international characters and emojis).

Some of these third-party components are the subject to commercial licenses and others are subject to open source licenses. For open source solutions that we incorporate into our technology, we include the package name and associated license in a notice.txt file found in the same directory as the server.

The notice.txt file should always stay in the same directory as the server. This is particularly important in instances where your company has redistribution rights, such as an ISV who duplicates server binaries and (re)distributes those to an eventual end-user at a third-party company. Ensuring that the notice.txt file "travels with" the server binary is important to maintain third-party and FairCom license compliance.

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