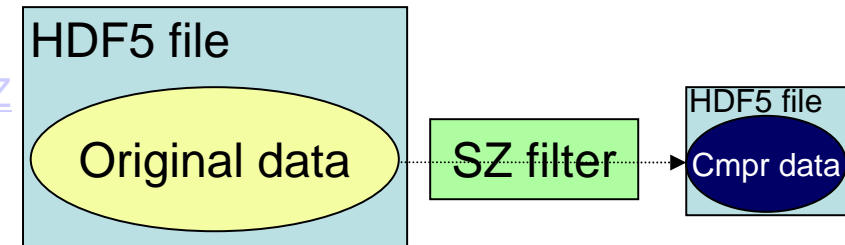


H5Z-SZ: Handling HDF5 with SZ filter

- Download and install HDF5
- Download SZ and install SZ
 - git clone <https://github.com/szcompressor/SZ>
- Compile [SZ-package]/H5Z-SZ
 - Set SZPATH and HDF5PATH in Makefile
 - cd H5Z-SZ; make; make install
 - Add \$SZPATH/lib and \$HDF5PATH/lib in LD_LIBRARY_PATH
 - export HDF5_PLUGIN_PATH=\${SZ_INSTALL_PATH}/lib
- Quick start:
 - Use-case A with plugin:
 - (1) Put the sz.config configuration in the current directory. (Please see README in SZ to understand the configuration sz.config)
 - (2) h5repack.sh [input_hdf5_file] [compressed_hdf5_file] or
h5repack -f UD=32017,0 [input_hdf5_file] [compressed_hdf5_file]
 - (3) Read the compressed HDF5 file:
h5dump [compressed_hdf5_file] > data.txt
 - (4) Decompress the data and dump them to a HDF5 file.
h5repack -f NONE compressed.h5 decompressed.h5
 - Use-case B with library:
 - (1) cd [SZ-package]/H5Z-SZ/test;
 - (2) Set SZPATH and HDF5PATH in Makefile
 - (3) make (Two executables will be generated: szToHDF5 and dszFromHDF5)
 - (4) szToHDF5 will load a 3d array and then write the compressed bytes in a HDF5 file. (See test_compress.sh for details)
 - (5) dszFromHDF5 will read the HDF5 file generated by test_compress.h and then decompress the data inside it. (See test_decompress.sh for details)



H5repack with plugin

As demonstrated in the first slide, you can use h5repack command with plugin to compress the data in a hdf5 file and then store the data into another hdf5 file. There are two ways to do so:

Option 1: load the error bound information from sz.config (which should be stored in the current local directory where you are operating the h5repack command)

Option 2: you can use h5repack cd_values parameters. To this end, you can use example/print_h5repack_args.c to generate the parameters based on the error bound information. (you need to modify example/Makefile before building the codes in examples/.

Example: print_h5repack_args -M ABS -A 1E-3 (output:
-f UD=32017,0,9,0,1062232653,3539053052,0,0,0,0,0,0)

H5Z-SZ: API

- C programming API:
 - In order to set the HDF5 SZ filter in C/C++, the key is generating `cd_values[]` for the filter.
 - void **SZ_errConfigToCdArray**(size_t* `cd_nelmts`, unsigned int **`cd_values`, int `error_bound_mode`, float `abs_error`, float `rel_error`, float `pw_rel_error`, float `psnr`);

Input: `dataType`: SZ_FLOAT, SZ_DOUBLE, SZ_INT16, SZ_INT32, etc. (The complete data type definitions can be found in SZ/sz/include/defines.h: line 43~52)

`error_bound_mode`: ABS, REL, PW_REL, or PSNR. (More modes can be found in SZ/sz/include/defines.h: line 29~41)

`abs_error`: absolute error bound

`rel_error`: value-range based relative error bound

`pw_rel_error`: point-wise relative error bound

`psnr`: peak signal to noise ratio (PSNR).

Output: `cd_nelmts`: the number of elements in `cd_values[]`

`cd_values`: the elements of `cd_values[]`

H5Z SZ: API (Cont'd)

Example: Please check the example `./test/szToHDF5.c` to understand how to set hdf5 filter appropriately. It also demonstrates how to set different error bounds for specific fields/variables.

If you want to set a particular error bound for each field/variable (a.k.a., one dataset) in one HDF5 file, you can use **SZ_errConfigToCdArray()**.

- After you specify the `error_bound_mode`, only the corresponding error bounding parameter will be valid and all others will be ignored.
- For example, if `error_bound_mode` is set to `ABS`, only the `abs_error` argument is valid, and other arguments such as `rel_error`, `pw_rel_error` and `psnr` could be set to 0 for simplicity.
- Please check `./test/szToHDF5.c` (line 90) for details:
 - `SZ_errConfigToCdArray(&cd_nelmts, &cd_values, ABS, 0.01, 0, 0, 0);`

Trouble Shooting

1. Core-dump segmentation fault issue when trying to compress data by h5repack.

Answer: I noted that if I use hdf5-1.12.0 on Fedora Linux, it may encounter the core-dump issue. But after installing hdf5-1.10.1 and compiling by it, everything works well.

2. The compressed data has the same size with the original file size.

Answer: There might be two reasons:

- (1) The first thing you need to check is HDF5_PLUGIN_PATH and make sure libhdf5sz.so could be found there. If there is anything incorrect about setting the environment variable HDF5_PLUGIN_PATH, it will have this 'same-size' issue.
- (2) If you are sure the HDF5_PLUGIN_PATH is set correctly, please change your hdf5 version. My experience is that hdf5-1.10.1 works fine but hdf5-1.12.0 doesn't. As for this reason, you can simply change the filter to any other filters such as lossless compression filter embedded in hdf5, and you will observe the same issue.



Any questions?

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