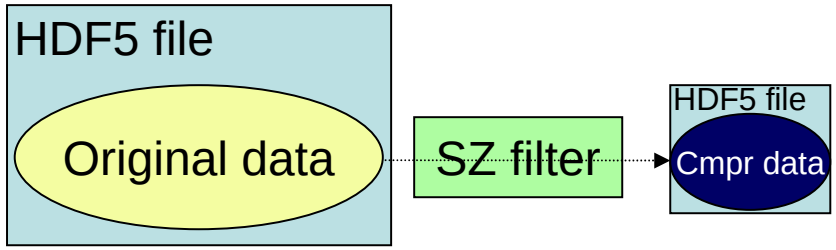
# H5Z-SZ: Handling HDF5 with SZ filter

- 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=32017,0,0,981668463,0,0,0)

# 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 fines 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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