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# **HDF5/JSON Specification**

*Release 0.1*

**The HDF Group**

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Specification and tools for representing HDF5 in JSON

Contents:



Instructions for installing hdf5-json library and utilities.

### 1.1 Prerequisites

A computer running a 64-bit version of Windows, Mac OS X, or Linux.

You will also need the following Python packages:

- Python 2.7, 3.3, 3.4, or 3.5
- NumPy 1.10.4 or later
- h5py 2.5 or later

If you are not familiar with installing Python packages, the easiest route is to use a package manager such as Anaconda (as described below).

If you have a git client installed on your system, you can directly download the hdf5-json source from GitHub: `git clone --recursive https://github.com/HDFGroup/hdf5-json.git`. Otherwise, you can download a zip file of the source from GitHub (as described below).

### 1.2 Installing on Windows

Anaconda from Continuum Analytics can be used to easily manage the package dependencies needed for hdf5-json.

In a browser go to: <http://continuum.io/downloads> and click the “Windows 64-bit Python 2.7 Graphical Installer” button.

Install Anaconda using the default options.

Once Anaconda is installed select “Anaconda Command Prompt” from the start menu.

In the command window that appears, create a new anaconda environment using the following command: `conda create -n hdf5json python=2.7 h5py`

Answer 'y' to the prompt, and the packages will be fetched.

In the same command window, run: `activate hdf5json`

In a browser go to: <https://github.com/HDFGroup/hdf5-json> and click the "Download ZIP" button (right side of page). Save the file as "hdf5json.zip" to your Downloads directory.

Alternatively, if you have git installed, you can run: `git clone --recursive https://github.com/HDFGroup/hdf5-json.git` to download the hdf5-json source tree.

If you downloaded the ZIP file, in Windows Explorer, right-click on the file and select "Extract All...". You can choose any folder as the destination.

Next, in the command window, cd to the folder you extracted the source files to.

Run: `python setup.py install` to install the package.

### 1.3 Installing on Linux/Mac OS X

Anaconda from Continuum Analytics can be used to easily manage the package dependencies needed for hdf5-json.

In a browser go to: <http://continuum.io/downloads> and click the "Mac OS X 64-bit Python 2.7 Graphical Installer" button for Mac OS X or: "Linux 64-bit Python 2.7".

Install Anaconda using the default options.

Once Anaconda is installed, open a new shell and run the following on the command line:

```
conda create -n hdf5json python=2.7 h5py
```

Answer 'y' to the prompt, and the packages will be fetched.

In the same shell, run: `source activate hdf5json`

Run: `git clone --recursive https://github.com/HDFGroup/hdf5-json.git` to download the source tree. Alternatively, in a browser go to: <https://github.com/HDFGroup/hdf5-json> and click the "Download ZIP" button (right side of page). Download the zip file and extract to the destination directory of your choice.

Next, cd to the folder you extracted the source files to.

Run:

```
python setup.py install
```

to install the package.

Alternatively, you can install directly from PyPI.

Run:

```
pip install h5json
```

### 1.4 Verification

To verify hdf5-json was installed correctly, you can convert a test HDF5 file to json and back.

Open a new shell (on Windows, run "Anaconda Command Prompt" from the start menu).

In this shell, run the following commands:

- `source activate hdf5json` (just: `activate hdf5json` on Windows)
- `cd <hdf5-json installation directory>`



- `cd util`
- `python h5tojson.py ../data/hdf5/tall.h5 > tall.json`
- `python jsontoh5.py tall.json tall.h5`

At this point the file `tall.json` should contain a JSON description of the original file and the file `tall.h5` should be an HDF5 equivalent to the original file.

Running:

```
python testall.py
```

will run the complete set of unit and integration tests.

You should also be able to import the `h5json` package in any Python script:

```
import h5json
```



## 2.1 File

```

file ::= "{
  "id" ":" identifier ","
  "created" ":" utc_datetime ","
  "lastModified" ":" utc_datetime ","
  "root" ":" id_reference ","
  "groups" ":" "{" group_hashtable "}" ","
  "datasets" ":" "{" dataset_hashtable "}" ","
  "datatypes" ":" "{" datatype_hashtable "}" ","
  "userblock" ":" byte_array ","
  "userblockSize" ":" non_negative_integer /power of 2, >= 512/ ","
  "creationProperties" ":" fcpl ","
  "driverInfo" ":" file_driver_info ","
  "apiVersion" ":" "1.0.0"
}"

```

```

group_hashtable ::= group ("," group)*
dataset_hashtable ::= dataset ("," dataset)*
datatype_hashtable ::= datatype_object ("," datatype_object)*

```

```

fcpl ::= "{
  "chunkStorageConfig" ":" chunk_storage_config ","
  "freeListConfig" ":" free_list_config ","
  "sizeConfig" ":" size_config ","
  "sohmConfig" ":" sohm_config ","
  "superBlockVersion" ":" non_negative_integer ","
  "symbolTableConfig" ":" sym_tab_config ","
}"

```

```
"}"
```

```
chunk_storage_config ::= "{  
    "chunkStorageBTreeHalfRank" ":" positive_integer  
}"
```

```
free_list_config ::= "{  
    "freeListVersion" ":" non_negative_integer  
}"
```

```
size_config ::= "{  
    "lengthSizeInBytes" ":" positive_integer  
    "offsetSizeInBytes" ":" positive_integer  
}"
```

```
sohm_config ::= "{  
    "maxList" ":" non_negative_integer ","  
    "minBTree" ":" non_negative_integer ","  
    "version" ":" non_negative_integer ","  
    "indexes" ":" "[" sohm_index_list "]"  
}"  
  
sohm_index_list ::= sohm_index ("," sohm_index)*  
sohm_index ::= "{  
    "messageTypes" ":" "[" sohm_message_type_list "]" ","  
    "minMessageSize" ":" non_negative_integer  
}"  
  
sohm_message_type_list ::= sohm_message_type ("," sohm_message_type)*  
sohm_message_type ::= "H5O_SHMMSG_ATTR_FLAG"  
| "H5O_SHMMSG_DTYPE_FLAG"  
| "H5O_SHMMSG_FILL_FLAG"  
| "H5O_SHMMSG_PLINE_FLAG"  
| "H5O_SHMMSG_SDSPACE_FLAG"
```

```
sym_tab_config ::= "{  
    "nodeSize" ":" positive_integer  
    "treeRank" ":" positive_integer  
    "version" ":" non_negative_integer  
}"
```

```
file_driver_info ::= family_driver_info | multi_driver_info  
family_driver_info ::= "{  
    "memberSize" ":" positive_integer  
}"  
  
multi_driver_info ::= "[" data_distribution_list "]"  
data_distribution_list ::= data_item ("," data_item)*
```

```

data_item          ::=  "{"
                    "dataMap" ":" data_kind ","
                    "fileName" ":" unicode_string ","
                    "address" ":" positive_integer ","
                    "relaxFlag" ":" false | true
                    "}"

data_kind          ::=  "H5FD_MEM_SUPER"
                    | "H5FD_MEM_BTREE"
                    | "H5FD_MEM_DRAW"
                    | "H5FD_MEM_GHEAP"
                    | "H5FD_MEM_LHEAP"
                    | "H5FD_MEM_OHDR"

```

## 2.2 Group

```

group ::= identifier ":" "{"
      "alias" ":" hdf5_path_name_array
      "attributes" ":" attribute_collection ","
      "links" ":" link_collection ","
      "created" ":" utc_datetime ","
      "lastModified" ":" utc_datetime ","
      "creationProperties" ":" gcpl
      "}"

link_collection ::= "[" link_list "]"
link_list       ::= link ("," link)*
link            ::= hard_link | soft_link | external_link | ud_link
hard_link       ::= "{"
                  "class" ":" "H5L_TYPE_HARD",
                  "title" ":" link_name ","
                  "collection" ":" ("datasets" | "datatypes" | "groups" )
                  "id" ":" uuid
                  "creationProperties" ":" lcpl
                  "}"
soft_link       ::= "{"
                  "class" ":" "H5L_TYPE_SOFT",
                  "title" ":" link_name ","
                  "h5path" ":" unicode_string
                  "creationProperties" ":" lcpl
                  "}"
external_link   ::= "{"
                  "class" ":" "H5L_TYPE_EXTERNAL",
                  "title" ":" link_name ","
                  "file" ":" unicode_string
                  "h5path" ":" unicode_string
                  "creationProperties" ":" lcpl
                  "}"
ud_link         ::= "{"
                  "class" ":" "H5L_TYPE_USER_DEFINED",
                  "title" ":" link_name ","

```

```
        "target" ":" byte_array
        "creationProperties" ":" lcpl
        "}"
lcpl ::= "{"
        "charSet" ":" char_encoding
        "creationOrder" ":" non_negative_integer
        "}"

gcpl ::= "{"
        ocp ","
        "filters" ":" "[" link_name_filter_list "]" ","
        "linkCreationOrder" ":" link_crt_order ","
        "linkPhaseChange" ":" link_phase_change ","
        "linksEstimate" ":" links_estimate ","
        "localHeapSizeHint" ":" non_negative_integer ","
        "trackTimes" ":" track_times
        "}"
link_crt_order ::= "H5P_CRT_ORDER_TRACKED"
                | "H5P_CRT_ORDER_INDEXED"
link_phase_change ::= "{"
        "maxCompact" ":" non_negative_integer ","
        "minDense" ":" non_negative_integer
        "}"
links_estimate ::= "{"
        "numEntries" ":" non_negative_integer ","
        "nameLength" ":" non_negative_integer
        "}"
link_name_filter_list ::= deflate_filter
```

## 2.3 Dataset

```
dataset ::= identifier ":" "{"
        "alias" ":" hdf5_path_name_array
        "attributes" ":" attribute_collection ","
        "type" ":" datatype | datatype_object_ref ","
        "shape" ":" dataspace ","
        "value" ":" json_value ","
        "creationProperties" ":" dcpl
        "}"
json_value ::= json_string
            | json_number
            | json_array
            | json_null

dcpl ::= "{"
        "allocTime" ":" alloc_time ","
        "attributeCreationOrder" ":" attr_crt_order ","
        "attributePhaseChange" ":" attr_phase_change ","
```

```

        "fillTime" ":" fill_time ","
        "fillValue" ":" fill_value ","
        "filters" ":" filter_list "]" ","
        "layout" ":" layout ","
        "trackTimes" ":" track_times
        "}"
alloc_time ::= "H5D_ALLOC_TIME_DEFAULT"
           | "H5D_ALLOC_TIME_EARLY"
           | "H5D_ALLOC_TIME_INCR"
           | "H5D_ALLOC_TIME_LATE"
fill_time ::= "H5D_FILL_TIME_IFSET"
           | "H5D_FILL_TIME_ALLOC"
           | "H5D_FILL_TIME_NEVER"
fill_value ::= json_value
layout ::= chunked_layout | compact_layout | contiguous_layout
chunked_layout ::= "{"
               "class" ":" "H5D_CHUNKED"
               "dims" ":" dims_array
               "}"
compact_layout ::= "{"
               "class" ":" "H5D_COMPACT"
               "}"
contiguous_layout ::= "{"
                  "class" ":" "H5D_CONTIGUOUS" ","
                  "externalStorage" ":" external
                  "}"
external ::= file_extent_list "]"
file_extent_list ::= file_extent ("," file_extent)*
file_extent ::= "{"
             "name" ":" ascii_string ","
             "offset" ":" non_negative_integer
             "size" ":" positive_integer
             "}"

```

## 2.4 Dataspace

```

dataspace ::= null_dataspace | scalar_dataspace | simple_dataspace
null_dataspace ::= "{"
               "class" ":" "H5S_NULL"
               "}"
scalar_dataspace ::= "{"
                  "class" ":" "H5S_SCALAR"
                  "}"
simple_dataspace ::= "{"
                  "class" ":" "H5S_SIMPLE" ","
                  "dims" ":" dims_array ","
                  "maxdims" ":" maxdims_array
                  "}"

dataspace_selection ::= "{"

```

```
        "class" ":" selection_class ","
        "selection" ":" ( hyperslab_selection
        | point_selection)
selection_class ::= "H5S_SEL_HYPERSLABS"
                | "H5S_SEL_POINTS"
hyperslab_selection ::= "[" block_list "]"
block_list ::= block ("," block)*
block ::= "{"
        "start" ":" coordinate ","
        "opposite" ":" coordinate
        "}"
point_selection ::= "[" coordinate_list "]"
coordinate_list ::= coordinate ("," coordinate)*
coordinate ::= non_negative_integer_array
```

## 2.5 Datatype

```
datatype_object ::= identifier ":" "{"
                "alias" ":" hdf5_path_name_array
                "type" ":" datatype
                "}"
datatype ::= array_datatype
          | bitfield_datatype
          | compound_datatype
          | enumeration_datatype
          | floating_point_datatype
          | integer_datatype
          | opaque_datatype
          | reference_datatype
          | string_datatype
          | vlen_datatype

array_datatype ::= "{"
                "class" ":" "H5T_ARRAY" ","
                "base" ":" datatype | datatype_object_ref ","
                "dims" ":" dims_array
                "}"

bitfield_datatype ::= "{"
                "class" ":" "H5T_BITFIELD" ","
                ( bitfield_predef | bitfield_user )
                "}"
bitfield_predef ::= "base" ":"
                  ( "H5T_STD_B8BE" | "H5T_STD_B8LE"
                    | "H5T_STD_B16BE" | "H5T_STD_B16LE"
                    | "H5T_STD_B32BE" | "H5T_STD_B32LE"
                    | "H5T_STD_B64BE" | "H5T_STD_B64LE" )
bitfield_user ::= "bitOffset" ":" non_negative_integer_array
```



```

        "byteOrder" ":" byte_order ","
        "lsbPad" ":" bit_padding ","
        "msbPad" ":" bit_padding ","
        "precision" ":" positive_integer ","
        "size" ":" positive_integer
bit_padding ::= "H5T_PAD_ZERO"
              | "H5T_PAD_ONE"
              | "H5T_PAD_BACKGROUND"
byte_order  ::= "H5T_ORDER_LE" | "H5T_ORDER_BE"

compound_datatype ::= "{"
                  "class" ":" "H5T_COMPOUND" ","
                  "fields" ":" "[" field_list "]"
                  "}"
field_list  ::= field_def ("," field_def)*
field_def   ::= "{"
              "name" ":" ascii_string ","
              "type" ":" datatype | datatype_object_ref ","
              "}"

enumeration_datatype ::= "{"
                    "base" ":" ( integer_datatype |
                                datatype_reference ) ","
                    "class" ":" "H5T_ENUM" ","
                    "members" ":" "[" enum_member_list "]"
                    "}"
enum_member_list ::= enum_member ("," enum_member)*
enum_member      ::= "{"
                  "name" ":" ascii_string ","
                  "value" ":" integer
                  "}"

floating_point_datatype ::= "{"
                        "class" ":" "H5T_FLOAT" ","
                        ( float_predef | float_user )
                        "}"
float_predef          ::= "base" ":"
                        ( "H5T_IEEE_F32BE" | "H5T_IEEE_F32LE"
                          | "H5T_IEEE_F64BE" | "H5T_IEEE_F64LE" )
float_user            ::= "{"
                        "bitOffset" ":" non_negative_integer ","
                        "byteOrder" ":" byte_order ","
                        "expBias" ":" positive_integer ","
                        "expBits" ":" positive_integer ","
                        "expBitPos" ":" positive_integer ","
                        "intlbPad" ":" bit_padding ","
                        "lsbPad" ":" bit_padding ","
                        "mantBits" ":" positive_integer ","
                        "mantBitPos" ":" non_negative_integer ","

```

```

        "mantNorm" ":" mant_norm ","
        "msbitPad" ":" bit_padding ","
        "precision" ":" positive_integer ","
        "signBitPos" ":" positive_integer ","
        "size" ":" positive_integer
    }"
mant_norm ::= "H5T_NORM_IMPLIED"
           | "H5T_NORM_MSBSET"
           | "H5T_NORM_NONE"

integer_datatype ::= "{"
                  "class" ":" "H5T_INTEGER" ","
                  ( integer_predef | integer_user )
                  }"
integer_predef ::= "base" ":"
                  ( "H5T_STD_I8BE" | "H5T_STD_I8LE"
                    | "H5T_STD_I16BE" | "H5T_STD_I16LE"
                    | "H5T_STD_I32BE" | "H5T_STD_I32LE"
                    | "H5T_STD_I64BE" | "H5T_STD_I64LE"
                    | "H5T_STD_U8BE" | "H5T_STD_U8LE"
                    | "H5T_STD_U16BE" | "H5T_STD_U16LE"
                    | "H5T_STD_U32BE" | "H5T_STD_U32LE"
                    | "H5T_STD_U64BE" | "H5T_STD_U64LE" )
integer_user ::= "{"
               "bitOffset" ":" non_negative_integer ","
               "byteOrder" ":" byte_order ","
               "lsbPad" ":" bit_padding ","
               "msbPad" ":" bit_padding ","
               "precision" ":" positive_integer ","
               "signType" ":" sign_type ","
               "size" ":" positive_integer
               }"
sign_type ::= "H5T_SGN_NONE" | "H5T_SGN_2"

opaque_datatype ::= "{"
                  "class" ":" "H5T_OPAQUE" ","
                  "size" ":" positive_integer ","
                  "tag" ":" ascii_string
                  }"

reference_datatype ::= "{"
                    "class" ":" "H5T_REFERENCE" ","
                    "base" ":"
                    ( "H5T_STD_REF_OBJ"
                      | "H5T_STD_REF_DSETREG" )
                    }"
object_reference_value ::= path
region_reference_value ::= "{"
                          "dataset" ":" dataset_ref ";"
                          "selection" ":" dataspace_selection

```

```

dataset_ref      ::=  "datasets/" id_reference
datatype_ref     ::=  "datatypes/" id_reference
group_ref       ::=  "groups/" id_reference

string_datatype ::=  "{"
  "charSet" ":" char_encoding
  "class" ":" "H5T_STRING" ","
  "length" ":" string_length
  "strPad" ":" string_padding ","
  "}"
char_encoding    ::=  "H5T_CSET_ASCII" | "H5T_CSET_UTF8"
string_length    ::=  positive_integer | "H5T_VARIABLE"
string_padding   ::=  "H5T_STR_NULLTERM"
                  | "H5T_STR_NULLPAD"
                  | "H5T_STR_SPACEPAD"

vlen_datatype   ::=  "{"
  "class" ":" "H5T_VLEN" ","
  "base" ":" datatype | datatype_object_ref ","
  "}"

```

## 2.6 Attribute

```

attribute_collection ::=  "[" attribute_list "]"
attribute_list       ::=  attribute ("," attribute)*
attribute            ::=  "{"
  "name" ":" ascii_string | unicode_string ","
  "type" ":" datatype | datatype_object_ref ","
  "shape" ":" dataspace ","
  "value" ":" json_value ","
  "creationProperties" ":" acpl
  "}"
acpl                 ::=  "{"
  "nameCharEncoding" ":" char_encoding
  "}"

```

## 2.7 Filter

```

filter_list ::=  filter ("," filter)*
filter      ::=  deflate_filter
              | fletcher32_filter
              | lzf_filter
              | nbit_filter
              | scaleoffset_filter

```

```
| shuffle_filter  
| szip_filter  
| other_filter
```

```
deflate_filter ::= "{  
  "class" ":" "H5Z_FILTER_DEFLATE" ", "  
  "id" ":" " 1" ", "  
  "level" ":" "[0-9]/"  
}"
```

```
fletcher32_filter ::= "{  
  "class" ":" "H5Z_FILTER_FLETCHER32" ", "  
  "id" ":" " 3"  
}"
```

```
lzf_filter ::= "{  
  "class" ":" "H5Z_FILTER_LZF" ", "  
  "id" ":" " 32000"  
}"
```

```
nbit_filter ::= "{  
  "class" ":" "H5Z_FILTER_NBIT" ", "  
  "id" ":" " 5"  
}"
```

```
scaleoffset_filter ::= "{  
  "class" ":" "H5Z_FILTER_SCALEOFFSET" ", "  
  "id" ":" " 6" ", "  
  "scaleType" ":" scale_type ", "  
  "scaleOffset" ":" positive_integer  
}"
```

```
scale_type ::= "H5Z_SO_FLOAT_DSCALE"  
| "H5Z_SO_FLOAT_ESCALE"  
| "H5Z_SO_INT"
```

```
shuffle_filter ::= "{  
  "class" ":" "H5Z_FILTER_SHUFFLE" ", "  
  "id" ":" " 2"  
}"
```

```
szip_filter ::= "{  
  "class" ":" "H5Z_FILTER_SZIP" ", "  
  "id" ":" " 4" ", "  
  "bitsPerPixel" ":" positive_integer ", "
```

```

        "coding" ":" coding ","
        "pixelsPerBlock" ":" positive_integer ","
        "pixelsPerScanline" ":" positive_integer
        "}"
coding ::= "H5_SZIP_EC_OPTION_MASK"
        | "H5_SZIP_NN_OPTION_MASK"

other_filter ::= "{
        "class" ":" "H5Z_FILTER_USER" ","
        "id" ":" positive_integer ","
        "parameters" ":" positive_integer_array
        "}"

```

## 2.8 Miscellaneous

```

ocp ::= "attributeCreationOrder" ":" attr_crt_order ","
      "attributePhaseChange" ":" attr_phase_change ","
      "trackTimes" ":" track_times
attr_crt_order ::= "H5P_CRT_ORDER_TRACKED"
        | "H5P_CRT_ORDER_INDEXED"
attr_phase_change ::= "{
        "maxCompact" ":" non_negative_integer ","
        "minDense" ":" non_negative_integer
        "}"
track_times ::= "false" | "true"

```

### URL

```

url ::= scheme "://" domain [ ":" port ] "/" path [ "#" fragment ]
scheme ::= "file" | "http"
domain ::= rfc1738_url_path
port ::= non_negative_integer
path ::= ( "datasets" | "datatypes" | "groups" ) "/" identifier
fragment ::= "h5(" hdf5_path_name ")"

```

```

hdf5_path_name_array ::= "[" hdf5_path_name_list "]"
hdf5_path_name_list ::= hdf5_path_name, ("," hdf5_path_name)*
hdf5_path_name ::= [ "/" ] link_name ("/" link_name)*
link_name ::= ascii_string_wo_slash | unicode_string_wo_slash

```

### Simple Types

```
byte_array           ::=  "[" byte_list "]"
byte_list            ::=  byte_value ("," byte_value)*
byte_value           ::=  /0x[0-F][0-F]/
dims_array           ::=  non_negative_integer_array
maxdims_array        ::=  "[" maxdims_list "]"
maxdims_list         ::=  maxdim ("," maxdim)*
maxdim               ::=  positive_integer | "H5S_UNLIMITED"
non_negative_integer_array ::=  "[" non_negative_integer_list "]"
non_negative_integer_list ::=  non_negative_integer
                                                                ("," non_negative_integer)*
non_negative_integer ::=  /integer >= 0/
positive_integer_array ::=  "[" positive_integer_list "]"
positive_integer_list ::=  positive_integer
                                                                ("," positive_integer)*
positive_integer     ::=  /integer > 0/
```

## Date and Time

```
utc_datetime ::=  **TBD**
```

## Strings

```
ascii_string_wo_slash ::=  **TBD**
ascii_string           ::=  **TBD**
unicode_string_wo_slash ::=  **TBD**
unicode_string         ::=  **TBD**
```

## Identifier

```
id_reference ::=  identifier
identifier   ::=  uuid | **TBD**
uuid        ::=  /[a-f0-9]{8}-[a-f0-9]{4}-[a-f0-9]{4}-[a-f0-9]{4}-[a-f0-9]{12}/
```

### 3.1 The “Classic”

This example is equivalent to the one in section 4 of DDL in BNF for HDF5.

```
{
  "apiVersion": "0.0.0",
  "id": "e203fee7-89b4-4216-894d-7aef0e3a199d",
  "root": "903d1d75-e617-4767-a3bf-0cb3ee509027",
  "groups": {
    "903d1d75-e617-4767-a3bf-0cb3ee509027": {
      "attributes": [{
        "name": "attr1",
        "type": {
          "class": "H5T_STRING",
          "length": 17,
          "strPad": "H5T_STR_NULLTERM",
          "charSet": "H5T_CSET_ASCII"
        },
        "shape": {
          "class": "H5S_SCALAR"
        },
        "value": "string attribute"
      }],
      "links": [
        {
          "class": "H5L_TYPE_HARD",
          "title": "dset1",
          "collection": "datasets",
          "id": "30292613-8d2a-4dc4-a277-b9d59d5b0d20"
        },
        {
          "class": "H5L_TYPE_HARD",
          "title": "group1",
          "collection": "groups",

```

```

        "id": "be8dcb22-b411-4439-85e9-ea384a685ae0"
      },
      {
        "class": "H5L_TYPE_HARD",
        "title": "group2",
        "collection": "groups",
        "id": "be8dcb22-b411-4439-85e9-ea384a685ae0"
      },
      {
        "class": "H5L_TYPE_HARD",
        "title": "dset2",
        "collection": "datasets",
        "id": "0a68caca-629a-44aa-9f37-311e7ffb8417"
      },
      {
        "class": "H5L_TYPE_HARD",
        "title": "dset3",
        "collection": "datasets",
        "id": "4b43748e-817f-44c6-a9f1-16e242fd374b"
      },
      {
        "class": "H5L_TYPE_SOFT",
        "title": "slink1",
        "h5path": "somevalue"
      },
      {
        "class": "H5L_TYPE_HARD",
        "title": "type1",
        "collection": "datatypes",
        "id": "a93ff089-d466-44e7-b3f0-09db34ec2ef5"
      }
    ]
  },
  "be8dcb22-b411-4439-85e9-ea384a685ae0": {
    "links": [{
      "class": "H5L_TYPE_HARD",
      "title": "dset3",
      "collection": "datasets",
      "id": "42f5e3a2-5e70-4faf-9893-fd216257a0d9"
    }]
  },
  "datasets": {
    "30292613-8d2a-4dc4-a277-b9d59d5b0d20": {
      "type": {
        "class": "H5T_INTEGER",
        "base": "H5T_STD_I32BE"
      },
      "shape": {
        "class": "H5S_SIMPLE",
        "dims": [ 10, 10 ],
        "maxdims": [ 10, 10 ]
      },
      "value": [
        [ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 ],
        [ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 ],
        [ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 ],
        [ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 ]
      ]
    }
  }
}

```



```

        [ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 ],
        [ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 ],
        [ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 ],
        [ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 ],
        [ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 ],
        [ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 ]
    ]
},
"0a68caca-629a-44aa-9f37-311e7ffb8417": {
    "type": {
        "class": "H5T_COMPOUND",
        "fields": [
            {
                "name": "a",
                "type": {
                    "class": "H5T_INTEGER",
                    "base": "H5T_STD_I32BE"
                }
            },
            {
                "name": "b",
                "type": {
                    "class": "H5T_FLOAT",
                    "base": "H5T_IEEE_F32BE"
                }
            },
            {
                "name": "c",
                "type": {
                    "class": "H5T_FLOAT",
                    "base": "H5T_IEEE_F64BE"
                }
            }
        ]
    },
    "shape": {
        "class": "H5S_SIMPLE",
        "dims": [5],
        "maxdims": [5]
    },
    "value": [
        [ 1, 0.1, 0.01 ],
        [ 2, 0.2, 0.02 ],
        [ 3, 0.3, 0.03 ],
        [ 4, 0.4, 0.04 ],
        [ 5, 0.5, 0.05 ]
    ]
},
"4b43748e-817f-44c6-a9f1-16e242fd374b": {
    "type": {
        "class": "H5T_VLEN",
        "base": {
            "class": "H5T_INTEGER",
            "base": "H5T_STD_I32LE"
        }
    },
    "shape": {
        "class": "H5S_SIMPLE",

```

```

        "dims": [4],
        "maxdims": [4]
    },
    "value": [
        [ 0 ],
        [ 10, 11 ],
        [ 20, 21, 22 ],
        [ 30, 31, 32, 33 ]
    ]
},
"42f5e3a2-5e70-4faf-9893-fd216257a0d9": {
    "type": "a93ff089-d466-44e7-b3f0-09db34ec2ef5",
    "shape": {
        "class": "H5S_SIMPLE",
        "dims": [5],
        "maxdims": [5]
    },
    "value": [
        [
            [ 0, 1, 2, 3 ],
            [
                [ 0.1, 0.1, 0.1, 0.1, 0.1, 0.1 ],
                [ 0.2, 0.2, 0.2, 0.2, 0.2, 0.2 ],
                [ 0.3, 0.3, 0.3, 0.3, 0.3, 0.3 ],
                [ 0.4, 0.4, 0.4, 0.4, 0.4, 0.4 ],
                [ 0.5, 0.5, 0.5, 0.5, 0.5, 0.5 ]
            ]
        ],
        [
            [ 0, 1, 2, 3 ],
            [
                [ 0.1, 0.1, 0.1, 0.1, 0.1, 0.1 ],
                [ 0.2, 0.2, 0.2, 0.2, 0.2, 0.2 ],
                [ 0.3, 0.3, 0.3, 0.3, 0.3, 0.3 ],
                [ 0.4, 0.4, 0.4, 0.4, 0.4, 0.4 ],
                [ 0.5, 0.5, 0.5, 0.5, 0.5, 0.5 ]
            ]
        ],
        [
            [ 0, 1, 2, 3 ],
            [
                [ 0.1, 0.1, 0.1, 0.1, 0.1, 0.1 ],
                [ 0.2, 0.2, 0.2, 0.2, 0.2, 0.2 ],
                [ 0.3, 0.3, 0.3, 0.3, 0.3, 0.3 ],
                [ 0.4, 0.4, 0.4, 0.4, 0.4, 0.4 ],
                [ 0.5, 0.5, 0.5, 0.5, 0.5, 0.5 ]
            ]
        ],
        [
            [ 0, 1, 2, 3 ],
            [
                [ 0.1, 0.1, 0.1, 0.1, 0.1, 0.1 ],
                [ 0.2, 0.2, 0.2, 0.2, 0.2, 0.2 ],
                [ 0.3, 0.3, 0.3, 0.3, 0.3, 0.3 ],
                [ 0.4, 0.4, 0.4, 0.4, 0.4, 0.4 ],
                [ 0.5, 0.5, 0.5, 0.5, 0.5, 0.5 ]
            ]
        ]
    ],
},

```

```

        [
          [ 0, 1, 2, 3 ],
          [
            [ 0.1, 0.1, 0.1, 0.1, 0.1, 0.1 ],
            [ 0.2, 0.2, 0.2, 0.2, 0.2, 0.2 ],
            [ 0.3, 0.3, 0.3, 0.3, 0.3, 0.3 ],
            [ 0.4, 0.4, 0.4, 0.4, 0.4, 0.4 ],
            [ 0.5, 0.5, 0.5, 0.5, 0.5, 0.5 ]
          ]
        ]
      ]
    },
    "datatypes": {
      "a93ff089-d466-44e7-b3f0-09db34ec2ef5": {
        "type": {
          "class": "H5T_COMPOUND",
          "fields": [
            {
              "name": "a",
              "type": {
                "class": "H5T_ARRAY",
                "base": {
                  "class": "H5T_INTEGER",
                  "base": "H5T_STD_I32BE"
                },
                "dims": [4]
              },
            },
            {
              "name": "b",
              "type": {
                "class": "H5T_ARRAY",
                "base": {
                  "class": "H5T_FLOAT",
                  "base": "H5T_IEEE_F32BE"
                },
                "dims": [5, 6]
              },
            }
          ]
        }
      }
    }
  }
}

```

## 3.2 An HDF5 Array Datatype

```

{
  "apiVersion": "0.0.0",
  "datasets": {
    "146c9fb5-7b51-11e4-a549-3c15c2da029e": {
      "shape": {
        "class": "H5S_SIMPLE",
        "dims": [4],
      }
    }
  }
}

```

```

        "maxdims": [4]
    },
    "type": {
        "base": {
            "base": "H5T_STD_I64LE",
            "class": "H5T_INTEGER"
        },
        "class": "H5T_ARRAY",
        "dims": [3, 5]
    },
    "value": [
        [
            [0, 0, 0, 0, 0],
            [0, -1, -2, -3, -4],
            [0, -2, -4, -6, -8]
        ],
        [
            [0, 1, 2, 3, 4],
            [1, 1, 1, 1, 1],
            [2, 1, 0, -1, -2]
        ],
        [
            [0, 2, 4, 6, 8],
            [2, 3, 4, 5, 6],
            [4, 4, 4, 4, 4]
        ],
        [
            [0, 3, 6, 9, 12],
            [3, 5, 7, 9, 11],
            [6, 7, 8, 9, 10]
        ]
    ]
},
"groups": {
    "146b5775-7b51-11e4-a63d-3c15c2da029e": {
        "links": [
            {
                "class": "H5L_TYPE_HARD",
                "title": "DS1",
                "collection": "datasets",
                "id": "146c9fb5-7b51-11e4-a549-3c15c2da029e"
            }
        ]
    }
},
"root": "146b5775-7b51-11e4-a63d-3c15c2da029e"
}

```

### 3.3 An HDF5 Compound Datatype

```

{
    "datasets": {
        "2fd9e630-7b51-11e4-b2b8-3c15c2da029e": {
            "shape": {

```

```

        "class": "H5S_SIMPLE",
        "dims": [10],
        "maxdims": [10]
    },
    "type": {
        "class": "H5T_COMPOUND",
        "fields": [
            {
                "name": "date",
                "type": {
                    "base": "H5T_STD_I64LE",
                    "class": "H5T_INTEGER"
                }
            },
            {
                "name": "time",
                "type": {
                    "class": "H5T_STRING",
                    "charSet": "H5T_CSET_ASCII",
                    "strPad": "H5T_STR_NULLPAD",
                    "length": 6
                }
            },
            {
                "name": "temp",
                "type": {
                    "base": "H5T_STD_I64LE",
                    "class": "H5T_INTEGER"
                }
            },
            {
                "name": "pressure",
                "type": {
                    "base": "H5T_IEEE_F64LE",
                    "class": "H5T_FLOAT"
                }
            },
            {
                "name": "wind",
                "type": {
                    "class": "H5T_STRING",
                    "charSet": "H5T_CSET_ASCII",
                    "strPad": "H5T_STR_NULLPAD",
                    "length": 6
                }
            }
        ]
    },
    "value": [
        [24, "13:53", 63, 29.88, "SE 10"],
        [24, "12:53", 61, 29.87, "SE 10"],
        [24, "11:53", 61, 29.86, "S 8"],
        [24, "10:53", 58, 29.85, "SE 10"],
        [24, "9:53", 60, 29.83, "SW 8"],
        [24, "8:53", 60, 29.81, "SW 7"],
        [24, "7:53", 61, 29.78, "W 10 G"],
        [24, "6:53", 62, 29.75, "Calm"],
        [24, "5:53", 62, 29.73, "S 7"],
    ]
}

```

```

        [24, "4:53", 63, 29.75, "SE 8"]
    ]
  },
  "groups": {
    "2fd89866-7b51-11e4-9d8e-3c15c2da029e": {
      "attributes": [
        {
          "name": "note",
          "shape": {
            "class": "H5S_SCALAR"
          },
          "type": {
            "class": "H5T_STRING",
            "charSet": "H5T_CSET_ASCII",
            "strPad": "H5T_STR_NULLTERM",
            "length": "H5T_VARIABLE"
          },
          "value": "Seattle, WA Weather observations Sept 21-24, 2014. KSEA_
↪station.\nSource: NOAA"
        }
      ],
      "links": [
        {
          "class": "H5L_TYPE_HARD",
          "title": "dset",
          "collection": "datasets",
          "id": "2fd9e630-7b51-11e4-b2b8-3c15c2da029e"
        }
      ]
    }
  },
  "root": "2fd89866-7b51-11e4-9d8e-3c15c2da029e"
}

```

### 3.4 An HDF5 Datatype Object

```

{
  "apiVersion": "0.0.0",
  "datasets": {
    "25d6f985-7b51-11e4-a037-3c15c2da029e": {
      "shape": {
        "class": "H5S_SIMPLE",
        "dims": [4],
        "maxdims": [4]
      },
      "type": "datatypes/25d7088f-7b51-11e4-ac9b-3c15c2da029e",
      "value": [
        [12345678, "SEA", 56.3, 29.35],
        [12333343, "LAX", 73.3, 32.33],
        [14543645, "PDX", 65.3, 31.23],
        [14344545, "IDA", 72.3, 30.43]
      ]
    }
  },
}

```

```

"datatypes": {
  "25d7088f-7b51-11e4-ac9b-3c15c2da029e": {
    "type": {
      "class": "H5T_COMPOUND",
      "fields": [
        {
          "name": "Serial number",
          "type": {
            "base": "H5T_STD_I64BE",
            "class": "H5T_INTEGER"
          }
        },
        {
          "name": "Location",
          "type": {
            "class": "H5T_STRING",
            "charSet": "H5T_CSET_ASCII",
            "strPad": "H5T_STR_NULLTERM",
            "length": "H5T_VARIABLE"
          }
        },
        {
          "name": "Temperature (F)",
          "type": {
            "base": "H5T_IEEE_F64BE",
            "class": "H5T_FLOAT"
          }
        },
        {
          "name": "Pressure (inHg)",
          "type": {
            "base": "H5T_IEEE_F64BE",
            "class": "H5T_FLOAT"
          }
        }
      ]
    }
  }
},
"groups": {
  "25d607cc-7b51-11e4-9bc3-3c15c2da029e": {
    "attributes": [
      {
        "name": "attr1",
        "shape": {
          "class": "H5S_SCALAR"
        },
        "type": "datatypes/25d7088f-7b51-11e4-ac9b-3c15c2da029e",
        "value": [
          12345678,
          "SEA",
          56.3,
          29.35
        ]
      }
    ],
    "links": [
      {

```

```

        "class": "H5L_TYPE_HARD",
        "title": "DS1",
        "collection": "datasets",
        "id": "25d6f985-7b51-11e4-a037-3c15c2da029e"
    },
    {
        "class": "H5L_TYPE_HARD",
        "title": "Sensor_Type",
        "collection": "datatypes",
        "id": "25d7088f-7b51-11e4-ac9b-3c15c2da029e"
    }
]
},
"root": "25d607cc-7b51-11e4-9bc3-3c15c2da029e"
}

```

### 3.5 An “empty” HDF5 File

```

{
  "apiVersion": "0.0.0",
  "groups": {
    "913d8791-7b51-11e4-89fd-3c15c2da029e": {}
  },
  "root": "913d8791-7b51-11e4-89fd-3c15c2da029e"
}

```

### 3.6 An HDF5 Enumerated Datatype (Attribute)

```

{
  "apiVersion": "0.0.0",
  "datasets": {
    "a615cf0a-7b51-11e4-bc7e-3c15c2da029e": {
      "attributes": [
        {
          "name": "A1",
          "shape": {
            "class": "H5S_SIMPLE",
            "dims": [4, 7]
          },
          "type": {
            "base": {
              "base": "H5T_STD_I16BE",
              "class": "H5T_INTEGER"
            },
            "class": "H5T_ENUM",
            "members": [
              {
                "name": "GAS",
                "value": 2
              },
              {

```



```

        "name": "LIQUID",
        "value": 1
      },
      {
        "name": "PLASMA",
        "value": 3
      },
      {
        "name": "SOLID",
        "value": 0
      }
    ]
  },
  "value": [
    [0, 0, 0, 0, 0, 0, 0],
    [0, 1, 2, 3, 0, 1, 2],
    [0, 2, 0, 2, 0, 2, 0],
    [0, 3, 2, 1, 0, 3, 2]
  ]
},
"shape": {
  "class": "H5S_NULL"
},
"type": {
  "base": "H5T_STD_I32LE",
  "class": "H5T_INTEGER"
},
"value": null
},
"groups": {
  "a614dc9c-7b51-11e4-a3f7-3c15c2da029e": {
    "links": [
      {
        "class": "H5L_TYPE_HARD",
        "title": "DS1",
        "collection": "datasets",
        "id": "a615cf0a-7b51-11e4-bc7e-3c15c2da029e"
      }
    ]
  }
},
"root": "a614dc9c-7b51-11e4-a3f7-3c15c2da029e"
}

```

### 3.7 An HDF5 Fixed-Length String Datatype (Dataset)

```

{
  "apiVersion": "0.0.0",
  "datasets": {
    "99d645d1-7bf7-11e4-92bc-3c15c2da029e": {
      "shape": {
        "class": "H5S_SIMPLE",
        "dims": [4],

```

```

        "maxdims": [4]
    },
    "type": {
        "class": "H5T_STRING",
        "charSet": "H5T_CSET_ASCII",
        "strPad": "H5T_STR_NULLPAD",
        "length": 7
    },
    "value": ["Parting", "is such", "sweet", "sorrow."]
}
},
"groups": {
    "99d54ede-7bf7-11e4-a316-3c15c2da029e": {
        "links": [
            {
                "class": "H5L_TYPE_HARD",
                "title": "DS1",
                "collection": "datasets",
                "id": "99d645d1-7bf7-11e4-92bc-3c15c2da029e"
            }
        ]
    }
}
},
"root": "99d54ede-7bf7-11e4-a316-3c15c2da029e"
}

```

### 3.8 An HDF5 Uninitialized HDF5 Object Reference

```

{
    "apiVersion": "0.0.0",
    "datasets": {
        "9faa470f-7bf7-11e4-8eb6-3c15c2da029e": {
            "shape": {
                "class": "H5S_SIMPLE",
                "dims": [1],
                "maxdims": [1]
            },
            "type": {
                "base": "H5T_STD_REF_OBJ",
                "class": "H5T_REFERENCE"
            },
            "value": [null]
        }
    },
    "groups": {
        "9fa94f7d-7bf7-11e4-9081-3c15c2da029e": {
            "links": [
                {
                    "class": "H5L_TYPE_HARD",
                    "title": "DS1",
                    "collection": "datasets",
                    "id": "9faa470f-7bf7-11e4-8eb6-3c15c2da029e"
                }
            ]
        }
    }
}

```

```

    },
    "root": "9fa94f7d-7bf7-11e4-9081-3c15c2da029e"
  }

```

### 3.9 An HDF5 Dataset with an HDF5 NULL Dataspace

```

{
  "apiVersion": "0.0.0",
  "datasets": {
    "23d3e919-7b53-11e4-961d-3c15c2da029e": {
      "shape": {
        "class": "H5S_NULL"
      },
      "type": {
        "base": "H5T_STD_I32LE",
        "class": "H5T_INTEGER"
      },
      "value": null
    }
  },
  "groups": {
    "23d2e06b-7b53-11e4-9910-3c15c2da029e": {
      "links": [
        {
          "class": "H5L_TYPE_HARD",
          "title": "DS1",
          "collection": "datasets",
          "id": "23d3e919-7b53-11e4-961d-3c15c2da029e"
        }
      ]
    }
  },
  "root": "23d2e06b-7b53-11e4-9910-3c15c2da029e"
}

```

### 3.10 An HDF5 Object Reference Datatype (Attribute)

```

{
  "apiVersion": "0.0.0",
  "datasets": {
    "a09a7f14-7bf7-11e4-8eef-3c15c2da029e": {
      "attributes": [
        {
          "name": "A1",
          "shape": {
            "class": "H5S_SIMPLE",
            "dims": [2]
          },
          "type": {
            "base": "H5T_STD_REF_OBJ",
            "class": "H5T_REFERENCE"
          }
        }
      ]
    }
  }
}

```

```

        "value": [
            "groups/a09a9b99-7bf7-11e4-aa4b-3c15c2da029e",
            "datasets/a09a8efa-7bf7-11e4-9fb6-3c15c2da029e"
        ]
    },
    "shape": {
        "class": "H5S_NULL"
    },
    "type": {
        "base": "H5T_STD_I32LE",
        "class": "H5T_INTEGER"
    },
    "value": null
},
"a09a8efa-7bf7-11e4-9fb6-3c15c2da029e": {
    "shape": {
        "class": "H5S_NULL"
    },
    "type": {
        "base": "H5T_STD_I32LE",
        "class": "H5T_INTEGER"
    },
    "value": null
}
},
"groups": {
    "a099880c-7bf7-11e4-82d6-3c15c2da029e": {
        "links": [
            {
                "class": "H5L_TYPE_HARD",
                "title": "DS1",
                "collection": "datasets",
                "id": "a09a7f14-7bf7-11e4-8eef-3c15c2da029e"
            },
            {
                "class": "H5L_TYPE_HARD",
                "title": "DS2",
                "collection": "datasets",
                "id": "a09a8efa-7bf7-11e4-9fb6-3c15c2da029e"
            },
            {
                "class": "H5L_TYPE_HARD",
                "title": "G1",
                "collection": "groups",
                "id": "a09a9b99-7bf7-11e4-aa4b-3c15c2da029e"
            }
        ]
    },
    "a09a9b99-7bf7-11e4-aa4b-3c15c2da029e": {}
},
"root": "a099880c-7bf7-11e4-82d6-3c15c2da029e"
}

```

### 3.11 An HDF5 Region Reference Datatype (Attribute)

```

{
  "apiVersion": "0.0.0",
  "datasets": {
    "a27c4dlc-7bf7-11e4-8fa1-3c15c2da029e": {
      "attributes": [
        {
          "name": "A1",
          "shape": {
            "class": "H5S_SIMPLE",
            "dims": [2]
          },
          "type": {
            "base": "H5T_STD_REF_DSETREG",
            "class": "H5T_REFERENCE"
          },
          "value": [
            {
              "id": "a27c5e5e-7bf7-11e4-a259-3c15c2da029e",
              "class": "H5S_SEL_POINTS",
              "selection": [
                [0, 1],
                [2, 11],
                [1, 0],
                [2, 4]
              ]
            },
            {
              "id": "a27c5e5e-7bf7-11e4-a259-3c15c2da029e",
              "class": "H5S_SEL_HYPERSLABS",
              "selection": [
                {
                  "start": [0, 0],
                  "opposite": [0, 2]
                },
                {
                  "start": [0, 11],
                  "opposite": [0, 13]
                },
                {
                  "start": [2, 0],
                  "opposite": [2, 2]
                },
                {
                  "start": [2, 11],
                  "opposite": [2, 13]
                }
              ]
            }
          ]
        }
      ],
      "shape": {
        "class": "H5S_NULL"
      },
      "type": {
        "base": "H5T_STD_I32LE",

```

```

        "class": "H5T_INTEGER"
    },
    "value": null
},
"a27c5e5e-7bf7-11e4-a259-3c15c2da029e": {
    "shape": {
        "class": "H5S_SIMPLE",
        "dims": [3, 16],
        "maxdims": [3, 16]
    },
    "type": {
        "base": "H5T_STD_I8LE",
        "class": "H5T_INTEGER"
    },
    "value": [
        [84, 104, 101, 32, 113, 117, 105, 99, 107, 32, 98, 114, 111, 119, 110,
→ 0],
        [102, 111, 120, 32, 106, 117, 109, 112, 115, 32, 111, 118, 101, 114,
→ 32, 0],
        [116, 104, 101, 32, 53, 32, 108, 97, 122, 121, 32, 100, 111, 103, 115,
→ 0]
    ]
},
"groups": {
    "a27b629e-7bf7-11e4-b14c-3c15c2da029e": {
        "links": [
            {
                "class": "H5L_TYPE_HARD",
                "title": "DS1",
                "collection": "datasets",
                "id": "a27c4d1c-7bf7-11e4-8fa1-3c15c2da029e"
            },
            {
                "class": "H5L_TYPE_HARD",
                "title": "DS2",
                "collection": "datasets",
                "id": "a27c5e5e-7bf7-11e4-a259-3c15c2da029e"
            }
        ]
    }
},
"root": "a27b629e-7bf7-11e4-b14c-3c15c2da029e"
}

```

### 3.12 A resizable HDF5 Dataset

```

{
    "apiVersion": "0.0.0",
    "datasets": {
        "a36df1ba-7bf7-11e4-b0ea-3c15c2da029e": {
            "dcpl": {
                "fillValue": 0,
                "layout": {
                    "class": "H5D_CHUNKED",

```

```

        "dims": [8]
      }
    },
    "shape": {
      "class": "H5S_SIMPLE",
      "dims": [10],
      "maxdims": [20]
    },
    "type": {
      "base": "H5T_STD_I64LE",
      "class": "H5T_INTEGER"
    },
    "value": [0, 2, 4, 6, 8, 10, 12, 14, 16, 18]
  },
  "a36e0fe3-7bf7-11e4-a278-3c15c2da029e": {
    "dcpl": {
      "fillValue": 0,
      "layout": {
        "class": "H5D_CHUNKED",
        "dims": [8, 8]
      }
    },
    "shape": {
      "class": "H5S_SIMPLE",
      "dims": [10, 10],
      "maxdims": [10, 20]
    },
    "type": {
      "base": "H5T_STD_I64LE",
      "class": "H5T_INTEGER"
    },
    "value": [
      [1, 2, 3, 4, 5, 6, 7, 8, 9, 10],
      [2, 4, 6, 8, 10, 12, 14, 16, 18, 20],
      [3, 6, 9, 12, 15, 18, 21, 24, 27, 30],
      [4, 8, 12, 16, 20, 24, 28, 32, 36, 40],
      [5, 10, 15, 20, 25, 30, 35, 40, 45, 50],
      [6, 12, 18, 24, 30, 36, 42, 48, 54, 60],
      [7, 14, 21, 28, 35, 42, 49, 56, 63, 70],
      [8, 16, 24, 32, 40, 48, 56, 64, 72, 80],
      [9, 18, 27, 36, 45, 54, 63, 72, 81, 90],
      [10, 20, 30, 40, 50, 60, 70, 80, 90, 100]
    ]
  },
  "a36e207d-7bf7-11e4-ac4a-3c15c2da029e": {
    "shape": {
      "class": "H5S_SIMPLE",
      "dims": [10],
      "maxdims": [H5S_UNLIMITED]
    },
    "type": {
      "base": "H5T_STD_I64LE",
      "class": "H5T_INTEGER"
    },
    "value": [0, 2, 4, 6, 8, 10, 12, 14, 16, 18]
  },
  "a36e3c1c-7bf7-11e4-90c4-3c15c2da029e": {
    "shape": {

```

```

        "class": "H5S_SIMPLE",
        "dims": [10, 10],
        "maxdims": [10, H5S_UNLIMITED]
    },
    "type": {
        "base": "H5T_STD_I64LE",
        "class": "H5T_INTEGER"
    },
    "value": [
        [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],
        [1, 2, 3, 4, 5, 6, 7, 8, 9, 10],
        [2, 4, 6, 8, 10, 12, 14, 16, 18, 20],
        [3, 6, 9, 12, 15, 18, 21, 24, 27, 30],
        [4, 8, 12, 16, 20, 24, 28, 32, 36, 40],
        [5, 10, 15, 20, 25, 30, 35, 40, 45, 50],
        [6, 12, 18, 24, 30, 36, 42, 48, 54, 60],
        [7, 14, 21, 28, 35, 42, 49, 56, 63, 70],
        [8, 16, 24, 32, 40, 48, 56, 64, 72, 80],
        [9, 18, 27, 36, 45, 54, 63, 72, 81, 90]
    ]
}
},
"groups": {
    "a36cf968-7bf7-11e4-88a7-3c15c2da029e": {
        "links": [
            {
                "class": "H5L_TYPE_HARD",
                "title": "resizable_1d",
                "collection": "datasets",
                "id": "a36df1ba-7bf7-11e4-b0ea-3c15c2da029e"
            },
            {
                "class": "H5L_TYPE_HARD",
                "title": "resizable_2d",
                "collection": "datasets",
                "id": "a36e0fe3-7bf7-11e4-a278-3c15c2da029e"
            },
            {
                "class": "H5L_TYPE_HARD",
                "title": "unlimited_1d",
                "collection": "datasets",
                "id": "a36e207d-7bf7-11e4-ac4a-3c15c2da029e"
            },
            {
                "class": "H5L_TYPE_HARD",
                "title": "unlimited_2d",
                "collection": "datasets",
                "id": "a36e3c1c-7bf7-11e4-90c4-3c15c2da029e"
            }
        ]
    }
},
"root": "a36cf968-7bf7-11e4-88a7-3c15c2da029e"
}

```



### 3.13 HDF5 scalar Datasets and Attributes

```

{
  "apiVersion": "0.0.0",
  "datasets": {
    "41e49e63-7b86-11e4-852f-3c15c2da029e": {
      "shape": {
        "class": "H5S_SCALAR"
      },
      "type": {
        "base": "H5T_STD_I32LE",
        "class": "H5T_INTEGER"
      },
      "value": 42
    },
    "41e4b5a8-7b86-11e4-b6f6-3c15c2da029e": {
      "shape": {
        "class": "H5S_SIMPLE",
        "dims": [1],
        "maxdims": [1]
      },
      "type": {
        "base": "H5T_STD_I32LE",
        "class": "H5T_INTEGER"
      },
      "value": [42]
    }
  },
  "groups": {
    "41e373c0-7b86-11e4-a863-3c15c2da029e": {
      "attributes": [
        {
          "name": "attr1",
          "shape": {
            "class": "H5S_SCALAR"
          },
          "type": {
            "base": "H5T_STD_I64LE",
            "class": "H5T_INTEGER"
          },
          "value": 42
        },
        {
          "name": "attr2",
          "shape": {
            "class": "H5S_SCALAR"
          },
          "type": {
            "base": "H5T_STD_I64LE",
            "class": "H5T_INTEGER"
          },
          "value": 42
        }
      ],
      "links": [
        {
          "class": "H5L_TYPE_HARD",
          "title": "0d",

```

```

        "collection": "datasets",
        "id": "41e49e63-7b86-11e4-852f-3c15c2da029e"
    },
    {
        "class": "H5L_TYPE_HARD",
        "title": "1d",
        "collection": "datasets",
        "id": "41e4b5a8-7b86-11e4-b6f6-3c15c2da029e"
    }
]
},
"root": "41e373c0-7b86-11e4-a863-3c15c2da029e"
}

```

### 3.14 A sample File

```

{
  "apiVersion": "0.0.0",
  "datasets": {
    "7f335a2e-7ab1-11e4-87a5-3c15c2da029e": {
      "attributes": [
        {
          "name": "attr1",
          "shape": {
            "class": "H5S_SIMPLE",
            "dims": [27]
          },
          "type": {
            "base": "H5T_STD_I8LE",
            "class": "H5T_INTEGER"
          },
          "value": [49, 115, 116, 32, 97, 116, 116, 114, 105, 98, 117, 116, ↵
↵101, 32, 111, 102, 32, 100, 115, 101, 116, 49, 46, 49, 46, 49, 0]
        },
        {
          "name": "attr2",
          "shape": {
            "class": "H5S_SIMPLE",
            "dims": [27]
          },
          "type": {
            "base": "H5T_STD_I8LE",
            "class": "H5T_INTEGER"
          },
          "value": [50, 110, 100, 32, 97, 116, 116, 114, 105, 98, 117, 116, ↵
↵101, 32, 111, 102, 32, 100, 115, 101, 116, 49, 46, 49, 46, 49, 0]
        }
      ],
      "shape": {
        "class": "H5S_SIMPLE",
        "dims": [10, 10],
        "maxdims": [10, 10]
      },
      "type": {

```

```

        "base": "H5T_STD_I32BE",
        "class": "H5T_INTEGER"
    },
    "value": [
        [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],
        [0, 1, 2, 3, 4, 5, 6, 7, 8, 9],
        [0, 2, 4, 6, 8, 10, 12, 14, 16, 18],
        [0, 3, 6, 9, 12, 15, 18, 21, 24, 27],
        [0, 4, 8, 12, 16, 20, 24, 28, 32, 36],
        [0, 5, 10, 15, 20, 25, 30, 35, 40, 45],
        [0, 6, 12, 18, 24, 30, 36, 42, 48, 54],
        [0, 7, 14, 21, 28, 35, 42, 49, 56, 63],
        [0, 8, 16, 24, 32, 40, 48, 56, 64, 72],
        [0, 9, 18, 27, 36, 45, 54, 63, 72, 81]
    ]
},
"7f3374a6-7ab1-11e4-94e2-3c15c2da029e": {
    "shape": {
        "class": "H5S_SIMPLE",
        "dims": [20],
        "maxdims": [20]
    },
    "type": {
        "base": "H5T_STD_I32BE",
        "class": "H5T_INTEGER"
    },
    "value": [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, ↵
↵18, 19]
},
"7f33c885-7ab1-11e4-ac4d-3c15c2da029e": {
    "shape": {
        "class": "H5S_SIMPLE",
        "dims": [10],
        "maxdims": [10]
    },
    "type": {
        "base": "H5T_IEEE_F32BE",
        "class": "H5T_FLOAT"
    },
    "value": [1.0, 1.100000023841858, 1.2000000476837158, 1.2999999523162842, ↵
↵1.399999976158142, 1.5, 1.600000023841858, 1.7000000476837158, 1.7999999523162842, ↵
↵1.899999976158142]
},
"7f33e211-7ab1-11e4-8669-3c15c2da029e": {
    "shape": {
        "class": "H5S_SIMPLE",
        "dims": [3, 5],
        "maxdims": [3, 5]
    },
    "type": {
        "base": "H5T_IEEE_F32BE",
        "class": "H5T_FLOAT"
    },
    "value": [
        [0.0, 0.10000000149011612, 0.20000000298023224, 0.30000001192092896, ↵
↵0.4000000059604645],
        [0.0, 0.20000000298023224, 0.4000000059604645, 0.6000000238418579, 0.
↵800000011920929],

```

```

        [0.0, 0.30000001192092896, 0.6000000238418579, 0.8999999761581421, 1.
↪2000000476837158]
    ]
  },
  "groups": {
    "7f323835-7ab1-11e4-b6da-3c15c2da029e": {
      "attributes": [
        {
          "name": "attr1",
          "shape": {
            "class": "H5S_SIMPLE",
            "dims": [10]
          },
          "type": {
            "base": "H5T_STD_I8LE",
            "class": "H5T_INTEGER"
          },
          "value": [97, 98, 99, 100, 101, 102, 103, 104, 105, 0]
        },
        {
          "name": "attr2",
          "shape": {
            "class": "H5S_SIMPLE",
            "dims": [2, 2]
          },
          "type": {
            "base": "H5T_STD_I32BE",
            "class": "H5T_INTEGER"
          },
          "value": [
            [0, 1],
            [2, 3]
          ]
        }
      ]
    },
    "links": [
      {
        "class": "H5L_TYPE_HARD",
        "title": "g1",
        "collection": "groups",
        "id": "7f332f8f-7ab1-11e4-9a20-3c15c2da029e"
      },
      {
        "class": "H5L_TYPE_HARD",
        "title": "g2",
        "collection": "groups",
        "id": "7f33b04c-7ab1-11e4-8c78-3c15c2da029e"
      }
    ]
  },
  "7f332f8f-7ab1-11e4-9a20-3c15c2da029e": {
    "links": [
      {
        "class": "H5L_TYPE_HARD",
        "title": "g1.1",
        "collection": "groups",
        "id": "7f334102-7ab1-11e4-94b4-3c15c2da029e"
      }
    ]
  }
}

```

```

    },
    {
      "class": "H5L_TYPE_HARD",
      "title": "g1.2",
      "collection": "groups",
      "id": "7f338cb8-7ab1-11e4-9185-3c15c2da029e"
    }
  ]
},
"7f334102-7ab1-11e4-94b4-3c15c2da029e": {
  "links": [
    {
      "class": "H5L_TYPE_HARD",
      "title": "dset1.1.1",
      "collection": "datasets",
      "id": "7f335a2e-7ab1-11e4-87a5-3c15c2da029e"
    },
    {
      "class": "H5L_TYPE_HARD",
      "title": "dset1.1.2",
      "collection": "datasets",
      "id": "7f3374a6-7ab1-11e4-94e2-3c15c2da029e"
    }
  ]
},
"7f338cb8-7ab1-11e4-9185-3c15c2da029e": {
  "links": [
    {
      "class": "H5L_TYPE_HARD",
      "title": "g1.2.1",
      "collection": "groups",
      "id": "7f339ef5-7ab1-11e4-9ee3-3c15c2da029e"
    },
    {
      "class": "H5L_TYPE_EXTERNAL",
      "title": "extlink",
      "file": "somefile",
      "h5path": "somepath"
    }
  ]
},
"7f339ef5-7ab1-11e4-9ee3-3c15c2da029e": {
  "links": [
    {
      "class": "H5L_TYPE_SOFT",
      "title": "slink",
      "h5path": "somevalue"
    }
  ]
},
"7f33b04c-7ab1-11e4-8c78-3c15c2da029e": {
  "links": [
    {
      "class": "H5L_TYPE_HARD",
      "title": "dset2.1",
      "collection": "datasets",
      "id": "7f33c885-7ab1-11e4-ac4d-3c15c2da029e"
    }
  ],
},

```

```

        {
            "class": "H5L_TYPE_HARD",
            "title": "dset2.2",
            "collection": "datasets",
            "id": "7f33e211-7ab1-11e4-8669-3c15c2da029e"
        }
    ]
},
"root": "7f323835-7ab1-11e4-b6da-3c15c2da029e"
}

```

### 3.15 A few HDF5 Groups

```

{
    "apiVersion": "0.0.0",
    "groups": {
        "a6c2fdf8-7bf7-11e4-9882-3c15c2da029e": {
            "links": [
                {
                    "href": "groups/a6c3f58c-7bf7-11e4-a370-3c15c2da029e",
                    "title": "g1"
                },
                {
                    "href": "groups/a6c42494-7bf7-11e4-ab57-3c15c2da029e",
                    "title": "g2"
                },
                {
                    "href": "a6c46ab3-7bf7-11e4-9229-3c15c2da029e",
                    "title": "g3"
                }
            ]
        },
        "a6c3f58c-7bf7-11e4-a370-3c15c2da029e": {
            "links": [
                {
                    "class": "H5L_TYPE_HARD",
                    "title": "g1.1",
                    "collection": "groups",
                    "id": "a6c40ab5-7bf7-11e4-9279-3c15c2da029e"
                },
                {
                    "class": "H5L_TYPE_HARD",
                    "title": "g1.2",
                    "collection": "groups",
                    "id": "a6c417f5-7bf7-11e4-b5b9-3c15c2da029e"
                }
            ]
        },
        "a6c40ab5-7bf7-11e4-9279-3c15c2da029e": {},
        "a6c417f5-7bf7-11e4-b5b9-3c15c2da029e": {},
        "a6c42494-7bf7-11e4-ab57-3c15c2da029e": {
            "links": [
                {
                    "class": "H5L_TYPE_HARD",

```

```

        "title": "g2.1",
        "collection": "groups",
        "id": "a6c43326-7bf7-11e4-ad08-3c15c2da029e"
    }
  ]
},
"a6c43326-7bf7-11e4-ad08-3c15c2da029e": {
  "links": [
    {
      "class": "H5L_TYPE_HARD",
      "title": "g2.1.1",
      "collection": "groups",
      "id": "a6c4420a-7bf7-11e4-b535-3c15c2da029e"
    },
    {
      "class": "H5L_TYPE_HARD",
      "title": "g2.1.2",
      "collection": "groups",
      "id": "a6c45070-7bf7-11e4-b666-3c15c2da029e"
    },
    {
      "class": "H5L_TYPE_HARD",
      "title": "g2.1.3",
      "collection": "groups",
      "id": "a6c45e26-7bf7-11e4-bb94-3c15c2da029e"
    }
  ]
},
"a6c4420a-7bf7-11e4-b535-3c15c2da029e": {},
"a6c45070-7bf7-11e4-b666-3c15c2da029e": {},
"a6c45e26-7bf7-11e4-bb94-3c15c2da029e": {},
"a6c46ab3-7bf7-11e4-9229-3c15c2da029e": {
  "links": [
    {
      "class": "H5L_TYPE_HARD",
      "title": "g3.1",
      "collection": "groups",
      "id": "a6c4782b-7bf7-11e4-b1e0-3c15c2da029e"
    },
    {
      "class": "H5L_TYPE_HARD",
      "title": "g3.2",
      "collection": "groups",
      "id": "a6c484ca-7bf7-11e4-973a-3c15c2da029e"
    },
    {
      "class": "H5L_TYPE_HARD",
      "title": "g3.3",
      "collection": "groups",
      "id": "a6c4918f-7bf7-11e4-a8fc-3c15c2da029e"
    },
    {
      "class": "H5L_TYPE_HARD",
      "title": "g3.4",
      "collection": "groups",
      "href": "a6c49d2b-7bf7-11e4-a6ca-3c15c2da029e"
    }
  ]
}
]

```

```

    },
    "a6c4782b-7bf7-11e4-b1e0-3c15c2da029e": {},
    "a6c484ca-7bf7-11e4-973a-3c15c2da029e": {},
    "a6c4918f-7bf7-11e4-a8fc-3c15c2da029e": {},
    "a6c49d2b-7bf7-11e4-a6ca-3c15c2da029e": {}
  },
  "root": "a6c2fdf8-7bf7-11e4-9882-3c15c2da029e"
}

```

### 3.16 An HDF5 variable-length Datatype (Dataset)

```

{
  "apiVersion": "0.0.0",
  "datasets": {
    "89dfb414-7b83-11e4-8384-3c15c2da029e": {
      "shape": {
        "class": "H5S_SIMPLE",
        "dims": [2],
        "maxdims": [2]
      },
      "type": {
        "base": {
          "base": "H5T_STD_I32LE",
          "class": "H5T_INTEGER"
        },
        "class": "H5T_VLEN"
      },
      "value": [
        [3, 2, 1],
        [1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144]
      ]
    }
  },
  "groups": {
    "89de7ee6-7b83-11e4-b0e9-3c15c2da029e": {
      "links": [
        {
          "class": "H5L_TYPE_HARD",
          "title": "DS1",
          "collection": "datasets",
          "id": "89dfb414-7b83-11e4-8384-3c15c2da029e"
        }
      ]
    }
  },
  "root": "89de7ee6-7b83-11e4-b0e9-3c15c2da029e"
}

```

### 3.17 An HDF5 variable-length String Datatype (Attribute)

```

{
  "apiVersion": "0.0.0",

```



```

"datasets": {
  "a9217e6b-7bf7-11e4-9645-3c15c2da029e": {
    "attributes": [
      {
        "name": "A1",
        "shape": {
          "class": "H5S_SIMPLE",
          "dims": [4]
        },
        "type": {
          "class": "H5T_STRING",
          "charSet": "H5T_CSET_ASCII",
          "strPad": "H5T_STR_NULLTERM",
          "length": "H5T_VARIABLE"
        },
        "value": ["Parting", "is such", "sweet", "sorrow."]
      }
    ],
    "shape": {
      "class": "H5S_NULL"
    },
    "type": {
      "base": "H5T_STD_I32LE",
      "class": "H5T_INTEGER"
    },
    "value": null
  }
},
"groups": {
  "a9208b38-7bf7-11e4-b1be-3c15c2da029e": {
    "links": [
      {
        "href": "datasets/a9217e6b-7bf7-11e4-9645-3c15c2da029e",
        "title": "DS1"
      }
    ]
  }
},
"root": "a9208b38-7bf7-11e4-b1be-3c15c2da029e"
}

```