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# **HDF5/JSON Specification**

*Release 0.1*

**The HDF Group**

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<b>1</b>	<b>Installing hdf5-json</b>	<b>3</b>
1.1	Prerequisites . . . . .	3
1.2	Installing on Windows . . . . .	3
1.3	Installing on Linux/Mac OS X . . . . .	4
1.4	Verification . . . . .	4
<b>2</b>	<b>Production Rules</b>	<b>7</b>
2.1	File . . . . .	7
2.2	Group . . . . .	9
2.3	Dataset . . . . .	10
2.4	Dataspace . . . . .	11
2.5	Datatype . . . . .	12
2.6	Attribute . . . . .	15
2.7	Filter . . . . .	15
2.8	Miscellaneous . . . . .	17
<b>3</b>	<b>Examples</b>	<b>19</b>
3.1	The “Classic” . . . . .	19
3.2	An HDF5 Array Datatype . . . . .	23
3.3	An HDF5 Compound Datatype . . . . .	24
3.4	An HDF5 Datatype Object . . . . .	26
3.5	An “empty” HDF5 File . . . . .	28
3.6	An HDF5 Enumerated Datatype (Attribute) . . . . .	28
3.7	An HDF5 Fixed-Length String Datatype (Dataset) . . . . .	29
3.8	An HDF5 Uninitialized HDF5 Object Reference . . . . .	30
3.9	An HDF5 Dataset with an HDF5 NULL Dataspace . . . . .	30
3.10	An HDF5 Object Reference Datatype (Attribute) . . . . .	31
3.11	An HDF5 Region Reference Datatype (Attribute) . . . . .	32
3.12	A resizable HDF5 Dataset . . . . .	34
3.13	HDF5 scalar Datasets and Attributes . . . . .	36
3.14	A sample File . . . . .	37
3.15	A few HDF5 Groups . . . . .	41
3.16	An HDF5 variable-length Datatype (Dataset) . . . . .	43
3.17	An HDF5 variable-length String Datatype (Attribute) . . . . .	44



Specification and tools for representing HDF5 in JSON

Contents:



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## Installing hdf5-json

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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
```



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## Production Rules

---

### 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_SHMESG_ATTR_FLAG"
| "H5O_SHMESG_DTYPE_FLAG"
| "H5O_SHMESG_FILL_FLAG"
| "H5O_SHMESG_PLINE_FLAG"
| "H5O_SHMESG_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

```

```
selection_class ::= | point_selection)
                 ::= "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 ","
                 "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 ]
        ]
      ]
    ]
  }

```

```

    ]
  ]
}
},
"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: https://www.ksea.com/weather/observations/2014/09/21-24/
    }
  ],
  "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, 1
      ],
      {
        "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, 1
    ]
  },
  "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, 1.399999976158]
  },
  "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, 0.4000000059604
      [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": "a6c2fd8-7bf7-11e4-9882-3c15c2da029e"
}

```

### 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"  
}
```