

Grail

1.0

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# Chapter 1

## Hierarchical Index

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This inheritance list is sorted roughly, but not completely, alphabetically:

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## Chapter 2

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<a href="#">VerticalListRenderer</a>	117
<a href="#">VideoPlayer</a>	117
<a href="#">WebCursor</a>	118
<a href="#">WebDraw</a>	118
<a href="#">Widget2D</a>	119
<a href="#">X11Util</a>	120
<a href="#">XDLCompiler</a>	120
<a href="#">XDLIterator</a>	120

<a href="#">XDLRaw</a>	121
<a href="#">XDLRequest</a>	121
<a href="#">XDType</a>	122



## Chapter 3

# Class Documentation

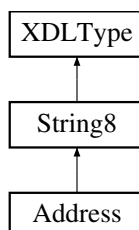
### 3.1 A Class Reference

#### Public Member Functions

- void **doit** (const char filename[ ])

### 3.2 Address Class Reference

Inheritance diagram for Address:



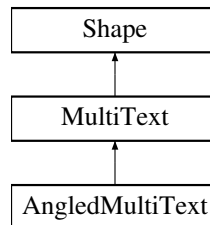
#### Public Member Functions

- **Address** (const std::string &s)
- void **writeMeta** (Buffer &b) const override
- void **display** (Buffer &binaryIn, Buffer &asciiOut) const
- void **format** (Buffer &binaryIn, Buffer &asciiOut, const char fmt[ ]) const

## Additional Inherited Members

### 3.3 AngledMultiText Class Reference

Inheritance diagram for AngledMultiText:



## Public Member Functions

- **AngledMultiText** ([Canvas](#) \*c, const [Style](#) \*s, float angle, float x, float y)
- void **render** () override

## Additional Inherited Members

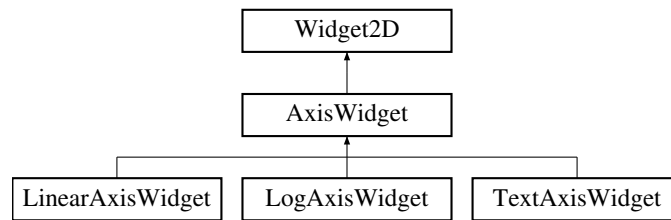
### 3.4 AudioPlayer Class Reference

## Public Member Functions

- **AudioPlayer** (const [AudioPlayer](#) &orig)=delete
- [AudioPlayer](#) & **operator=** (const [AudioPlayer](#) &orig)=delete
- void **newContext** (std::string name)
- void **setCurrentContext** (std::string name)
- void **loadFile** (std::string filePath)
- void **loadPlaylist** (std::string filePath, bool append=false)
- void **setVolume** (int volume)
- void **seekLocation** (std::string time, std::string type="relative")
- void **revertSeek** ()
- void **playlistNext** ()
- void **playlistPrev** ()
- void **playlistPlayIndex** (int index)
- void **playlistClear** ()
- void **playlistRemoveIndex** (int index)
- void **playlistMove** (int index1, int index2)
- void **playlistShuffle** ()
- void **printCurrentTime** ()
- void **setPaused** ()
- void **setPlaying** ()
- void **togglePause** ()

## 3.5 AxisWidget Class Reference

Inheritance diagram for AxisWidget:



### Classes

- struct [Format](#)

### Public Member Functions

- **AxisWidget** ([StyledMultiShape2D](#) \*m, [MultiText](#) \*t, double x, double y, double w, double h, double minBound=0, double maxBound=0, double tickInterval=1, double tickDrawSize=5, bool showTicks=true, bool isVert=false, std::string axisTitle="", const glm::vec4 &axisColor=glm::black, const glm::vec4 &tickColor=glm::black, int tickFormatWidth=2, int tickFormatPrecision=2, double bottomOffset=0)
- void **setTickDrawSize** (double i)
- void **setShowTicks** (bool b)
- void **setIsVert** (bool b)
- void **setTitle** (std::string text)
- void **setAxisColor** (const glm::vec4 &color)
- void **setTickColor** (const glm::vec4 &color)
- void **setTickFormat** (int width, int precision)
- double **getTickInterval** ()
- double **getMinBound** ()
- double **getMaxBound** ()
- virtual void **setBounds** (double minBound, double maxBound)=0
- virtual void **setTickInterval** (double tickInterval)=0
- virtual void **setTickLabels** (std::vector< std::string > tickLabels)=0

### Protected Member Functions

- void **addAxisTitle** ()

### Protected Attributes

- double **minBound**
- double **maxBound**
- double **tickInterval**
- double **tickDrawSize**
- [Format](#) **tickFormat**
- bool **showTicks**
- bool **isVert**
- std::string **axisTitle**
- glm::vec4 **axisColor**
- glm::vec4 **tickColor**
- double **bottomOffset**

## 3.6 BadType Class Reference

```
#include <Config.hh>
```

### Public Member Functions

- **BadType** (const char filename[], int lineNum)

### Friends

- ostream & **operator**<< (ostream &s, const [BadType](#) &e)

### 3.6.1 Detailed Description

Represent a config file used to configure complicated applications

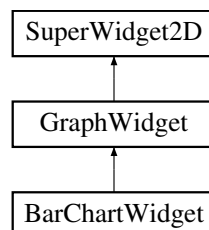
File format supports comments starting with #  
name-value pairs of data, with declaration of the type of names

supported in the constructor so that subclasses of [Config](#) can specify the required types of each tag. In this way, the [Config](#) utility can display the line number and an error if the data is not as required

TODO: Since [Config](#) files can be very large, and parsing is slow, it is possible to extend this model to automatically generate a binary version of the config. In this way, the config file can effectively be compiled. This is important only if the file is large so at the moment we can ignore

## 3.7 BarChartWidget Class Reference

Inheritance diagram for BarChartWidget:



### Public Member Functions

- **BarChartWidget** ([Canvas](#) \*c, double x, double y, double w, double h)
- void **setBarStyle** (const [Style](#) \*s)
- void **setBarWidth** (double width)
- void **setBarColors** (const std::vector< glm::vec4 > &colors)
- void **setBarOutlineColors** (const std::vector< glm::vec4 > &colors)
- void **setValues** (const std::vector< double > &values)
- void **setNames** (const std::vector< std::string > &names)
- void **createXAxis** (AxisType a=AxisType::TEXT) override
- void **createYAxis** (AxisType a) override
- void **init** () override



## Additional Inherited Members

## 3.8 Benchmark Class Reference

### Public Member Functions

- uint64\_t **elapsed** () const
- void **start** ()
- void **end** ()

### Static Public Member Functions

- static void **benchmark** (void(\*Func)())
- static void **benchmark** (void(\*Func)(int), int n)

### Friends

- std::ostream & **operator**<< (std::ostream &s, const [Benchmark](#) &b)

## 3.9 Bezier Class Reference

### Public Member Functions

- **Bezier** (float ax, float bx, float cx, float dx, float ay, float by, float cy, float dy, int n, bool end, const glm::vec4 &c={0, 0, 0, 1})
- float **getax** () const
- float **getay** () const
- float **getbx** () const
- float **getby** () const
- float **getcx** () const
- float **getcy** () const
- float **getdx** () const
- float **getdy** () const
- float **getp1x** () const
- float **getp1y** () const
- float **getp2x** () const
- float **getp2y** () const
- float **getp3x** () const
- float **getp3y** () const
- float **getp4x** () const
- float **getp4y** () const
- int **getn** () const
- double **getdt** () const
- bool **getEnd** () const
- glm::vec4 **getColor** () const

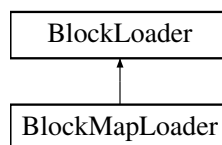
### 3.10 BlockAllocator< blockSize > Class Template Reference

#### Public Member Functions

- **BlockAllocator** (uint32\_t size)
- void \* **alloc** (uint32\_t size)

### 3.11 BlockLoader Class Reference

Inheritance diagram for BlockLoader:



#### Classes

- struct [GeneralHeader](#)
- struct [Info](#)
- struct [SecurityHeaderV0](#)
- struct [SecurityHeaderV1](#)

#### Public Types

- enum class **Type** { **gismap** , **hashmap** }

#### Public Member Functions

- **BlockLoader** (const char filename[])
- **BlockLoader** (const [BlockLoader](#) &orig)=delete
- [BlockLoader](#) & **operator=** (const [BlockLoader](#) &orig)=delete
- void **init** (uint64\_t \*mem, uint64\_t size)
- void **init** (uint64\_t bytes, Type t, uint32\_t version)
- void **readBlockFile** (const char filename[])
- uint32\_t **getAuthHeaderSize** () const
- uint32\_t **getHeaderSize** () const
- bool **authenticate** () const
- **BlockLoader** (uint64\_t bytes, Type t, uint32\_t version)
- uint32\_t **getAuthHeaderSize** () const
- bool **authenticate** () const

#### Public Attributes

- uint64\_t \* **mem**
- uint64\_t **size**
- [GeneralHeader](#) \* **generalHeader**
- [SecurityHeaderV0](#) \* **securityHeader**

## Protected Member Functions

- **BlockLoader** (const [Info](#) &info)

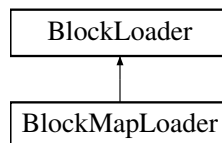
## 3.12 BlockMapLoader::BlockMapHeader Struct Reference

### Public Attributes

- uint32\_t **numNamedEntities**
- uint32\_t **numRegionContainers**
- uint32\_t **numRegions**
- uint32\_t **numSegments**
- uint32\_t **numPoints**
- uint32\_t **deltaEncoded**: 1
- [BoundRect](#) **bounds**

## 3.13 BlockMapLoader Class Reference

Inheritance diagram for BlockMapLoader:



### Classes

- struct [BlockMapHeader](#)
- struct [BoundRect](#)
- struct [NamedEntities](#)
- struct [NamedEntry](#)
- struct [Region](#)
- struct [RegionContainer](#)
- struct [Segment](#)

### Public Types

- enum class **EntityType** { **REGION\_CONTAINER** , **REGION** , **SEGMENT** , **POINT** }

## Public Member Functions

- void **init** (const uint64\_t \*mem, uint64\_t size)
- void **init** (uint32\_t numLists, uint32\_t numPoints)
- **BlockMapLoader** (const char filename[])
- **BlockMapLoader** (const char filename[], const char[])
- const [Region](#) \* **getRegions** () const
- const [Segment](#) \* **getSegments** () const
- void **save** (const char filename[])
- void **filterX** (double xMin, double xMax)
- void **filterY** (double yMin, double yMax)
- void **filter** (double xMin, double xMax, double yMin, double yMax)
- void **methodPolygon** ()
- void **methodPolyline** ()
- uint64\_t **sum** () const
- void **deltaEncode** ()
- void **deltaUnEncode** ()
- void **dumpSegment** (uint32\_t seg)
- uint32\_t **getNumRegionContainers** () const
- const [BlockMapHeader](#) \* **getBlockMapHeader** () const
- uint32\_t **getNumRegions** () const
- uint32\_t **getNumSegments** () const
- uint32\_t **getNumPoints** () const
- const float \* **getXPoints** () const
- const float \* **getYPoints** () const
- const [Segment](#) & **getSegment** (uint32\_t i)

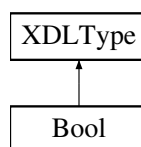
## Static Public Member Functions

- static [BlockMapLoader](#) **loadCompressed** (const char filename[])
- static void **diff** (const [BlockMapLoader](#) &a, const [BlockMapLoader](#) &b)

## Additional Inherited Members

## 3.14 Bool Class Reference

Inheritance diagram for Bool:



## Public Member Functions

- **Bool** (bool val=false)
- DataType **getDataType** () const override
- uint32\_t **size** () const override
- void **write** ([Buffer](#) &buf) const override
- void **display** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut) const
- void **format** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut, const char fmt[]) const

## Additional Inherited Members

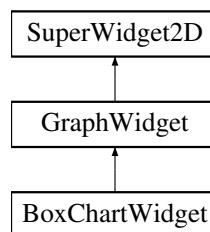
## 3.15 BlockMapLoader::BoundRect Struct Reference

### Public Attributes

- float **xMin**
- float **xMax**
- float **yMin**
- float **yMax**

## 3.16 BoxChartWidget Class Reference

Inheritance diagram for BoxChartWidget:



### Public Member Functions

- **BoxChartWidget** ([Canvas](#) \*c, double x, double y, double w, double h)
- void **setWhiskerStyle** (const [Style](#) \*s)
- void **setBoxStyle** (const [Style](#) \*s)
- void **setBoxWidth** (double width)
- void **setBoxColors** (std::vector< glm::vec4 > &colors)
- void **setWhiskerColors** (std::vector< glm::vec4 > &colors)
- void **setOutlineColors** (std::vector< glm::vec4 > &colors)
- void **setPointsPerBox** (int n)
- void **setData** (const std::vector< double > &data)
- void **setNames** (const std::vector< std::string > &names)
- void **createXAxis** (AxisType a=AxisType::TEXT) override
- void **createYAxis** (AxisType a=AxisType::LINEAR) override
- void **init** () override

## Additional Inherited Members

## 3.17 Buffer Class Reference

```
#include <BinBuffer.hh>
```

## Public Member Functions

- **Buffer** (int initialSize)
- **Buffer** (size\_t initialSize, bool writing)
- **Buffer** (const char filename[], size\_t initialSize)
- **Buffer** (const char filename[], size\_t initialSize, const char \*)
- **Buffer** (const [Buffer](#) &c)=delete
- void **operator=** (const [Buffer](#) &orig)=delete
- void **attachWrite** (int sockfd)
- void **attachRead** (int sockfd)
- void **displayText** (ostream &s) const
- void **displayRawRead** () const
- void **displayRaw** () const
- void **displayHTTPRaw** ()
- void **flush** ()
- void **readNext** ()
- void **write** (const string &s)
- void **write** (const char \*s, uint32\_t len)
- void **appendU8** (uint8\_t)
- void **appendU16** (uint16\_t)
- void **appendU32** (uint32\_t)
- void **appendU64** (uint64\_t)
- void **appendI8** (int8\_t)
- void **appendI16** (int16\_t)
- void **appendI32** (int32\_t)
- void **appendI64** (int64\_t)
- void **appendF32** (float)
- void **appendF64** (double)
- void **append** (const char \*v)
- void **append** (const char \*v, uint32\_t len)
- uint32\_t **parseU32** ()
- double **parseF64** ()
- float **parseF32** ()
- bool **parseRegex** (const regex &r, const char \*&start, int &len)
- bool **parseToken** (const string &match)
- bool **getUri** (const char \*&ptr, uint32\_t &len)
- bool **getHTTPVersion** (const char \*&ptr, uint32\_t &len)
- bool **getHost** (const char \*&ptr, uint32\_t &len)
- void **pointToStart** ()
- bool **getNextTokenWithSpace** (const char \*&ptr, const uint32\_t &len)
- string **readString8** ()
- string **readString16** ()
- string **readString32** ()
- void **write** (DataType t)
- DataType **readType** ()
- void **write** (DataType t, const char \*name)
- template<typename T >  
void **write** (T v)
- void **write** ([XDLRaw](#) &v)
- void **specialWrite** (const char \*buf, const uint32\_t len)
- template<typename T >  
void **writeList** ([List1](#) < T > &list)
- void **writeStudent** ([Student](#) v)
- void **writeList** ([List1](#) < [Student](#) > &list)
- void **checkSpace** (size\_t sz)

- void **fastCheckSpace** (size\_t sz)
- template<typename T >  
void **checkArraySpace** (T v[], size\_t n)
- template<typename T >  
void **checkVectorSpace** (const vector< T > &v)
- template<typename T >  
[Buffer](#) & **operator**<< (T v)
- int8\_t **\_readI8** ()
- int16\_t **\_readI16** ()
- int32\_t **\_readI32** ()
- int64\_t **\_readI64** ()
- int8\_t **readI8** ()
- int16\_t **readI16** ()
- int32\_t **readI32** ()
- int64\_t **readI64** ()
- uint8\_t **\_readU8** ()
- uint16\_t **\_readU16** ()
- uint32\_t **\_readU32** ()
- uint64\_t **\_readU64** ()
- float **\_readF32** ()
- double **\_readF64** ()
- uint8\_t **readU8** ()
- uint16\_t **readU16** ()
- uint32\_t **readU32** ()
- uint64\_t **readU64** ()
- float **readF32** ()
- double **readF64** ()
- template<typename T >  
T **\_read** ()

### 3.17.1 Detailed Description

A binary high-speed buffer to support writing objects portably to a binary stream so it can be read back in (persistence)

### 3.17.2 Member Function Documentation

#### 3.17.2.1 getNextTokenWithSpace()

```
bool Buffer::getNextTokenWithSpace (
    const char *& ptr,
    const uint32_t & len )
```

extract the next space-delimited value from the buffer if return true, this means ptr is pointing to the text, len = the length of the token (until the next space) and the current pointer advances past the token

#### 3.17.2.2 write() [1/2]

```
template<typename T >
void Buffer::write (
    T v ) [inline]
```

write is the fast write that does not check for buffer overrun. Use only when checking size of a large block

### Template Parameters

<i>T</i>	the tpe of the integer to write
----------	---------------------------------

### Parameters

<i>v</i>	the value
----------	-----------

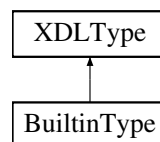
#### 3.17.2.3 write() [2/2]

```
void Buffer::write (
    XDLRaw & v )
```

Special case for [XDLRaw](#) which will write out a complete block of bytes directly without copying

## 3.18 BuiltinType Class Reference

Inheritance diagram for BuiltinType:



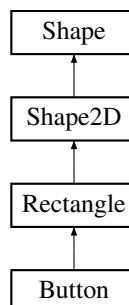
### Public Member Functions

- **BuiltinType** (const std::string &name, const DataType &t)
- uint32\_t **size** () const override
- void **write** ([Buffer](#) &buf) const override
- void **writeMeta** ([Buffer](#) &buf) const override
- DataType **getDataType** () const override
- void **display** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut) const
- void **format** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut, const char fmt[]) const

### Additional Inherited Members

## 3.19 Button Class Reference

Inheritance diagram for Button:





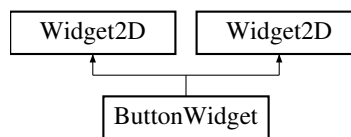
## Public Member Functions

- **Button** (float x, float y, float width, float height)
- void **init** ()
- void **updateButton** ()
- void **render** ()

## Additional Inherited Members

## 3.20 ButtonWidget Class Reference

Inheritance diagram for ButtonWidget:



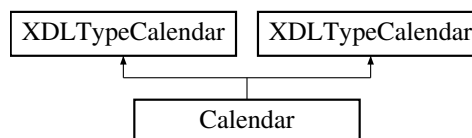
## Public Member Functions

- **ButtonWidget** (StyledMultiShape2D \*m, MultiText \*t, const std::string &text, float x, float y, float w, float h)
- void **init** () override
- **ButtonWidget** (StyledMultiShape2D \*m, MultiText \*t, const std::string[ ] &text, float x, float y, float w, float h)
- void **init** () override

## Additional Inherited Members

## 3.21 Calendar Class Reference

Inheritance diagram for Calendar:



## Public Member Functions

- **Calendar** (const char filename[ ])
- **Calendar** (const char filename[ ])

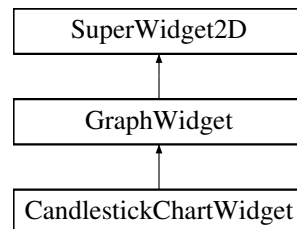
## 3.22 Camera Class Reference

### Public Member Functions

- **Camera** (int screenWidth, int screenHeight, const glm::vec3 &camPos=glm::vec3(4, 3, 5), const glm::vec3 &lookingAt=glm::vec3(0, 0, 0), const glm::vec3 &upVector=glm::vec3(0, 1, 0), float fov=45.0f, float zNear=0.1f, float zFar=100.0f)
- void **setScreenWidth** (int w)
- void **setScreenHeight** (int h)
- void **setCamPos** (const glm::vec3 &pos)
- void **translate** (float x, float y, float z)
- void **setLookingAt** (const glm::vec3 &pos)
- void **incrCamPos** (const glm::vec3 &pos)
- void **incrLookingAt** (const glm::vec3 &pos)
- void **setUpVector** (const glm::vec3 &pos)
- void **setFovRad** (float r)
- void **setZnear** (float z)
- void **setZFar** (float z)
- void **zoomIn** (float s)
- void **zoomIn** ()
- void **zoomOut** ()
- glm::mat4 **getViewProjection** ()

## 3.23 CandlestickChartWidget Class Reference

Inheritance diagram for CandlestickChartWidget:



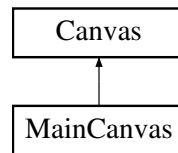
### Public Member Functions

- **CandlestickChartWidget** ([Canvas](#) \*c, double x, double y, double w, double h)
- void **setLineStyle** (const [Style](#) \*s)
- void **setBoxStyle** (const [Style](#) \*s)
- void **setBoxWidth** (double width)
- void **setBoxColors** (const std::vector< glm::vec4 > &colors)
- void **setBoxOutlineColors** (const std::vector< glm::vec4 > &colors)
- void **setData** (const std::vector< double > &data)
- void **setNames** (const std::vector< std::string > &names)
- void **createXAxis** (AxisType a=AxisType::TEXT) override
- void **createYAxis** (AxisType a) override
- void **init** () override

## Additional Inherited Members

## 3.24 Canvas Class Reference

Inheritance diagram for Canvas:



## Public Member Functions

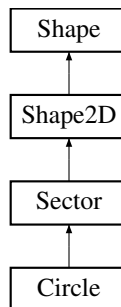
- **Canvas** (*GLWin* \*w, const *Style* \*style, uint32\_t vpX, uint32\_t vpY, uint32\_t vpW, uint32\_t vpH, uint32\_t pX, uint32\_t pY)
- **Canvas** (const *Canvas* &orig)=delete
- *Canvas* & **operator=** (const *Canvas* &orig)=delete
- uint32\_t **getWidth** () const
- uint32\_t **getHeight** () const
- *GLWin* \* **getWin** () const
- glm::mat4 \* **getProjection** ()
- void **setProjection** (const glm::mat4 &proj)
- void **setOrthoProjection** (float xLeft, float xRight, float yBottom, float yTop)
- *Camera* \* **setLookAtProjection** (float eyeX, float eyeY, float eyeZ, float lookAtX, float lookAtY, float lookAtZ, float upX, float upY, float upZ)
- void **resetProjection** ()
- template<typename S >  
S \* **addLayer** (S \*shape)
- *Shape* \* **getLayer** (uint32\_t i)
- void **init** ()
- void **process\_input** (Inputs \*in, float dt)
- void **update** ()
- const *Style* \* **getStyle** () const
- void **render** ()
- void **cleanup** ()

## Protected Attributes

- *GLWin* \* **w**
- std::vector< *Shape* \* > **layers**
- uint32\_t **vpX**
- uint32\_t **vpY**
- uint32\_t **vpW**
- uint32\_t **vpH**
- uint32\_t **pX**
- uint32\_t **pY**
- glm::mat4 **projection**
- glm::mat4 **originalProjection**
- const *Style* \* **style**
- *Camera* \* **cam**

### 3.25 Circle Class Reference

Inheritance diagram for Circle:



#### Public Member Functions

- **Circle** (float x, float y, float rad, float angleInc, [Style](#) \*s)

#### Additional Inherited Members

### 3.26 Client< SocketImpl, ProtocolImpl > Class Template Reference

#### Public Member Functions

- **Client** (const char addr[])
- **Client** (const [Client](#) &)=delete
- [Client](#) & **operator=** (const [Client](#) &)=delete
- void **connect** (const char addr[])
- < T > void [write](#) (const T &data)
- void **send** ()
- void **sendAndWaitforResponse** ()
- void **sendAndKeepOpen** ()

#### 3.26.1 Member Function Documentation

##### 3.26.1.1 write()

```

template<typename SocketImpl , typename ProtocolImpl >
<T> void Client< SocketImpl, ProtocolImpl >::write (
    const T & data ) [inline]
  
```

Write data into the out buffer

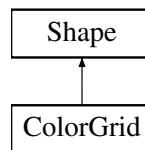
## 3.27 Color Class Reference

### Public Member Functions

- **Color** (float r, float g, float b, float a)
- **operator glm::vec4** () const
- **Color lighter** () const
- **Color darker** () const

## 3.28 ColorGrid Class Reference

Inheritance diagram for ColorGrid:



### Public Member Functions

- **ColorGrid** (uint32\_t xsize, uint32\_t ysize)
- void **init** () override
- void **render** () override
- void **addGrid** (float x0, float y0, float dx, float dy)
- void **addRectangle** (float x, float y, float w, float h)

### Additional Inherited Members

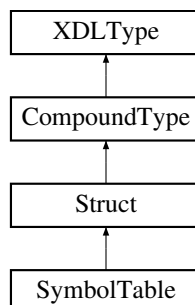
## 3.29 Combiner Class Reference

### Public Member Functions

- **Combiner** (const char staticFileName[])
- void **parsePage** (int pageNum, const char dynamicFileName[])

## 3.30 CompoundType Class Reference

Inheritance diagram for CompoundType:



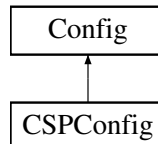
## Public Member Functions

- **CompoundType** (const std::string &name)

## Additional Inherited Members

### 3.31 Config Class Reference

Inheritance diagram for Config:



## Public Types

- enum class **Type** {  
**U16** , **U32** , **U64** , **I16** ,  
**I32** , **I64** , **F64** , **F32** ,  
**BOOL** , **STRING** }

## Public Member Functions

- void **load** (const string &filename)
- void **save** (const string &filename)
- template<typename T >  
void **set** (const string &name, T val)
- uint16\_t **getUInt16** (const string &name) const
- uint32\_t **getUInt32** (const string &name) const
- uint64\_t **getUInt64** (const string &name) const
- int16\_t **getInt16** (const string &name) const
- int32\_t **getInt32** (const string &name) const
- int64\_t **getInt64** (const string &name) const
- bool **getBool** (const string &name) const
- double **getDouble** (const string &name) const
- string **getString** (const string &name) const
- void **mandatory** (int count...)
- void **optional** (int count...)

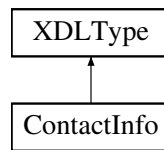
### 3.32 HashMap< Val >::ConstIterator Class Reference

## Public Member Functions

- **ConstIterator** (const [HashMap](#) &list)
- bool **operator!** () const
- void **operator++** ()
- const char \* **key** () const
- const Val \* **value** () const

## 3.33 ContactInfo Class Reference

Inheritance diagram for ContactInfo:



### Public Member Functions

- **ContactInfo** (const [Address](#) &address, const [Phone](#) &phone, const [Email](#) &email)
- DataType **getDataType** () const override
- uint32\_t **size** () const override
- void **write** ([Buffer](#) &b) const override
- void **writeMeta** ([Buffer](#) &b) const override
- void **display** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut) const
- void **format** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut, const char fmt[]) const

### Additional Inherited Members

## 3.34 csp Class Reference

```
#include <configcsp.hh>
```

### Public Attributes

- uint16\_t **port**
- prot **protocol**
- ip **ip\_ver**
- string **log**
- string **base**
- buf **buffer**

### 3.34.1 Detailed Description

NEEDED: We need a hardcoded list of what all is needed in the proj

```
check_correct(HashMap map1<k,v>): for name in hardcoded_list: if typeOF(map1[name]) == type we need/within
enum/range continue else raise error with type_name print error to log exit 1
```

## 3.35 CSPClient Class Reference

### Public Member Functions

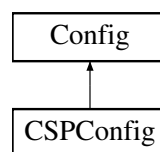
- **CSPClient** (char \*addr, int port)
- [pageBuffer](#) **pageRequest** (uint32\_t pageid)
- void **testPrint** (int pageid)
- void **addPage** (string staticData, vector< [Insertion](#) > &dynamic)
- void **addPage** (string staticData)
- void **addPage** (string staticFile, string offsetFile)
- void **printPageData** (int pageid)
- [pageBuffer](#) **pageRequestFile** (uint32\_t pageid)

### Protected Attributes

- [Buffer](#) & in
- [Buffer](#) & out

## 3.36 CSPConfig Class Reference

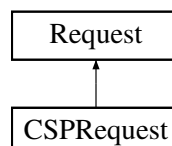
Inheritance diagram for CSPConfig:



### Additional Inherited Members

## 3.37 CSPRequest Class Reference

Inheritance diagram for CSPRequest:



### Public Member Functions

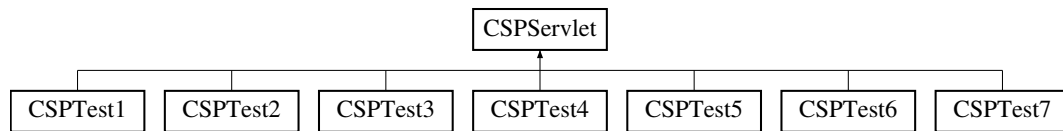
- void **handle** (int fd) override
- void **handle** (int sckt, const char \*command) override



## Additional Inherited Members

## 3.38 CSPServlet Class Reference

Inheritance diagram for CSPServlet:



### Public Member Functions

- void **request** ([Request](#) &r)
- virtual void **request** ([CSPRequest](#) &r)=0

### Static Public Member Functions

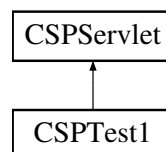
- static int **add** ([CSPServlet](#) \*s)

### Friends

- class **CSPRequest**

## 3.39 CSPTTest1 Class Reference

Inheritance diagram for CSPTTest1:



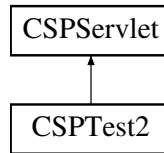
### Public Member Functions

- void **request** ([CSPRequest](#) &r)

### Additional Inherited Members

## 3.40 CSPTTest2 Class Reference

Inheritance diagram for CSPTTest2:



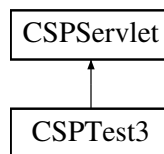
### Public Member Functions

- void **request** ([CSPRequest](#) &r)

### Additional Inherited Members

## 3.41 CSPTTest3 Class Reference

Inheritance diagram for CSPTTest3:



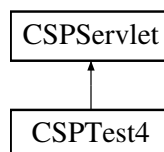
### Public Member Functions

- void **request** ([CSPRequest](#) &r)

### Additional Inherited Members

## 3.42 CSPTTest4 Class Reference

Inheritance diagram for CSPTTest4:



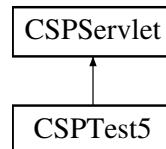
### Public Member Functions

- void request ([CSPRequest](#) &r)

### Additional Inherited Members

## 3.43 CSPTTest5 Class Reference

Inheritance diagram for CSPTTest5:



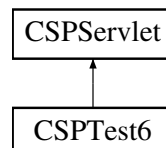
### Public Member Functions

- void request ([CSPRequest](#) &r)

### Additional Inherited Members

## 3.44 CSPTTest6 Class Reference

Inheritance diagram for CSPTTest6:



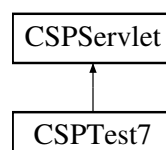
### Public Member Functions

- void request ([CSPRequest](#) &r)

### Additional Inherited Members

## 3.45 CSPTTest7 Class Reference

Inheritance diagram for CSPTTest7:



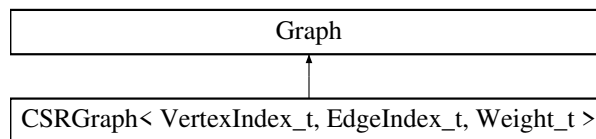
## Public Member Functions

- void **request** ([CSPRequest](#) &r)

## Additional Inherited Members

## 3.46 CSRGraph< VertexIndex\_t, EdgeIndex\_t, Weight\_t > Class Template Reference

Inheritance diagram for CSRGraph< VertexIndex\_t, EdgeIndex\_t, Weight\_t >:



## Classes

- struct [VertexCount](#)

## Public Types

- typedef void(\* **FuncVert**) (uint32\_t src, uint32\_t dest)

## Public Member Functions

- **CSRGraph** (const [CSRGraph](#) &orig)=delete
- [CSRGraph](#) & **operator=** (const [CSRGraph](#) &orig)=delete
- uint32\_t **getV** () const
- uint64\_t **getE** () const
- Weight\_t **getW** (VertexIndex\_t src, VertexIndex\_t dest) const
- bool **isAdjacent** (VertexIndex\_t src, VertexIndex\_t dest) const
- void **getEdge** (EdgeIndex\_t i, VertexIndex\_t \*v1, VertexIndex\_t \*v2)
- VertexIndex\_t **countAdjacencies** (VertexIndex\_t v)
- **CSRGraph** (const char csrBeginName[], const char csrAdjName[], const char weightName[])
- void **dfs** (VertexIndex\_t v, FuncVert f)
- void **bfs** (uint32\_t v, FuncVert f)
- uint32\_t \* **computeHistogram** () const
- void **printHistogram** () const
- const VertexIndex\_t \* **group** ()
- void **cluster** ()

## Static Public Member Functions

- static bool **sortDescCount** (const [VertexCount](#) &a, const [VertexCount](#) &b)

## Public Attributes

- VertexIndex\_t **startIndexLen**
- EdgeIndex\_t **adjLen**
- EdgeIndex\_t **weightLen**
- EdgeIndex\_t \* **startIndex**
- VertexIndex\_t \* **adjacency**
- Weight\_t \* **weight**

## 3.47 CString Class Reference

### Public Member Functions

- **CString** (const char msg[], uint32\_t len)
- **CString** (const [CString](#) &orig)
- [CString](#) & **operator=** (const [CString](#) &orig)
- **CString** ([CString](#) &&orig)
- char **operator[]** (uint32\_t i) const
- char & **operator[]** (uint32\_t i)
- uint32\_t **len** () const
- char \* **str** ()

### Friends

- std::ostream & **operator<<** (std::ostream &s, const [CString](#) &str)

## 3.48 CSVParser Class Reference

### Static Public Member Functions

- static std::vector< std::vector< std::string > > [readCSV](#) (const char filename[])  
*Read CSV file, Excel dialect. Accept "quoted fields ""with quotes""".*

## 3.49 CTimer Class Reference

### Public Member Functions

- void **reset** ()
- double **elapsedSeconds** () const
- double **elapsedMillis** () const
- double **elapsedMicros** () const
- double **elapsedNanos** () const

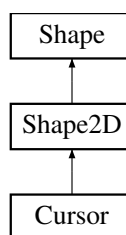
### 3.50 CubicFunc Class Reference

#### Public Member Functions

- double **arcLength** () const
- double **segmentLength** (int i) const
- double **deriv** (int i, double t) const

### 3.51 Cursor Class Reference

Inheritance diagram for Cursor:



#### Public Member Functions

- **Cursor** (float x, float y, [Style](#) \*s, int id)
- void **initIndices** ()
- void **process\_input** (Inputs \*in, float dt)
- void **update** ()
- void **render** ()

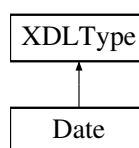
#### Static Public Member Functions

- static float **getXPos** (int id)
- static float **getYPos** (int id)

#### Additional Inherited Members

### 3.52 Date Class Reference

Inheritance diagram for Date:



## Public Member Functions

- **Date** ([JulianDate](#) jd)
- **operator JulianDate** () const
- **Date** (int32\_t year, uint32\_t month, uint32\_t day)
- [Date](#) **operator+** (int32\_t days) const
- [Date](#) **operator-** (int32\_t days) const
- [Date](#) **operator+=** (int32\_t days)
- [Date](#) **operator-=** (int32\_t days)
- bool **operator==** ([Date](#) d) const
- int32\_t **getYear** () const
- uint32\_t **getMonth** () const
- uint32\_t **getDay** () const
- **Date** (int32\_t year, uint8\_t month, uint8\_t day)
- int32\_t **getYear** () const
- uint32\_t **getMonth** () const
- uint32\_t **getDay** () const
- DataType **getDataType** () const
- uint32\_t **size** () const override
- void **write** ([Buffer](#) &buf) const override
- void **display** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut) const
- void **format** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut, const char fmt[]) const

## Friends

- int32\_t **operator-** ([Date](#) d1, [Date](#) d2)

## Additional Inherited Members

## 3.53 Decompressor Class Reference

### Public Member Functions

- void **decompressFileToRAM** (const char compressedFile[])
- void **decompressFile** (const char compressedFile[], const char outFile[])

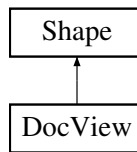
## 3.54 Document Class Reference

### Public Member Functions

- **Document** (const [PageLayout](#) &layout)
- **Document** (const [Document](#) &orig)=delete
- [Document](#) & **operator=** (const [Document](#) &orig)=delete
- const unsigned char \* **getText** () const
- const [Page](#) \* **getPage** (uint32\_t p) const
- const [PageLayout](#) \* **getLayout** () const
- uint32\_t **getPageCount** () const
- void **appendFile** (const [PageLayout](#) &layout, const char filename[])

### 3.55 DocView Class Reference

Inheritance diagram for DocView:



#### Public Member Functions

- **DocView** ([Canvas](#) \*c, const [Style](#) \*style, const [Document](#) \*doc)
- void **clear** ()
- void **printPageNum** (uint32\_t pageNum)
- void **print** (float x, float y, const [Font](#) \*f, uint32\_t v)
- void **advance** ()
- void **advance10** ()
- void **back** ()
- void **top** ()
- void **bottom** ()
- void **gotoPage** (uint32\_t pageNum)
- void **addChar** (const [Font](#) \*f, uint8\_t c)
- void **init** ()
- void **process\_input** (Inputs \*in, float dt)
- void **update** ()
- void **render** ()

#### Additional Inherited Members

### 3.56 DynArray< T > Class Template Reference

#### Public Member Functions

- **DynArray** (uint32\_t capacity)
- void **clear** ()
- **DynArray** (const [DynArray](#) &orig)
- [DynArray](#) & **operator=** (const [DynArray](#) &orig)=delete
- void **add** (const T &v)
- T **removeEnd** ()
- const T & **operator[]** (uint32\_t i) const
- T & **operator[]** (uint32\_t i)
- uint32\_t **size** () const
- const T & **last** () const

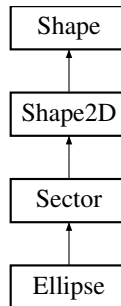
#### Friends

- std::ostream & **operator<<** (std::ostream &s, const [DynArray](#) &d)



## 3.57 Ellipse Class Reference

Inheritance diagram for Ellipse:



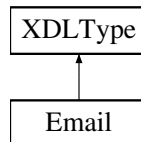
### Public Member Functions

- **Ellipse** (float x, float y, float xRad, float yRad, float angleInc, [Style](#) \*s)

### Additional Inherited Members

## 3.58 Email Class Reference

Inheritance diagram for Email:



### Public Member Functions

- **Email** (const std::string &s)
- DataType **getDataType** () const override
- uint32\_t **size** () const override
- void **write** ([Buffer](#) &b) const override
- void **writeMeta** ([Buffer](#) &b) const override
- void **display** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut) const
- void **format** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut, const char fmt[]) const

### Additional Inherited Members

## 3.59 ESRIPoint Class Reference

### Public Member Functions

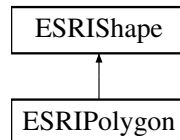
- **ESRIPoint** (double x, double y)

## Public Attributes

- double **x**
- double **y**

## 3.60 ESRIPolygon Class Reference

Inheritance diagram for ESRIPolygon:



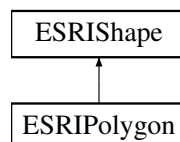
## Public Member Functions

- **ESRIPolygon** (SHPObject \*shapePtr)
- std::vector< [ESRIPoint](#) > **getPoints** ()

## Additional Inherited Members

## 3.61 ESRIShape Class Reference

Inheritance diagram for ESRIShape:



## Public Member Functions

- **ESRIShape** (SHPObject \*shapePtr)
- virtual std::vector< [ESRIPoint](#) > **getPoints** ()=0

## Static Public Member Functions

- static std::vector< std::unique\_ptr< [ESRIShape](#) > > **convertSHPObjects** (const std::vector< SHPObject \* > &shapeObjects)

## Public Attributes

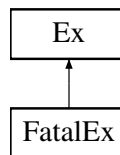
- int **shapeType**

## Protected Attributes

- SHPObject \* **shapePtr**

## 3.62 Ex Class Reference

Inheritance diagram for Ex:



## Public Member Functions

- **Ex** (const char filename[], uint32\_t lineNumber, Errcode e, const std::string &name="")

## Public Attributes

- const char \* **filename**
- const uint32\_t **lineNum**
- const std::string **name**
- int **param**
- Errcode **e**

## Static Public Attributes

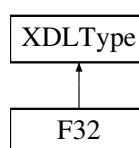
- static const char \* **errNames** []

## Friends

- std::ostream & **operator**<< (std::ostream &s, const [Ex](#) &e)

## 3.63 F32 Class Reference

Inheritance diagram for F32:



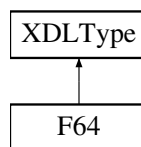
## Public Member Functions

- **F32** (float val=0)
- DataType **getDataType** () const override
- uint32\_t **size** () const override
- void **write** (Buffer &buf) const override
- void **display** (Buffer &binaryIn, Buffer &asciiOut) const
- void **format** (Buffer &binaryIn, Buffer &asciiOut, const char fmt[]) const

## Additional Inherited Members

## 3.64 F64 Class Reference

Inheritance diagram for F64:



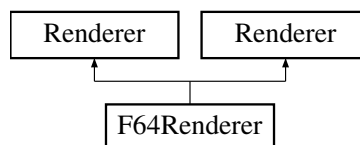
## Public Member Functions

- **F64** (double val=0)
- DataType **getDataType** () const
- uint32\_t **size** () const override
- void **write** (Buffer &buf) const override
- void **display** (Buffer &binaryIn, Buffer &asciiOut) const
- void **format** (Buffer &binaryIn, Buffer &asciiOut, const char fmt[]) const

## Additional Inherited Members

## 3.65 F64Renderer Class Reference

Inheritance diagram for F64Renderer:



## Public Member Functions

- virtual void **display** (Buffer &in, MultiShape2d \*m, MultiText \*t, float x0, float y0, float \*w, float \*h) const override
- virtual void **display** (Buffer &in, MultiShape2d \*m, MultiText \*t, float x0, float y0, float \*w, float \*h) const override

## Additional Inherited Members

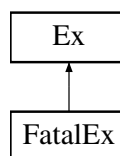
## 3.66 FastFontHeader Struct Reference

### Public Attributes

- uint32\_t **magic**
- uint32\_t **version**
- uint32\_t **w**
- uint32\_t **h**
- uint32\_t **numFaces**
- uint32\_t **numFonts**
- uint32\_t **numGlyphs**

## 3.67 FatalEx Class Reference

Inheritance diagram for FatalEx:



### Public Member Functions

- **FatalEx** (const char filename[], int lineNum, Errcode e, const std::string &name="")

## Additional Inherited Members

## 3.68 FileUtil Class Reference

### Public Member Functions

- void **searchDir** (const char dirName[])

### Static Public Member Functions

- static char \* **readComplete** (const char filename[])
- static void **readComplete** (char \*\*p, uint32\_t \*len, const char filename[])
- static bool **isDir** (const std::string &path)
- template<typename T >  
static uint32\_t **findAll** (std::regex \*reg, const std::string &dirName, T \*handler, void(T::\*f)(std::string filePath, std::string filename))
- static void **buildMapNameToFile** (const std::regex \*pattern, std::string dirName, void(\*f)(std::string name, const std::string &path))

### 3.68.1 Member Function Documentation

#### 3.68.1.1 buildMapNameToFile()

```
static void FileUtil::buildMapNameToFile (
    const std::regex * pattern,
    std::string dirName,
    void(*) (std::string name, const std::string &path) f ) [inline], [static]
```

This is static because it makes no sense to load fonts over and over again into multiple browser windows when they should be sharing

## 3.69 Font Class Reference

### Classes

- class [Glyph](#)

### Public Member Functions

- **Font** ([FontFace](#) \*Face, FT\_Face ftFace, uint16\_t height, uint8\_t bitmap[], uint32\_t &sizeX, uint32\_t &sizeY, uint32\_t &currX, uint32\_t &currY, uint32\_t &rowSize)
- **Font** (std::istream &)
- uint32\_t **getStartGlyph** () const
- void **addGlyph** (FT\_Face ftFace, std::unordered\_map< uint32\_t, uint32\_t > &glyphMap, uint8\_t c, uint8\_t bitmap[], uint32\_t &sizeX, uint32\_t &sizeY, uint32\_t &currX, uint32\_t &currY, uint32\_t &rowSize)
- const [Glyph](#) \* **getGlyph** (uint32\_t i) const
- uint16\_t **getHeight** () const
- uint32\_t **getTexture** () const
- float **getWidth** (const char text[], const uint32\_t len) const
- void **save** (std::ostream &fastfont)

### Static Public Member Functions

- static [Font](#) \* **getDefault** ()

### Public Attributes

- uint32\_t **maxWidth**
- uint16\_t **spaceWidth**

### Friends

- class **FontFace**
- std::ostream & **operator**<< (std::ostream &s, const [Font](#) &f)

### 3.69.1 Member Function Documentation

#### 3.69.1.1 addGlyph()

```
void Font::addGlyph (
    FT_Face ftFace,
    std::unordered_map< uint32_t, uint32_t > & glyphMap,
    uint8_t c,
    uint8_t bitmap[],
    uint32_t & sizeX,
    uint32_t & sizeY,
    uint32_t & currX,
    uint32_t & currY,
    uint32_t & rowSize )
```

- convert to an anti-aliased bitmap \*/

## 3.70 FontFace Class Reference

### Public Member Functions

- uint32\_t **getTexture** () const
- **FontFace** (FT\_Library ft, const std::string &faceName, const std::string &facePath, uint32\_t minFontSize, uint32\_t inc, uint32\_t maxFontSize, uint8\_t bitmap[], uint32\_t &sizeX, uint32\_t &sizeY, uint32\_t &currX, uint32\_t &currY, uint32\_t &rowSize)
- const [Font](#) \* **getFont** (uint32\_t size, int weight) const

### Static Public Member Functions

- static void **initAll** ()
- static void **addFontName** (std::string name, const std::string &path)
- static void **emptyFaces** ()
- static const [FontFace](#) \* **getFace** (int i)
- static const [Font](#) \* **get** (const char faceName[], uint32\_t size, uint32\_t boldness)

### Public Attributes

- uint32\_t **maxWidthIndex**

### Static Public Attributes

- static FT\_Library **ftLib**
- static constexpr char **TIMES** [] = "Times"
- static constexpr char **HELVETICA** [] = "Helvetica"
- static constexpr char **COURIER** [] = "Courier"
- static constexpr uint32\_t **NORMAL** = 1
- static constexpr uint32\_t **BOLD** = 9

## Friends

- class `Font`

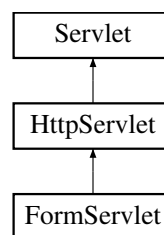
## 3.71 AxisWidget::Format Struct Reference

### Public Attributes

- int `width`
- int `precision`

## 3.72 FormServlet Class Reference

Inheritance diagram for `FormServlet`:

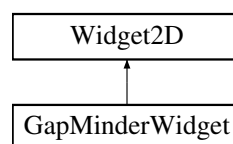


### Public Member Functions

- void `request` ([Request](#) &r)

## 3.73 GapMinderWidget Class Reference

Inheritance diagram for `GapMinderWidget`:



### Public Member Functions

- **GapMinderWidget** ([StyledMultiShape2D](#) \*m, [MultiText](#) \*t, float x, float y, float w, float h, const std::string &title, const [Style](#) \*titleStyle, const [Style](#) \*barStyle, float minX, float maxX, float minY, float maxY, float max←Multiplier, float minMultiplier, float tickSize, float tickStart, [Scale](#) \*yAxis, [Scale](#) \*xAxis)
- **GapMinderWidget** ([StyledMultiShape2D](#) \*m, [MultiText](#) \*t, float x, float y, float w, float h)
- **GapMinderWidget** ([StyledMultiShape2D](#) \*m, [MultiText](#) \*t, float x, float y, float w, float h, const std::vector< float > &xLocations, const std::vector< float > &yLocations)
- void **setMinMaxY** (float min, float max)
- void **setAxisScale** ([Scale](#) \*yAxis)
- void **setTitleStyle** (const [Style](#) \*s)
- void **chart** (const std::vector< float > &yLocations, const std::vector< float > &xLocations, const std::vector< float > &sizes, int rulerInterval, const std::vector< glm::vec4 > &c)
- void **setTitle** (const std::string &s)
- void **init** () override



## Additional Inherited Members

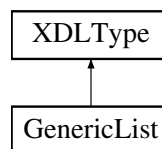
## 3.74 BlockLoader::GeneralHeader Struct Reference

### Public Attributes

- uint32\_t **magic**
- uint32\_t **type**: 16
- uint32\_t **version**: 16

## 3.75 GenericList Class Reference

Inheritance diagram for GenericList:



### Public Member Functions

- **GenericList** (const std::string &name, uint32\_t size, const std::string &listType)
- DataType **getDataType** () const override
- uint32\_t **size** () const override
- void **write** (Buffer &buf) const override
- void **writeMeta** (Buffer &buf) const override
- void **display** (Buffer &binaryIn, Buffer &asciiOut) const override
- XDLIterator \* **createIterator** () override

## Additional Inherited Members

## 3.76 GLWin Class Reference

### Public Types

- enum **Inputs** {  
**INSERT** = 260 , **DEL** = 261 , **RARROW** = 262 , **LARROW** = 263 ,  
**UPARROW** = 265 , **DOWNARROW** = 264 , **PAGEUP** = 266 , **PAGEDOWN** = 267 ,  
**F1** = 290 , **F2** = 291 , **F3** = 292 , **F4** = 293 ,  
**F5** = 294 , **F6** = 295 , **F7** = 296 , **F8** = 297 ,  
**F9** = 298 , **F10** = 299 , **F11** = 300 , **F12** = 301 ,  
**WHEELUP** = 401 , **WHEELDOWN** = 399 , **MOUSE0** = 0 , **MOUSE1** = 1 ,  
**MOUSE2** = 2 , **MOUSE3** = 3 , **MOUSE4** = 4 , **PRESS** = 8 ,  
**RELEASE** = 0 , **CTRL** = 512 , **SHIFT** = 1024 , **ALT** = 2048 }
- enum class **Security** { **SAFE** , **RESTRICTED** , **ASK** }

## Public Member Functions

- float **getTime** () const
- uint32\_t **lookupAction** (const char actionName[])
- void **setEvent** (uint32\_t e, uint32\_t a)
- void **setEvent** (uint32\_t key, uint32\_t mod, uint32\_t a)
- void **setAction** (uint32\_t a, Action action)
- void **loadBindings** ()
- uint32\_t **internalRegisterAction** (const char name[], Security s, Action action)
- void **bind** (uint32\_t input, const char actionName[])
- void **bind** (const char inputCmd[], const char actionName[])
- double **time** () const
- void **setDt** (double delta)
- **GLWin** (uint32\_t bgColor=0x000000FF, uint32\_t fgColor=0xFFFFFFFF, const char title[]=nullptr, uint32\_t exitAfter=0)
- **GLWin** (uint32\_t w, uint32\_t h, uint32\_t bgColor, uint32\_t fgColor, const char title[], uint32\_t exitAfter=0)  
*need to call setSize, startWindow manually*
- **Tab** \* **currentTab** ()
- void **setSize** (uint32\_t w, uint32\_t h)
- uint32\_t **getWidth** () const
- uint32\_t **getHeight** () const
- virtual void **init** ()
- void **startWindow** ()
- virtual void **render** ()
- void **addFontPath** (std::string path, std::string name)
- virtual void **update** ()
- virtual void **cleanup** ()
- void **resetAnim** ()
- void **setTime** (float t)
- void **tick** ()
- void **setEndTime** (float t)
- void **setDesiredColor** (const glm::vec3 &c, float delta)
- void **random** (glm::vec3 &v)
- void **mainLoop** ()
- void **setDirty** ()
- const **Style** \* **getDefaultStyle** () const
- const **Style** \* **getGuiStyle** () const
- const **Style** \* **getGuiTextStyle** () const
- const **Style** \* **getMenuStyle** () const
- const **Style** \* **getMenuTextStyle** () const
- const **Font** \* **getDefaultFont** () const
- const **Font** \* **getGuiFont** () const
- const **Font** \* **getMenuFont** () const
- virtual void **baselnit** ()
- void **bind2DOrtho** ()
- void **bind3D** ()
- void **clearSelected** (**GLWin** \*w)
- double **getTime** ()

## Static Public Member Functions

- static int **init** (GLWin \*g, uint32\_t w, uint32\_t h, uint32\_t exitAfter=0)
- static int **init** (GLWin \*g, uint32\_t exitAfter=0)
- static glm::mat4 \* **getProjection** ()
- static void **classInit** ()
- static void **classCleanup** ()
- static void **quit** (GLWin \*w)
- static void **refresh** (GLWin \*w)
- static void **saveFrame** (GLWin \*w)
- static void **resetCamera** (GLWin \*w)
- static void **gotoStartTime** (GLWin \*w)
- static void **gotoEndTime** (GLWin \*w)
- static void **speedTime** (GLWin \*w)
- static void **slowTime** (GLWin \*w)
- static void **resetTimeDilation** (GLWin \*w)
- static void **resetProjection3D** (GLWin \*w)
- static void **zoomOut3D** (GLWin \*w)
- static void **zoomIn3D** (GLWin \*w)
- static void **panRight3D** (GLWin \*w)
- static void **panLeft3D** (GLWin \*w)
- static void **panUp3D** (GLWin \*w)
- static void **panDown3D** (GLWin \*w)
- static void **selectObject3D** (GLWin \*w)
- static void **addSelectObject3D** (GLWin \*w)
- static void **toggleSelectObject3D** (GLWin \*w)
- static void **resetProjection2D** (GLWin \*w)
- static void **zoomOut2D** (GLWin \*w)
- static void **zoomIn2D** (GLWin \*w)
- static void **panRight2D** (GLWin \*w)
- static void **panLeft2D** (GLWin \*w)
- static void **panUp2D** (GLWin \*w)
- static void **panDown2D** (GLWin \*w)
- static void **gotoTop** (GLWin \*w)
- static void **gotoBottom** (GLWin \*w)
- static void **scrollUp** (GLWin \*w)
- static void **scrollDown** (GLWin \*w)
- static void **pageUp** (GLWin \*w)
- static void **pageDown** (GLWin \*w)
- static void **sectionUp** (GLWin \*w)
- static void **sectionDown** (GLWin \*w)
- static void **playSound** (GLWin \*w, const char name[])
- static void **stopSound** (GLWin \*w)
- static void **pressOnWidget** (GLWin \*w)
- static void **releaseWidget** (GLWin \*w)

## Public Attributes

- double **mouseX**
- double **mouseY**
- float **mousePressX**
- float **mousePressY**
- bool **dragMode**
- int **winXPos**
- int **winYPos**
- uint32\_t **width**
- uint32\_t **height**
- bool **dirty**
- bool **dirty2**
- bool **focused**
- uint32\_t **exitAfter**
- uint32\_t **numActions** [3]

## Static Public Attributes

- constexpr static uint32\_t **COMMON\_SHADER** = 0
- constexpr static uint32\_t **PER\_VERTEX\_SHADER** = 1
- constexpr static uint32\_t **TEXT\_SHADER** = 2
- constexpr static uint32\_t **TEXTURE\_SHADER** = 3
- constexpr static uint32\_t **CURSOR\_SHADER** = 4
- constexpr static uint32\_t **MULTI\_TEXTURE\_SHADER** = 5
- static std::string **baseDir**
- static uint32\_t **inputMap** [32768]
- static Action **actionMap** [4096]
- static std::unordered\_map< std::string, int > **actionNameMap**

## Protected Attributes

- [Style](#) \* **defaultStyle**
- [Style](#) \* **guiStyle**
- [Style](#) \* **guiTextStyle**
- [Style](#) \* **menuStyle**
- [Style](#) \* **menuTextStyle**
- [Font](#) \* **defaultFont**
- [Font](#) \* **guiFont**
- [Font](#) \* **menuFont**

## 3.77 Font::Glyph Class Reference

### Public Member Functions

- **Glyph** (float advance, float bearingX, float bearingY, float sizeX, float sizeY, float u0, float u1, float v1, float v0)

## Public Attributes

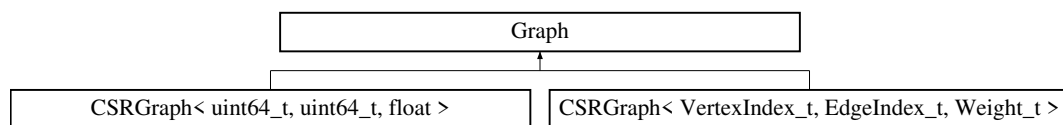
- float **advance**
- float **bearingX**
- float **bearingY**
- float **sizeX**
- float **sizeY**
- float **u0**
- float **u1**
- float **v1**
- float **v0**

## Friends

- std::ostream & **operator**<< (std::ostream &s, const [Font::Glyph](#) &g)

## 3.78 Graph Class Reference

Inheritance diagram for Graph:

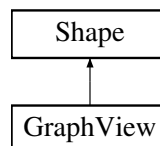


## Public Attributes

- uint64\_t **V**
- uint64\_t **E**

## 3.79 GraphView Class Reference

Inheritance diagram for GraphView:



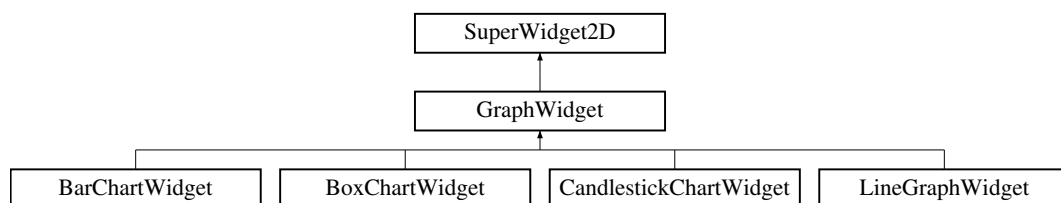
## Public Member Functions

- [CSRGraph](#)< uint64\_t, uint64\_t, float > \* **getGraph** ()
- void **setVertexRadius** (float vertR)
- void **addColor** (float r, float g, float b)
- void **addVert** (uint64\_t v, float x, float y, uint8\_t initialVertColor, [Point](#) points[])
- void **addEdge** (uint64\_t i, float x1, float y1, float x2, float y2, uint8\_t initialEdgeColor)
- void **updateVert** (uint64\_t v, uint8\_t colorVal)
- void **updateEdge** (uint64\_t i, uint8\_t colorVal)
- [GraphView](#) ([CSRGraph](#)< uint64\_t, uint64\_t, float > &g, [Canvas](#) \*c, [Style](#) \*style, glm::vec4 s)
- uint64\_t **getE** () const
- void **process\_input** (Inputs \*, float dt) override
- void **init** () override
- void **render** () override
- void **update** () override
- void **addEdges** (const [Point](#) vertexPos[], uint8\_t initialEdgeColor)

## Additional Inherited Members

## 3.80 GraphWidget Class Reference

Inheritance diagram for GraphWidget:



## Public Types

- enum **AxisType** { LINEAR , LOGARITHMIC , TEXT }

## Public Member Functions

- **GraphWidget** ([Canvas](#) \*c, double x, double y, double w, double h, [Style](#) \*baseStyle=nullptr, [Style](#) \*xAxisStyle=nullptr, [Style](#) \*xAxisTextStyle=nullptr, [Style](#) \*yAxisStyle=nullptr, [Style](#) \*yAxisTextStyle=nullptr)
- virtual void **createXAxis** (AxisType a)=0
- virtual void **createYAxis** (AxisType a)=0
- void **setBaseStyle** (const [Style](#) \*s)
- void **setGraphTitle** (std::string text)
- void **setXAxisTextStyle** (const [Style](#) \*xAxisTextStyle)
- void **setYAxisTextStyle** (const [Style](#) \*yAxisTextStyle)
- void **setXAxisStyle** (const [Style](#) \*xAxisStyle)
- void **setYAxisStyle** (const [Style](#) \*yAxisStyle)
- virtual void **init** ()=0

## Public Attributes

- [AxisWidget](#) \* **xAxis**
- [AxisWidget](#) \* **yAxis**

## Protected Member Functions

- void **commonRender** ()

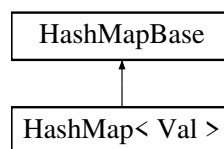
## Protected Attributes

- std::string **graphTitle**
- const [Style](#) \* **baseStyle**
- const [Style](#) \* **xAxisStyle**
- const [Style](#) \* **xAxisTextStyle**
- const [Style](#) \* **yAxisStyle**
- const [Style](#) \* **yAxisTextStyle**
- AxisType **xAxisType**
- AxisType **yAxisType**

## 3.81 Hash Class Reference

## 3.82 HashMap< Val > Class Template Reference

Inheritance diagram for HashMap< Val >:



## Classes

- class [ConstIterator](#)
- class [Iterator](#)

## Public Member Functions

- **HashMap** (uint32\_t sz, uint32\_t symbolSize=1024 \*1024)
- **HashMap** (const [HashMap](#) &orig)=delete
- [HashMap](#) & **operator=** (const [HashMap](#) &orig)=delete
- void **checkGrow** ()
- void **add** (const char s[], const Val &v)
- Val **add** (const char s[], uint32\_t len, const Val &v)
- bool **get** (const char s[], Val \*v) const
- Val \* **get** (const char s[])
- const Val \* **get** (const char s[]) const
- Val \* **get** (const char \*s, uint32\_t len)
- uint64\_t **hist** () const

## Public Attributes

- friend **Iterator**
- friend **ConstIterator**

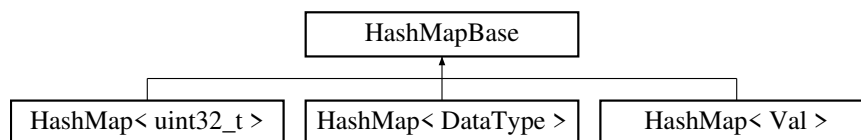
## Friends

- `std::ostream & operator<< (std::ostream &s, const HashMap &h)`

## Additional Inherited Members

## 3.83 HashMapBase Class Reference

Inheritance diagram for HashMapBase:



## Public Member Functions

- `const char * getWords () const`
- `uint32_t getWordsSize () const`

## Protected Member Functions

- `uint32_t fasthash1 (const char s[]) const`
- `uint32_t bytewisehash (const char s[], uint32_t len) const`
- `uint32_t bytewisehash (const char s[]) const`
- `uint32_t hash (const char s[]) const`
- `uint32_t hash (const char s[], uint32_t len) const`
- `HashMapBase (uint32_t sz, uint32_t symbolSize)`

## Static Protected Member Functions

- `static bool hasNoZero (uint32_t v)`
- `static bool hasNoZero (uint64_t v)`
- `static bool haszero (uint32_t v)`
- `static bool notzero (uint64_t v)`

## Protected Attributes

- `uint32_t size`
- `uint32_t symbolSize`
- `char * symbols`
- `char * current`
- `uint32_t * table`

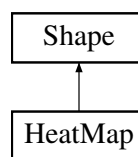


### Static Protected Attributes

- constexpr static int **r1** = 5
- constexpr static int **r2** = 7
- constexpr static int **r3** = 17
- constexpr static int **r4** = 13
- constexpr static int **r5** = 11
- constexpr static int **r6** = 16

## 3.84 HeatMap Class Reference

Inheritance diagram for HeatMap:



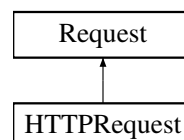
### Public Member Functions

- **HeatMap** (uint32\_t w, uint32\_t h)
- void **add** (float x1, float y1, float v1, float x2, float y2, float v2, float x3, float y3, float v3, float x4, float y4, float v4)
- void **init** () override
- void **render** () override
- void **update** () override

### Additional Inherited Members

## 3.85 HTTPRequest Class Reference

Inheritance diagram for HTTPRequest:



### Public Member Functions

- **HTTPRequest** (const char \*ReqType)
- void **handle** (int sckt) override
- void **handle** (int sckt, const char \*command) override

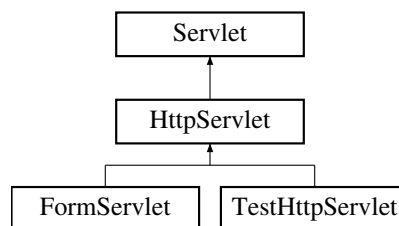
## Static Public Attributes

- static const std::string **POST** = "POST"
- static const std::string **GET** = "GET"
- static const std::string **UNIMPLEMENTED** = "???"

## Additional Inherited Members

## 3.86 HttpServlet Class Reference

Inheritance diagram for HttpServlet:

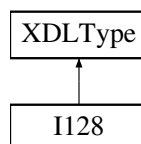


## Public Member Functions

- virtual void **request** (Buffer &out)=0

## 3.87 I128 Class Reference

Inheritance diagram for I128:



## Public Member Functions

- **I128** (int64\_t a, uint64\_t b)
- **I128** (int64\_t b)
- DataType **getDataType** () const
- uint32\_t **size** () const override
- void **write** (Buffer &buf) const override
- void **display** (Buffer &binaryIn, Buffer &asciiOut) const
- void **format** (Buffer &binaryIn, Buffer &asciiOut, const char fmt[]) const

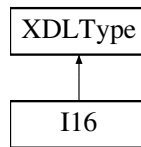
## Friends

- bool **operator==** (const I128 &a, const I128 &b)

## Additional Inherited Members

### 3.88 I16 Class Reference

Inheritance diagram for I16:



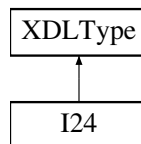
## Public Member Functions

- **I16** (int16\_t val)
- DataType **getDataType** () const
- uint32\_t **size** () const override
- void **write** (Buffer &buf) const override
- void **display** (Buffer &binaryIn, Buffer &asciiOut) const
- void **format** (Buffer &binaryIn, Buffer &asciiOut, const char fmt[]) const

## Additional Inherited Members

### 3.89 I24 Class Reference

Inheritance diagram for I24:



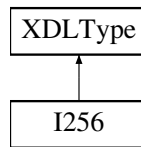
## Public Member Functions

- **I24** (int32\_t val)
- DataType **getDataType** () const
- uint32\_t **size** () const override
- void **write** (Buffer &buf) const override
- void **display** (Buffer &binaryIn, Buffer &asciiOut) const
- void **format** (Buffer &binaryIn, Buffer &asciiOut, const char fmt[]) const

## Additional Inherited Members

### 3.90 I256 Class Reference

Inheritance diagram for I256:



## Public Member Functions

- **I256** (int64\_t a, uint64\_t b, uint64\_t c, uint64\_t d)
- DataType **getDataType** () const override
- uint32\_t **size** () const override
- void **write** (Buffer &buf) const override
- void **display** (Buffer &binaryIn, Buffer &asciiOut) const
- void **format** (Buffer &binaryIn, Buffer &asciiOut, const char fmt[]) const

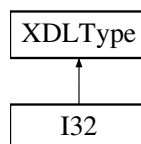
## Friends

- bool **operator==** (const I256 &a, const I256 &b)

## Additional Inherited Members

### 3.91 I32 Class Reference

Inheritance diagram for I32:



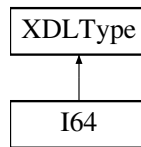
## Public Member Functions

- **I32** (int32\_t val)
- DataType **getDataType** () const
- uint32\_t **size** () const override
- void **write** (Buffer &buf) const override
- void **display** (Buffer &binaryIn, Buffer &asciiOut) const
- void **format** (Buffer &binaryIn, Buffer &asciiOut, const char fmt[]) const

## Additional Inherited Members

### 3.92 I64 Class Reference

Inheritance diagram for I64:



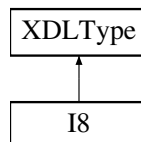
## Public Member Functions

- **I64** (int64\_t val)
- DataType **getDataType** () const override
- uint32\_t **size** () const override
- void **write** (Buffer &buf) const override
- void **display** (Buffer &binaryIn, Buffer &asciiOut) const
- void **format** (Buffer &binaryIn, Buffer &asciiOut, const char fmt[]) const

## Additional Inherited Members

### 3.93 I8 Class Reference

Inheritance diagram for I8:



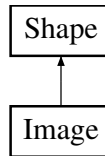
## Public Member Functions

- **I8** (int8\_t val)
- DataType **getDataType** () const
- uint32\_t **size** () const override
- void **write** (Buffer &buf) const override
- void **display** (Buffer &binaryIn, Buffer &asciiOut) const
- void **format** (Buffer &binaryIn, Buffer &asciiOut, const char fmt[]) const

## Additional Inherited Members

### 3.94 Image Class Reference

Inheritance diagram for Image:



## Public Member Functions

- **Image** ([Canvas](#) \*c, float x, float y, float width, float height, uint32\_t textureID=0)
- **Image** ([Canvas](#) \*c, float x, float y, float width, float height, const char \*filePath, uint32\_t textureID=0)
- void **addImage** (const char \*filePath)
- void **init** ()
- void **update** ()
- void **render** ()

## Additional Inherited Members

### 3.95 BlockLoader::Info Struct Reference

## Public Attributes

- uint64\_t **bytes**
- Type **t**
- uint32\_t **version**

### 3.96 InputEvent Class Reference

## Public Member Functions

- **InputEvent** (uint16\_t userid, uint16\_t input, uint16\_t mods, uint16\_t x, uint16\_t y)

## Public Attributes

- const uint16\_t **userid**
- const uint16\_t **input**: 12
- const uint16\_t **mods**: 4
- const uint16\_t **x**
- const uint16\_t **y**

## 3.97 Insertion Class Reference

### Public Member Functions

- **Insertion** (uint32\_t offset, DataType d)

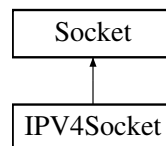
### Public Attributes

- const uint32\_t **offset**
- const DataType **d**

## 3.98 InterpretCSPStream Class Reference

## 3.99 IPV4Socket Class Reference

Inheritance diagram for IPV4Socket:



### Public Member Functions

- **IPV4Socket** (const char \*addr, uint16\_t port)
- **IPV4Socket** (uint16\_t port)
- void **listenOnPort** ()
- void **wait** ()
- void **send** (const char \*command)
- void **send** (uint32\_t reqn)

### Static Public Member Functions

- static int **send** (socket\_t sckt, const char \*buf, int size, int flags)
- static int **recv** (socket\_t sckt, const char \*buf, int size, int flags)

### Additional Inherited Members

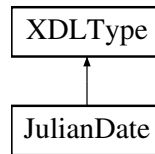
## 3.100 HashMap< Val >::Iterator Class Reference

### Public Member Functions

- **Iterator** (const [HashMap](#) &list)
- bool **operator!** () const
- void **operator++** ()
- const char \* **key** () const
- Val \* **value** ()

## 3.101 JulianDate Class Reference

Inheritance diagram for JulianDate:



### Public Member Functions

- **JulianDate** (int32\_t year, uint32\_t month, uint32\_t day, uint32\_t hour=0, uint32\_t min=0, uint32\_t second=0)
- **JulianDate operator+** (double days) const
- **JulianDate operator-** (double days) const
- **JulianDate operator+=** (double days)
- **JulianDate operator-=** (double days)
- bool **operator==** (**JulianDate** orig)
- **operator double** () const
- int32\_t **getYear** () const
- uint32\_t **getMonth** () const
- uint32\_t **getDay** () const
- uint32\_t **getHour** () const
- uint32\_t **getMinute** () const
- double **getSecond** () const
- void **format** (char dest[])
- double **getJulDate** () const
- void **extract** (int32\_t \*year, uint32\_t \*mm, uint32\_t \*dd, uint32\_t \*hh, uint32\_t \*min, uint32\_t \*ss)
- **JulianDate** (int32\_t year, uint8\_t month, uint8\_t day, uint8\_t hour, uint8\_t min, uint8\_t sec)
- int32\_t **getYear** () const
- uint32\_t **getMonth** () const
- uint32\_t **getDay** () const
- uint32\_t **getHour** () const
- uint32\_t **getMin** () const
- double **getSecond** () const
- DataType **getDataType** () const override
- uint32\_t **size** () const override
- void **write** (**Buffer** &buf) const override
- void **display** (**Buffer** &binaryIn, **Buffer** &asciiOut) const
- void **format** (**Buffer** &binaryIn, **Buffer** &asciiOut, const char fmt[]) const

### Static Public Member Functions

- static bool **isLeap** (uint32\_t year)

### Static Public Attributes

- static const double **epoch** = 2000
- static const uint16\_t **daysUpTo** [12]
- static const uint16\_t **daysInMonth** [12]
- static const char \* **monthAbbr** [12]
- static const char \* **monthNames** [12]



## Friends

- class **Date**
- double **operator-** ([JulianDate](#) a, [JulianDate](#) b)
- `std::ostream & operator<< (std::ostream &s, const JulianDate &jd)`

## Additional Inherited Members

### 3.101.1 Member Data Documentation

#### 3.101.1.1 daysInMonth

```
const uint16_t JulianDate::daysInMonth [static]
```

##### Initial value:

```
= {  
    31,  
    28,  
    31,  
    30,  
    31,  
    30,  
    31,  
    31,  
    30,  
    31,  
    30,  
    31,  
    30,  
    31  
}
```

#### 3.101.1.2 daysUpTo

```
const uint16_t JulianDate::daysUpTo [static]
```

##### Initial value:

```
= {  
    0,  
    31,  
    59,  
    90,  
    120,  
    151,  
    181,  
    212,  
    243,  
    273,  
    304,  
    334  
}
```

### 3.101.1.3 monthAbbr

```
const char * JulianDate::monthAbbr [static]
```

#### Initial value:

```
= { "Jan", "Feb", "Mar", "Apr",  
    "May", "Jun", "Jul", "Aug",  
    "Sep", "Oct", "Nov", "Dec" }
```

### 3.101.1.4 monthNames

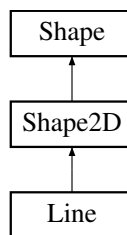
```
const char * JulianDate::monthNames [static]
```

#### Initial value:

```
= { "January", "February", "March", "April", "May", "June",  
    "July", "August", "September", "October", "November", "December" }
```

## 3.102 Line Class Reference

Inheritance diagram for Line:



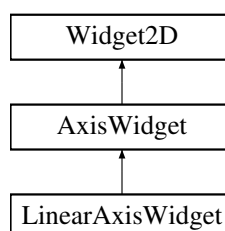
### Public Member Functions

- **Line** ([Canvas](#) \*c, float x1, float y1, float x2, float y2, [Style](#) \*s)
- void **initIndices** ()
- void **render** ()

### Additional Inherited Members

## 3.103 LinearAxisWidget Class Reference

Inheritance diagram for LinearAxisWidget:



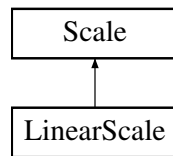
## Public Member Functions

- **LinearAxisWidget** ([StyledMultiShape2D](#) \*m, [MultiText](#) \*t, double x, double y, double w, double h)
- void **setBounds** (double minBound, double maxBound) override
- void **setTickInterval** (double tickInterval) override
- void **init** () override

## Additional Inherited Members

## 3.104 LinearScale Class Reference

Inheritance diagram for LinearScale:



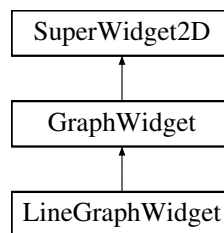
## Public Member Functions

- float **transform** (double x) override
- void **init** (double min, double max, double shift, double axisSize, double tickInterval) override
- float **next** (float v) override

## Additional Inherited Members

## 3.105 LineGraphWidget Class Reference

Inheritance diagram for LineGraphWidget:



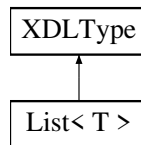
## Public Member Functions

- **LineGraphWidget** ([Canvas](#) \*c, double x, double y, double w, double h)
- void **setDataStyle** (const [Style](#) \*s)
- void **setPointFormat** (char pt, double size, glm::vec4 &color)
- void **setXPoints** (const std::vector< double > &xPoints)
- void **setYPoints** (const std::vector< double > &yPoints)
- void **createXAxis** (AxisType a) override
- void **createYAxis** (AxisType a) override
- void **init** () override

## Additional Inherited Members

### 3.106 List< T > Class Template Reference

Inheritance diagram for List< T >:



## Public Member Functions

- **List** (uint32\_t size=16)
- DataType **getDataType** () const
- void **add** (const T &e)
- uint32\_t **size** () const override
- void **write** (Buffer &buf) const override
- void **writeMeta** (Buffer &buf) const override
- void **read** (Buffer &buf)
- XDLIterator \* **createIterator** () override
- void **display** (Buffer &binaryIn, Buffer &asciiOut) const override

## Additional Inherited Members

### 3.107 List1< T > Class Template Reference

## Public Member Functions

- **List1** (uint8\_t initialSize)
- **List1** (const List &orig)=delete
- List1 & **operator=** (const List &orig)=delete
- void **addEnd** (const T &v)
- **List1** (uint32\_t initialSize)
- **List1** (const List1 &orig)
- uint32\_t **serializeSize** () const
- char \* **read** (char \*p)
- char \* **write** (char \*p)
- void **add** (const T &v)
- uint32\_t **getUsed** () const
- uint32\_t **getCapacity** () const
- T **getData** (int i) const
- uint32\_t **size** () const

## 3.108 List2 Class Reference

### Public Member Functions

- **List2** (uint16\_t size)

## 3.109 Log Class Reference

### Public Types

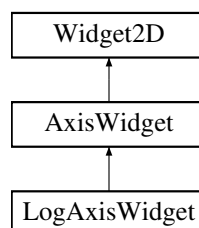
- enum class **Level** {  
    **LOGINFO** , **LOGDEBUG** , **LOGWARN** , **LOGERROR** ,  
    **LOGCRITICAL** }

### Public Member Functions

- void **setLogFile** (const char filename[ ])
- void **setLevel** (Level L)
- void **log** (Level severity, uint16\_t message)
- void **log** (Level severity, uint16\_t message, uint32\_t param)
- void **log** (Level severity, uint16\_t message, uint32\_t param1, uint32\_t param2)
- void **log** (Level severity, uint16\_t message, const std::string &name)
- void **warn** (Errcode message)
- void **error** (Errcode message)
- void **critical** (Errcode message)

## 3.110 LogAxisWidget Class Reference

Inheritance diagram for LogAxisWidget:



### Public Member Functions

- **LogAxisWidget** ([StyledMultiShape2D](#) \*m, [MultiText](#) \*t, double x, double y, double w, double h)
- void **setBounds** (double minBound, double maxBound) override
- void **setTickInterval** (double tickInterval) override
- void **init** () override

## Additional Inherited Members

### 3.111 LogReader Class Reference

```
#include <Log.hh>
```

#### Public Member Functions

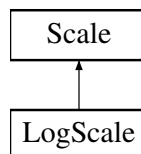
- **LogReader** (const char filename[], const char language[])
- bool **hasNext** (Log::Level severity)
- bool **hasNext** (uint16\_t message)
- void **print** (std::ostream &s)

#### 3.111.1 Detailed Description

Display a binary log in a user's preferred language

### 3.112 LogScale Class Reference

Inheritance diagram for LogScale:



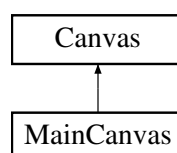
#### Public Member Functions

- float **transform** (double x) override
- void **init** (double min, double max, double shift, double axisSize, double tickInterval) override
- float **next** (float v) override

## Additional Inherited Members

### 3.113 MainCanvas Class Reference

Inheritance diagram for MainCanvas:



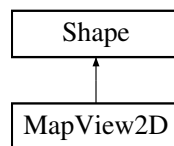
## Public Member Functions

- **MainCanvas** ([GLWin](#) \*parent)
- **MainCanvas** (const [MainCanvas](#) &)=delete
- **MainCanvas** & **operator=** (const [MainCanvas](#) &)=delete
- [StyledMultiShape2D](#) \* **getGui** ()
- [MultiText](#) \* **getGuiText** ()
- [StyledMultiShape2D](#) \* **getMenu** ()
- [MultiText](#) \* **getMenuText** ()
- void **init** ()
- void **render** ()
- void **cleanup** ()
- void **addButton** (const char text[], float x, float y, float w, float h)
- void **addLabel** (const char text[], float x, float y, float w, float h)
- void **addMenu** (const std::string menu[], uint32\_t numStrings, float x, float y)

## Additional Inherited Members

## 3.114 MapView2D Class Reference

Inheritance diagram for MapView2D:



## Public Member Functions

- void **setProjection** ()
- void **translate** (float percentX, float percentY)
- void **uniformZoom** (float s)
- **MapView2D** ([Canvas](#) \*parent, const [Style](#) \*s, [BlockMapLoader](#) \*bml=nullptr)
- glm::mat4 & **getTransform** ()
- void **init** () override
- void **render** () override
- void **update** () override
- void **dump** ()

## Additional Inherited Members

## 3.115 MatrixGraph Class Reference

## Public Member Functions

- **MatrixGraph** (int V)
- **MatrixGraph** (const [MatrixGraph](#) &orig)=delete
- [MatrixGraph](#) & **operator=** (const [MatrixGraph](#) &orig)=delete
- uint32\_t **getV** () const
- uint32\_t **getE** () const
- double **getW** (uint32\_t from, uint32\_t to) const
- void **setW** (uint32\_t from, uint32\_t to, double v)
- double **operator()** (int from, int to) const
- double & **operator()** (int from, int to)
- void **dfs** (int v)

## Static Public Attributes

- constexpr static double **INF** = std::numeric\_limits<double>::infinity()

## Friends

- std::istream & **operator>>** (std::istream &s, [MatrixGraph](#) &g)

## 3.116 Struct::Member Class Reference

### Public Member Functions

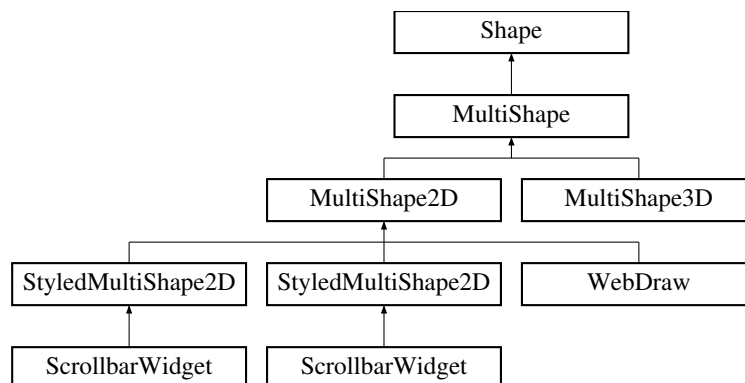
- **Member** (uint32\_t nameOffset, uint32\_t nameLen, const [XDType](#) \*type)

### Public Attributes

- uint32\_t **nameOffset**
- uint32\_t **nameLen**
- const [XDType](#) \* **type**

## 3.117 MultiShape Class Reference

Inheritance diagram for MultiShape:



### Public Member Functions

- **MultiShape** ([Canvas](#) \*parent, uint32\_t vertCount=1024, uint32\_t solidIndCount=1024, uint32\_t lineIndCount=1024, uint32\_t pointIndCount=1024, uint32\_t colorIndCount=1024)
- void **process\_input** (Inputs \*in, float dt) override
- void **update** () override
- void **addPoint** (float x, float y)



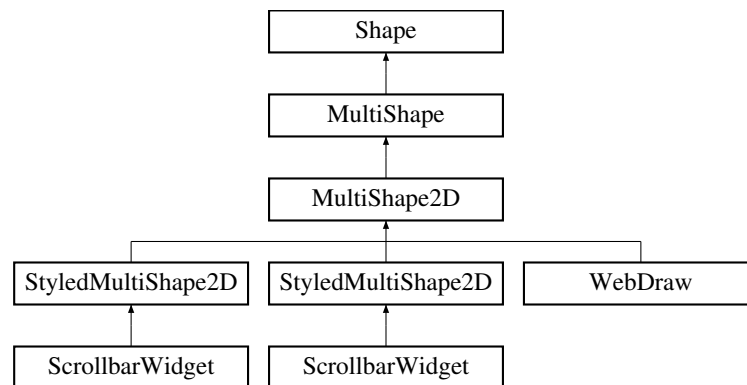
## Protected Attributes

- `std::vector< float > vertices`
- `std::vector< uint32_t > solidIndices`
- `std::vector< uint32_t > lineIndices`
- `std::vector< uint32_t > pointIndices`
- `std::vector< float > colorIndices`

## Additional Inherited Members

## 3.118 MultiShape2D Class Reference

Inheritance diagram for MultiShape2D:



## Public Member Functions

- `void drawPoint (float x, float y)`
- `MultiShape2D (Canvas *parent, const Style *s, uint32_t vertCount=1024, uint32_t solidIndCount=1024, uint32_t lineIndCount=1024, uint32_t pointIndCount=1024, uint32_t elemPerVert=2)`
- `void init ()` override
- `void render ()` override
- `void fillRectangle (float x, float y, float w, float h)`
- `void fillRoundRect (float x, float y, float w, float h, float rx, float ry)`
- `void fillTriangle (float x1, float y1, float x2, float y2, float x3, float y3)`
- `void fillPolygon (float x, float y, float xRad, float yRad, float n)`
- `void fillCircle (float x, float y, float rad, float angleInc)`
- `void fillEllipse (float x, float y, float xRad, float yRad, float angleInc)`
- `void drawRectangle (float x, float y, float w, float h)`
- `void drawRoundRect (float x, float y, float w, float h, float rx, float ry)`
- `void drawTriangle (float x1, float y1, float x2, float y2, float x3, float y3)`
- `void drawPolygon (float x, float y, float xRad, float yRad, float n)`
- `void drawCompletePolygon (float x, float y, float xRad, float yRad, float n)`
- `void drawCircle (float x, float y, float rad, float angleInc)`
- `void drawEllipse (float x, float y, float xRad, float yRad, float angleInc)`
- `void drawLine (float x1, float y1, float x2, float y2)`
- `void bezierSegment (const Bezier *b)`
- `void bezierSegmentByPoints (float p1x, float p1y, float p2x, float p2y, float p3x, float p3y, float p4x, float p4y, int n, bool end)`

- void **endBezierSegment** (const [Bezier](#) \*b)
- void **spine** (const std::vector< double > &points, int n)
- void **rectanglePoints** (float x, float y, float w, float h)
- void **roundRectPoints** (float x, float y, float w, float h, float rx, float ry)
- void **trianglePoints** (float x1, float y1, float x2, float y2, float x3, float y3)
- void **polygonPoints** (float x, float y, float xRad, float yRad, float n)
- void **circlePoints** (float x, float y, float rad, float angleInc)
- void **ellipsePoints** (float x, float y, float xRad, float yRad, float angleInc)
- const [Style](#) \* **getStyle** ()

### Protected Member Functions

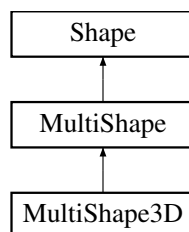
- void **sAddTriIndices** ()
- void **sAddQuadIndices** ()
- void **sAddSectorIndices** (uint32\_t centerIndex, uint32\_t indexCount)
- void **lAddTriIndices** ()
- void **lAddQuadIndices** ()
- void **lAddSectorIndices** (uint32\_t centerIndex, uint32\_t indexCount)
- void **pAddTriIndices** ()
- void **pAddQuadIndices** ()
- void **pAddSectorIndices** (uint32\_t centerIndex, uint32\_t indexCount)
- uint32\_t **addSector** (float x, float y, float xRad, float yRad, float fromAngle, float toAngle, float angleInc)
- uint32\_t **getPointIndex** () const
- void **addLine** (float x1, float y1, float x2, float y2)

### Protected Attributes

- const [Style](#) \* **style**
- uint32\_t **elemPerVert**

## 3.119 MultiShape3D Class Reference

Inheritance diagram for MultiShape3D:



## Public Member Functions

- **MultiShape3D** ([Canvas](#) \*canv, [Camera](#) \*c, const std::vector< const char \* > &textureFiles, [Transformation](#) \*t, uint32\_t elemPerVert=3, uint32\_t vertCount=1024, uint32\_t solidIndCount=1024, uint32\_t lineIndCount=1024, uint32\_t pointIndCount=1024, uint32\_t colorIndCount=1024)
- **MultiShape3D** ([Canvas](#) \*canv, [Camera](#) \*c, const char textureFile[], [Transformation](#) \*t, uint32\_t elemPerVert=3, uint32\_t vertCount=1024, uint32\_t solidIndCount=1024, uint32\_t lineIndCount=1024, uint32\_t pointIndCount=1024, uint32\_t colorIndCount=1024)
- void **init** () override
- void **render** () override
- void **genFastRectPrism** (float x, float y, float z, uint32\_t width, uint32\_t length, uint32\_t height, uint32\_t texIndex, TexCoordVector &texCoords)
- void **genFastCube** (float x, float y, float z, uint32\_t length, uint32\_t texIndex, TexCoordVector &texCoords)
- void **genRectPrism** (float x, float y, float z, uint32\_t width, uint32\_t length, uint32\_t height, uint32\_t texIndex, TexCoordVector &texCoords)
- void **genCube** (float x, float y, float z, uint32\_t length, uint32\_t texIndex, TexCoordVector &texCoords)
- void **genOBJModel** (const char \*filePath, std::vector< uint32\_t > &texIndices, float xOffset=0, float yOffset=0, float zOffset=0)
- void **genOBJModel** (const char \*filePath)

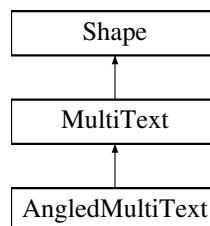
## Protected Attributes

- uint32\_t **elemPerVert**

## Additional Inherited Members

## 3.120 MultiText Class Reference

Inheritance diagram for MultiText:



## Public Member Functions

- **MultiText** ([Canvas](#) \*c, const [Style](#) \*style)
- **MultiText** ([Canvas](#) \*c, const [Style](#) \*style, uint32\_t size)
- void **addChar** (float x, float y, const [Font](#) \*f, const unsigned char c)
- void **addChar** (float x, float y, const [Font](#) \*f, const uint16\_t c)
- void **add** (float x, float y, const char s[], uint32\_t len)
- void **add** (float x, float y, const [Font](#) \*f, const char s[], uint32\_t len)
- void **add** (float x, float y, uint32\_t v)
- void **add** (float x, float y, const [Font](#) \*f, uint32\_t v)
- void **addHex** (float x, float y, const [Font](#) \*f, uint32\_t v)
- void **addHex8** (float x, float y, const [Font](#) \*f, uint32\_t v)

- void **add** (float x, float y, const [Font](#) \*f, int32\_t v)
- void **add** (float x, float y, float v)
- void **add** (float x, float y, const [Font](#) \*f, float v)
- void **add** (float x, float y, double v)
- void **add** (float x, float y, const [Font](#) \*f, double v)
- void **add** (float x, float y, const [Font](#) \*f, double v, int fieldWidth, int precision)
- void **addCentered** (float x, float y, const [Font](#) \*f, double v, int fieldWidth, int precision)
- void **addCentered** (float x, float y, const [Font](#) \*f, const char s[], uint32\_t len)
- void **checkAdd** (float &x, float &y, const [Font](#) \*f, const unsigned char c, float endMargin, float rowSize, float startOverMargin)
- uint32\_t **findFirstOverMargin** (float x, const [Font](#) \*f, const char s[], uint32\_t len, float rightMargin)
- void **clear** ()
- void **init** () override
- void **process\_input** (Inputs \*in, float dt)
- const [Style](#) \* **getStyle** ()
- void **update** () override
- void **render** () override

### Protected Member Functions

- void **addPoint** (float x, float y, float u, float v)

### Protected Attributes

- uint32\_t **textureId**
- const [Style](#) \* **style**
- std::vector< float > **vert**
- float **velX** = 1
- float **velY** = 1

## 3.121 MultiThreadHttpRequest Class Reference

### Public Member Functions

- void **handle** ()

## 3.122 MultiTransform Class Reference

### Public Member Functions

- **MultiTransform** (const glm::vec3 &pos=glm::vec3(1, 1, 1), const glm::vec3 &rot=glm::vec3(1, 1, 1), const glm::vec3 &scale=glm::vec3(1, 1, 1))
- void **setPos** (const glm::vec3 &v)
- void **setRot** (const glm::vec3 &v)
- void **setScale** (const glm::vec3 &v)
- void **incrPos** (const glm::vec3 &v)
- void **incrRot** (const glm::vec3 &v)
- void **incrScale** (const glm::vec3 &v)
- glm::mat4 **getModel** ()

## 3.123 BlockMapLoader::NamedEntities Struct Reference

### Public Attributes

- uint32\_t **numNames**
- uint32\_t **nameSizes**
- [NamedEntry](#) **entry** []

## 3.124 BlockMapLoader::NamedEntry Struct Reference

### Public Attributes

- uint32\_t **nameOffset**
- uint8\_t **len**
- uint8\_t **entityType**
- uint8\_t **type**
- uint32\_t **offset**

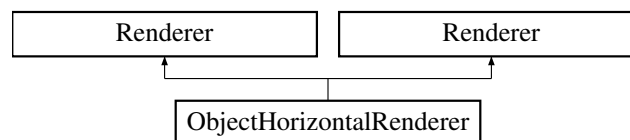
## 3.125 NullGraphObserver Class Reference

### Public Member Functions

- void **addVert** (uint32\_t index, float x, float y, uint8\_t initialVertColor, std::vector< [Point](#) > &)
- void **addEdge** (uint64\_t i, float x1, float y1, float x2, float y2, uint32\_t initialEdgeColor)
- void **updateVert** (uint32\_t i, uint8\_t colorVal)
- void **updateEdge** (uint64\_t j, uint8\_t colorVal)

## 3.126 ObjectHorizontalRenderer Class Reference

Inheritance diagram for ObjectHorizontalRenderer:



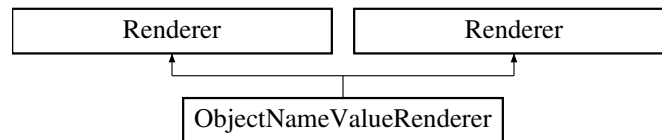
### Public Member Functions

- virtual void **display** ([Buffer](#) &in, MultiShape2d \*m, [MultiText](#) \*t, float x0, float y0, float \*w, float \*h) const override
- virtual void **display** ([Buffer](#) &in, MultiShape2d \*m, [MultiText](#) \*t, float x0, float y0, float \*w, float \*h) const override

## Additional Inherited Members

### 3.127 ObjectNameValueRenderer Class Reference

Inheritance diagram for ObjectNameValueRenderer:



## Public Member Functions

- virtual void **display** ([Buffer](#) &in, MultiShape2d \*m, [MultiText](#) \*t, float x0, float y0, float \*w, float \*h) const override
- virtual void **display** ([Buffer](#) &in, MultiShape2d \*m, [MultiText](#) \*t, float x0, float y0, float \*w, float \*h) const override

## Additional Inherited Members

### 3.128 Page Class Reference

## Public Member Functions

- **Page** (const string &inputFile)
- **Page** (const string &staticContent, vector< [Insertion](#) > insertions)
- **Page** (const string &staticFile, const string &insertFile)
- char \* **getStaticPointer** ()
- string **getStaticContent** () const
- vector< [Insertion](#) > **getInsertions** () const
- uint32\_t **getSize** () const
- uint32\_t **getStaticSize** () const
- void **addDynamic** (uint32\_t offset, DataType d)
- void **addStatic** (const string &t)
- bool **isStatic** ()
- uint32\_t **dynamicSize** (DataType d)
- **Page** (const unsigned char \*text, const [PageLayout](#) \*pageLayout, uint32\_t offset)
- void **addLine** (uint32\_t offset)
- uint32\_t **getLine** (uint32\_t line) const
- const [PageLayout](#) \* **getLayout** () const
- uint32\_t **size** () const

## Friends

- ostream & **operator<<** (ostream &s, const [Page](#) &p)

## 3.129 pageBuffer Class Reference

### Public Member Functions

- **pageBuffer** (char \*content, uint32\_t length)
- void **printPage** ()

## 3.130 PageLayout Class Reference

### Public Member Functions

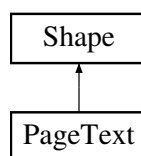
- **PageLayout** (float x0, float y0, float w, float h, float pageNumX, float pageNumY, float paragraphSpacing, uint32\_t linesPerPage, const [Font](#) \*f, float dropDead=0)

### Public Attributes

- float **x0**
- float **x1**
- float **xDropDead**
- float **y0**
- float **y1**
- float **w**
- float **h**
- float **pageNumX**
- float **pageNumY**
- float **paragraphSpacing**
- uint32\_t **linesPerPage**
- const [Font](#) \* **f**

## 3.131 PageText Class Reference

Inheritance diagram for PageText:



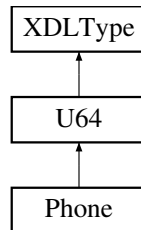
### Public Member Functions

- **MultiText** (const [Style](#) \*style, uint32\_t size)
- void **clear** ()
- void **loadText** (const char s[], uint32\_t len)
- void **addChar** (float x, float y, [Font](#) \*f, const char c)
- void **add** (float x, float y, const char s[], uint32\_t len)
- void **add** (float x, float y, uint32\_t v)
- void **add** (float x, float y, float v)
- void **add** (float x, float y, double v)
- void **init** ()
- void **process\_input** (Inputs \*in, float dt)
- void **update** ()
- void **render** ()

## Additional Inherited Members

### 3.132 Phone Class Reference

Inheritance diagram for Phone:



#### Public Member Functions

- **Phone** (uint64\_t v)
- void **writeMeta** (Buffer &b) const override
- void **display** (Buffer &binaryIn, Buffer &asciiOut) const
- void **format** (Buffer &binaryIn, Buffer &asciiOut, const char fmt[]) const

## Additional Inherited Members

### 3.133 Point Class Reference

#### Public Member Functions

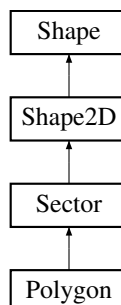
- **Point** (float x, float y)

#### Public Attributes

- double **x**
- double **y**
- double **z**
- float **x**
- float **y**

### 3.134 Polygon Class Reference

Inheritance diagram for Polygon:





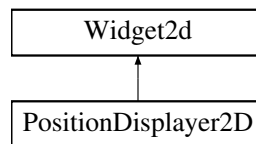
## Public Member Functions

- **Polygon** (float x, float y, float xRad, float yRad, float n, [Style](#) \*s)

## Additional Inherited Members

## 3.135 PositionDisplayer2D Class Reference

Inheritance diagram for PositionDisplayer2D:



## Public Member Functions

- **PositionDisplay2D** ([StyledMultiShape2D](#) \*m, [MultiText](#) \*t, uint32\_t x, uint32\_t y, uint32\_t w, uint32\_t h)
- void **addPoint** (float x, float y)
- void **move** (int i, float x, float y)
- void **init** ()

## 3.136 Prefs Class Reference

## Public Member Functions

- void **load** ()
- void **save** ()
- std::string **getConfDir** () const
- std::string **getFontDir** () const
- std::string **getShaderDir** () const
- uint32\_t **getPreferredX** () const
- uint32\_t **getPreferredY** () const
- uint32\_t **getPreferredWidth** () const
- uint32\_t **getPreferredHeight** () const
- bool **getFastLoadShaders** () const
- void **setFastLoadShaders** (uint32\_t fmt)

## Public Attributes

- bool **trySavingShader**

### 3.137 RCString Class Reference

#### Public Member Functions

- **RCString** (const char msg[], uint32\_t len)
- **RCString** (const char msg[])
- **RCString** (const [RCString](#) &a, const [RCString](#) &b, const [RCString](#) &c)
- **RCString** (const [RCString](#) &orig)
- [RCString](#) & **operator=** (const [RCString](#) &orig)
- **RCString** ([RCString](#) &&orig)
- char **operator[]** (uint32\_t i) const
- char & **operator[]** (uint32\_t i)
- uint32\_t **len** () const

#### Static Public Member Functions

- static uint32\_t **setMark** ()
- static void **freeToMark** (uint32\_t mark)

#### Friends

- std::ostream & **operator<<** (std::ostream &s, const [RCString](#) &str)

### 3.138 Record Class Reference

#### Public Member Functions

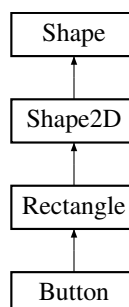
- void **add** (DataType t)

#### Friends

- ostream & **operator<<** (ostream &s, const [Record](#) &r)

### 3.139 Rectangle Class Reference

Inheritance diagram for Rectangle:



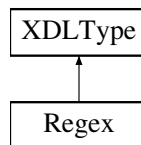
## Public Member Functions

- **Rectangle** ([Canvas](#) \*c, float x, float y, float width, float height, [Style](#) \*s)
- void **initIndices** ()
- void **render** ()

## Additional Inherited Members

## 3.140 Regex Class Reference

Inheritance diagram for Regex:



## Public Member Functions

- **Regex** (const std::string &name, const std::string &exp)
- bool **match** (const std::string &text) const
- uint32\_t **size** () const override
- void **write** ([Buffer](#) &buf) const override
- void **writeMeta** ([Buffer](#) &buf) const override
- DataType **getDataType** () const
- void **display** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut) const
- void **format** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut, const char fmt[]) const

## Additional Inherited Members

## 3.141 BlockMapLoader::Region Struct Reference

### Public Attributes

- uint32\_t **segmentStart**
- uint32\_t **startPoints**
- [BoundRect](#) **bounds**
- double **baseX**
- double **baseY**

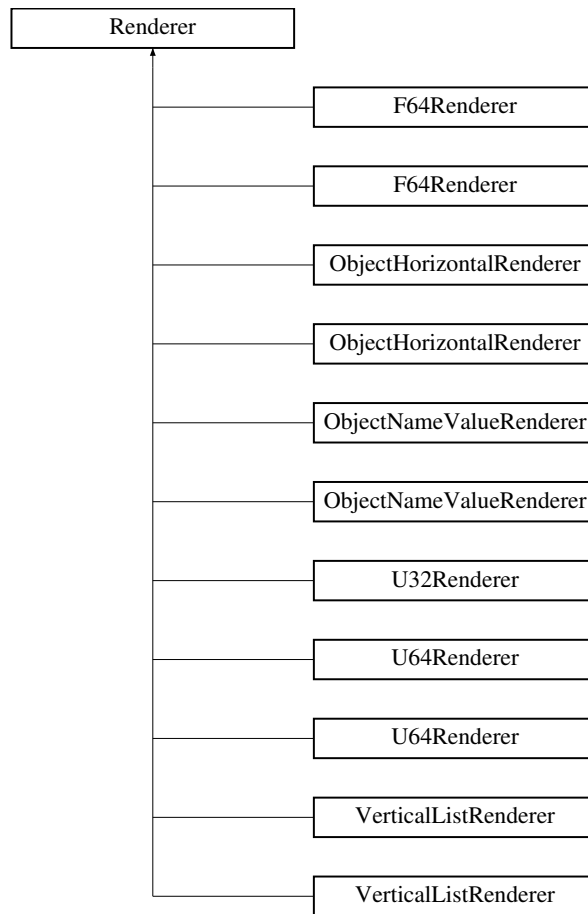
## 3.142 BlockMapLoader::RegionContainer Struct Reference

### Public Attributes

- uint32\_t **startRegion**
- uint32\_t **endRegion**
- [BoundRect](#) **bounds**

### 3.143 Renderer Class Reference

Inheritance diagram for Renderer:



#### Public Types

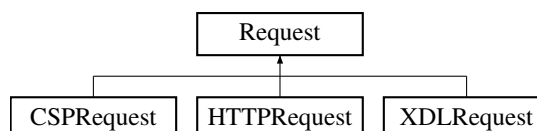
- enum **Dir** { **UP** , **DOWN** , **LEFT** , **RIGHT** }

#### Public Member Functions

- virtual void **display** ([Buffer](#) &in, MultiShape2d \*m, [MultiText](#) \*t, float x0, float y0, float \*w, float \*h) const =0
- void **update** (Dir)

### 3.144 Request Class Reference

Inheritance diagram for Request:



## Public Member Functions

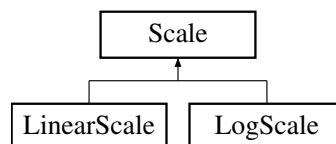
- virtual void **handle** (int sckt)=0
- virtual void **handle** (int sckt, const char \*command)=0
- Buffer & **getOut** ()
- Buffer & **getIn** ()

## Protected Attributes

- Buffer in
- Buffer out

## 3.145 Scale Class Reference

Inheritance diagram for Scale:



## Public Member Functions

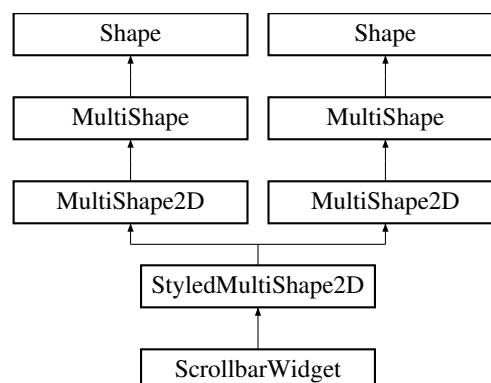
- virtual float **transform** (double x)=0
- virtual void **init** (double min, double max, double shift, double axisSize, double tickInterval)=0
- virtual float **next** (float v)=0

## Protected Attributes

- double **scale**
- double **shift**
- double **min**
- double **max**
- double **tickInterval**
- double **numInterval**

## 3.146 ScrollbarWidget Class Reference

Inheritance diagram for ScrollbarWidget:



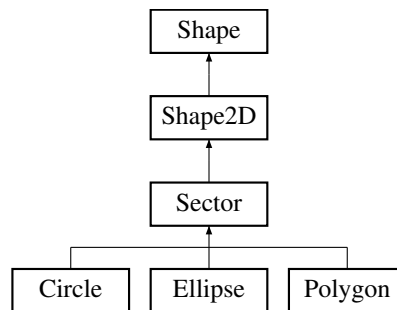
## Public Member Functions

- **ScrollbarWidget** ([Canvas](#) \*c, const [Style](#) \*s, float x, float y, float w, float h)
- void **init** () override
- void **render** () override
- void **update** () override
- void **draw** ()
- void **scroll** (float dy)

## Additional Inherited Members

## 3.147 Sector Class Reference

Inheritance diagram for Sector:



## Public Member Functions

- **Sector** ([Canvas](#) \*c, float x, float y, float xRad, float yRad, float fromAngle, float toAngle, float angleInc, [Style](#) \*s)
- void **initIndices** ()
- void **render** ()

## Additional Inherited Members

## 3.148 BlockLoader::SecurityHeaderV0 Struct Reference

### Public Attributes

- uint64\_t **yoho**

## 3.149 BlockLoader::SecurityHeaderV1 Struct Reference

### Public Attributes

- uint8\_t **hash** [32]
- uint8\_t **hash2** [32]
- uint8\_t **sigid** [32]

## 3.150 BlockMapLoader::Segment Struct Reference

### Public Attributes

- uint32\_t **numPoints**: 24
- uint32\_t **type**: 8

## 3.151 Server< SocketImpl, HandlerImpl > Class Template Reference

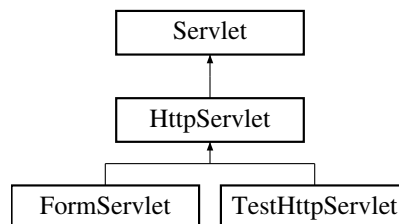
### Public Member Functions

- **Server** (int port)

## 3.152 Servlet Class Reference

```
#include <Servlet.hh>
```

Inheritance diagram for Servlet:



### Public Member Functions

- virtual void **request** (Buffer &out)=0

### 3.152.1 Detailed Description

Base class for servlet

This is the common behavior between protocols such as HTTP and CSP so this is the low-level data methods.

All servlets support a request, which is a client sending a message to

the server requesting data. In HTTP, a request is ASCII with many potential lines if input, whereas in CSP it is a lot shorter, fixed format, and binary

@author: Dov Kruger

### 3.153 ServletMap Class Reference

#### Public Member Functions

- **ServletMap** (uint32\_t initialSize=32768)
- void **add** (const std::string &name, [HttpServlet](#) \*s)
- [HttpServlet](#) \* **get** (const char \*s, size\_t size) const

### 3.154 set1 Struct Reference

#### Public Attributes

- uint32\_t **a**

### 3.155 set3 Struct Reference

#### Public Attributes

- string **first**
- string **last**

### 3.156 set4 Struct Reference

#### Public Attributes

- uint8\_t **a**
- uint16\_t **b**
- uint32\_t **c**
- uint64\_t **d**
- int8\_t **e**
- int16\_t **f**
- int32\_t **g**
- int64\_t **h**
- float **i**
- double **j**



## 3.157 Shader Class Reference

### Public Member Functions

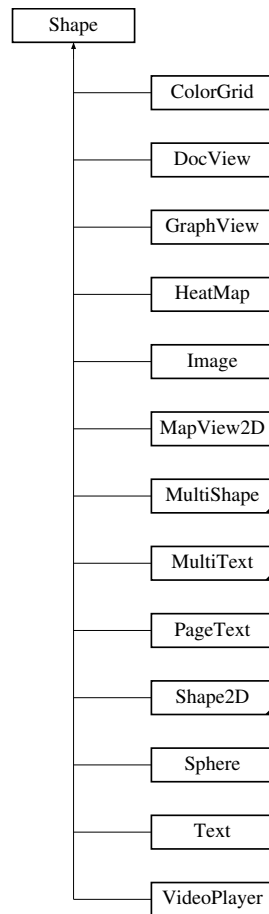
- **Shader** (const char shaderName[], const char vertexPath[], const char fragmentPath[], const char geometryPath[] =nullptr)
- void **cleanup** ()
- void **use** () const
- void **setBool** (const std::string &name, bool value) const
- void **setBool** (const char name[], bool value) const
- void **setBool** (int pos, bool value) const
- void **setInt** (const std::string &name, int value) const
- void **setInt** (const char name[], int value) const
- void **setInt** (int pos, int value) const
- void **setFloat** (const std::string &name, float value) const
- void **setFloat** (const char name[], float value) const
- void **setFloat** (int pos, float value) const
- void **setVec2** (const std::string &name, const glm::vec2 &value) const
- void **setVec2** (const char name[], const glm::vec2 &value) const
- void **setVec2** (int pos, const glm::vec2 &value) const
- void **setVec2** (const std::string &name, float x, float y) const
- void **setVec2** (const char name[], float x, float y) const
- void **setVec2** (int pos, float x, float y) const
- void **setVec3** (const std::string &name, const glm::vec3 &value) const
- void **setVec3** (const char name[], const glm::vec3 &value) const
- void **setVec3** (int pos, const glm::vec3 &value) const
- void **setVec3** (const std::string &name, float x, float y, float z) const
- void **setVec3** (const char name[], float x, float y, float z) const
- void **setVec3** (int pos, float x, float y, float z) const
- void **setVec4** (const std::string &name, const glm::vec4 &value) const
- void **setVec4** (const char name[], const glm::vec4 &value) const
- void **setVec4** (int pos, const glm::vec4 &value) const
- void **setVec4** (const std::string &name, float x, float y, float z, float w) const
- void **setVec4** (const char name[], float x, float y, float z, float w) const
- void **setVec4** (int pos, float x, float y, float z, float w) const
- void **setMat2** (const std::string &name, const glm::mat2 &mat) const
- void **setMat2** (const char name[], const glm::mat2 &mat) const
- void **setMat2** (int pos, const glm::mat2 &mat) const
- void **setMat3** (const std::string &name, const glm::mat3 &mat) const
- void **setMat3** (const char name[], const glm::mat3 &mat) const
- void **setMat3** (int pos, const glm::mat3 &mat) const
- void **setMat4** (const std::string &name, const glm::mat4 &mat) const
- void **setMat4** (const char name[], const glm::mat4 &mat) const
- void **setMat4** (int pos, const glm::mat4 &mat) const
- uint32\_t **getID** () const

### Static Public Member Functions

- static void **setDir** (const std::string &shaderDir)
- static uint32\_t **load** (const char shaderName[], const char vertRelPath[], const char fragRelPath[], const char geomRelPath[] =nullptr)
- static [Shader](#) \* **useShader** (uint32\_t sh)
- static void **cleanAll** ()

## 3.158 Shape Class Reference

Inheritance diagram for Shape:



### Public Member Functions

- **Shape** ([Canvas](#) \*parent)
- virtual void **init** ()=0
- virtual void **process\_input** (Inputs \*in, float dt)
- virtual void **update** ()=0
- virtual void **render** ()=0

### Protected Member Functions

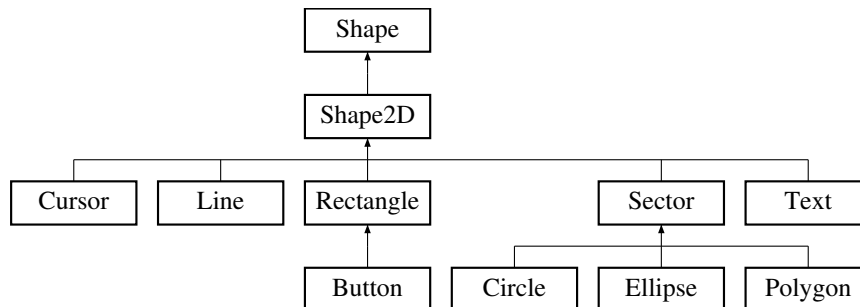
- template<typename T >  
void **gen** (uint32\_t &vb, std::vector< T > &list)

### Protected Attributes

- uint32\_t **vao**
- uint32\_t **vbo**
- uint32\_t **sbo**
- uint32\_t **lbo**
- uint32\_t **pbo**
- uint32\_t **cbo**
- [Canvas](#) \* **parentCanvas**

## 3.159 Shape2D Class Reference

Inheritance diagram for Shape2D:



### Public Member Functions

- **Shape2D** ([Canvas](#) \*c, float x, float y, [Style](#) \*style, [Transformation](#) \*transform=new [Transformation](#)())
- void **addPoint** (float x, float y)
- void **addColor** (float r, float g, float b)
- void **setColors** (float cols[], uint32\_t size)
- void **setColors** (std::vector< float > cols)
- std::vector< float > **getVertices** ()
- uint32\_t **getSize** ()
- [Style](#) \* **getStyle** ()
- [Transformation](#) \* **getTransformation** ()
- void **setTransform** ([Transformation](#) \*t)
- virtual void **init** () override
- virtual void **process\_input** (Inputs \*in, float dt) override
- virtual void **update** () override
- virtual void **render** ()=0
- void **initIndices** ()

### Protected Member Functions

- void **applyTransform** ([Shader](#) \*s)

### Protected Attributes

- float **x**
- float **y**
- std::vector< float > **vertices**
- std::vector< float > **colors**
- std::vector< uint32\_t > **solidIndices**
- std::vector< uint32\_t > **lineIndices**
- std::vector< uint32\_t > **pointIndices**
- [Style](#) \* **style**
- [Transformation](#) \* **transform**

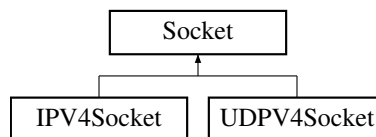
## 3.160 Shapefile Class Reference

### Public Member Functions

- **Shapefile** (const char filename[])
- void **init** ()
- SHPObject \* **getShape** (int index)
- std::vector< SHPObject \* > **getShapeVector** ()
- double \* **getMinBounds** ()
- double \* **getMaxBounds** ()

## 3.161 Socket Class Reference

Inheritance diagram for Socket:



### Public Member Functions

- **Socket** (const char \*addr, uint16\_t port)
- **Socket** (uint16\_t port, [Request](#) \*req)
- **Socket** (uint16\_t port)
- void **attach** ([Request](#) \*r)
- [Buffer](#) & **getOut** ()
- [Buffer](#) & **getIn** ()
- virtual void **wait** ()=0

### Static Public Member Functions

- static void **classCleanup** ()
- static void **classInit** ()

### Protected Attributes

- const char \* **address**
- uint16\_t **port**
- [Request](#) \* **req**
- [Buffer](#) **in**
- [Buffer](#) **out**

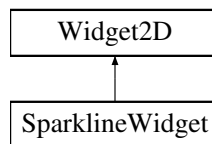
## 3.162 SocketIO Class Reference

### Static Public Member Functions

- static int **send** (socket\_t sckt, const char \*buf, int size, int flags)
- static int **recv** (socket\_t sckt, const char \*buf, int size, int flags)

## 3.163 SparklineWidget Class Reference

Inheritance diagram for SparklineWidget:



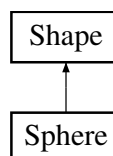
### Public Member Functions

- **SparklineWidget** (StyledMultiShape2D \*m, MultiText \*t, float x, float y, float w, float h, const std::string &title, const Style \*titleStyle, const Style \*barStyle, float minX, float maxX, float minY, float maxY, float maxMultiplier, float minMultiplier, float tickSize, float tickStart, Scale \*yAxis, Scale \*xAxis)
- **SparklineWidget** (StyledMultiShape2D \*m, MultiText \*t, float x, float y, float w, float h)
- **SparklineWidget** (StyledMultiShape2D \*m, MultiText \*t, float x, float y, float w, float h, const std::vector< float > &xLocations, const std::vector< float > &yLocations)
- void **setMinMaxY** (float min, float max)
- void **setAxisScale** (Scale \*yAxis)
- void **setTitleStyle** (const Style \*s)
- void **chart** (const std::vector< float > &yLocations, const std::vector< float > &xLocations, glm::vec4 &c)
- void **setTitle** (const std::string &s)
- void **init** () override

### Additional Inherited Members

## 3.164 Sphere Class Reference

Inheritance diagram for Sphere:



## Public Member Functions

- **Sphere** (uint32\_t latRes, uint32\_t lonRes)
- void **init** ()
- void **render** ()
- void **cleanup** ()

## Additional Inherited Members

### 3.165 Stack< T > Class Template Reference

## Public Member Functions

- **Stack** (uint32\_t capacity)
- void **push** (const T &v)
- bool **isEmpty** () const
- T **peek** () const
- T **pop** ()

## Friends

- std::ostream & **operator**<< (std::ostream &s, const [Stack](#) &stack)

### 3.166 Stats1D< T > Class Template Reference

## Classes

- struct [Summary](#)

## Public Member Functions

- [Stats1D](#) (T \*array, uint32\_t size, bool sorted=false)  
*Construct a new [Stats1D](#) object of a numeric type.*
- void [updateArray](#) (T \*newArray, uint32\_t newSize, bool sorted=false)  
*Updates the content of the array.*
- double [getMean](#) ()  
*Calculates mean of a numeric type.*
- std::vector< T > [getModes](#) ()  
*Finds the modes of a numeric type.*
- T [getIQR](#) ()  
*Calculates the IQR of a numeric type.*
- struct [Summary](#) [getSummary](#) ()  
*Returns a struct containing the five number summary of a numeric type.*
- double [getStdDev](#) ()  
*Calculates the standard deviation of a numeric type.*
- double [getVariance](#) ()  
*Calculates the variance of a numeric type.*
- double [getQuantile](#) (double percentile)  
*getQuantile - Gets a quantile of the sorted array*

## Friends

- `template<typename U >`  
`std::ostream & operator<< (std::ostream &os, Stats1D< U > &stats)`

## 3.166.1 Constructor & Destructor Documentation

### 3.166.1.1 Stats1D()

```
template<typename T >
Stats1D< T >::Stats1D (
    T * array,
    uint32_t size,
    bool sorted = false )
```

Construct a new [Stats1D](#) object of a numeric type.

The array may be of any numeric type and may be unsorted when it is passed into the object. The size of the array is assumed to match the size of the variable. The sorted flag defaults to false.

If a mistake is made when creating the array, or the array is updated, use `updateArray` to make any necessary changes.

#### Template Parameters

<i>T</i>	Any numeric type
----------	------------------

#### Parameters

<i>array</i>	<a href="#">A</a> pointer to the array to be analyzed
<i>size</i>	The size of the array to be analyzed
<i>sorted</i>	<a href="#">A</a> flag indicating if the array is sorted

## 3.166.2 Member Function Documentation

### 3.166.2.1 getIQR()

```
template<typename T >
T Stats1D< T >::getIQR
```

Calculates the IQR of a numeric type.

The interquartile range is the 50% range between the first and third quartile of a dataset. Together with the median of the dataset, it presents an alternative to the mean and standard deviation for finding outliers.

#### Template Parameters

<i>T</i>	Any numeric type
----------	------------------

#### Returns

*T* The IQR of a dataset

### 3.166.2.2 `getMean()`

```
template<typename T >
double Stats1D< T >::getMean
```

Calculates mean of a numeric type.

For a dataset without outliers or skew, the mean will represent the center of a dataset. Together with the standard deviation, it is useful for catching extreme values and describing the distribution of the data.

#### Template Parameters

<i>T</i>	Any numeric type
----------	------------------

#### Returns

double The mean of a dataset

### 3.166.2.3 `getModes()`

```
template<typename T >
vector< T > Stats1D< T >::getModes
```

Finds the modes of a numeric type.

The mode of a dataset is value that most frequently appears.

This returns a vector in order to allow the possibility of multiple modes, rather than just returning one of many modes.

#### Template Parameters

<i>T</i>	Any numeric type
----------	------------------

#### Returns

vector<T> [A](#) vector of modes of a dataset



### 3.166.2.4 getQuantile()

```
template<typename T >
double Stats1D< T >::getQuantile (
    double percentile )
```

getQuantile - Gets a quantile of the sorted array

This looks like it implements the R-6 algorithm for finding quantiles, but it is actually R-7. Upon reviewing the relevant paper, the index functions refer to an array with a starting index of 1, but C++ is 0-indexed. As such, the added one that is expected in R-7 has been negated. (Hyndman and Fan, 1997).

#### Parameters

<i>percentile</i>	The percentile to look for
-------------------	----------------------------

#### Returns

double The resultant quantile

### 3.166.2.5 getStdDev()

```
template<typename T >
double Stats1D< T >::getStdDev
```

Calculates the standard deviation of a numeric type.

The standard deviation of a dataset describes the spread of a data. A higher standard deviation indicates that the data is spread further from the mean of the dataset.

#### Template Parameters

<i>T</i>	Any numeric type
----------	------------------

#### Returns

double The standard deviation of a dataset

### 3.166.2.6 getSummary()

```
template<typename T >
struct Stats1D< T >::Summary Stats1D< T >::getSummary
```

Returns a struct containing the five number summary of a numeric type.

The five number summary contains the minimum, maximum, median, first quartile, and third quartile. These values are useful to describe the distribution of the dataset and find outliers.

## Template Parameters

<i>T</i>	Any generic type
----------	------------------

## Returns

struct Stats1D<T>::Summary [A](#) struct of the five number summary

3.166.2.7 `getVariance()`

```
template<typename T >
double Stats1D< T >::getVariance
```

Calculates the variance of a numeric type.

The variance of a dataset is the square of standard deviation and is another descriptor of the spread of a dataset. Among its many uses are sampling, inference, hypothesis testing, and goodness of fit.

## Template Parameters

<i>T</i>	Any numeric type
----------	------------------

## Returns

double The variance of a dataset

3.166.2.8 `updateArray()`

```
template<typename T >
void Stats1D< T >::updateArray (
    T * newArray,
    uint32_t newSize,
    bool sorted = false )
```

Updates the content of the array.

## Template Parameters

<i>T</i>	Any numeric type
----------	------------------

## Parameters

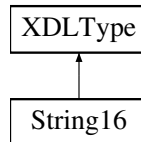
<i>newArray</i>	<a href="#">A</a> new array
<i>newSize</i>	<a href="#">A</a> new size

## Parameters

<i>sorted</i>	A new sorted flag, defaults to the existing flag
---------------	--

### 3.167 String16 Class Reference

Inheritance diagram for String16:



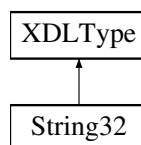
#### Public Member Functions

- **String16** (const std::string &val)
- DataType **getDataType** () const override
- uint32\_t **size** () const override
- void **write** (Buffer &buf) const override
- void **display** (Buffer &binaryIn, Buffer &asciiOut) const
- void **format** (Buffer &binaryIn, Buffer &asciiOut, const char fmt[]) const

#### Additional Inherited Members

### 3.168 String32 Class Reference

Inheritance diagram for String32:



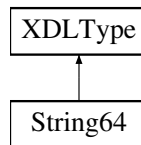
#### Public Member Functions

- **String32** (string val)
- DataType **getDataType** () const override
- uint32\_t **size** () const override
- void **write** (Buffer &buf) const override
- void **display** (Buffer &binaryIn, Buffer &asciiOut) const
- void **format** (Buffer &binaryIn, Buffer &asciiOut, const char fmt[]) const

## Additional Inherited Members

## 3.169 String64 Class Reference

Inheritance diagram for String64:



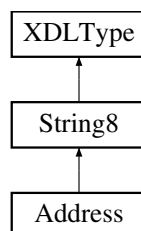
## Public Member Functions

- **String64** (string val)
- DataType **getDataType** () const override
- uint32\_t **size** () const override
- void **write** (Buffer &buf) const override
- void **display** (Buffer &binaryIn, Buffer &asciiOut) const override
- void **format** (Buffer &binaryIn, Buffer &asciiOut, const char fmt[]) const

## Additional Inherited Members

## 3.170 String8 Class Reference

Inheritance diagram for String8:



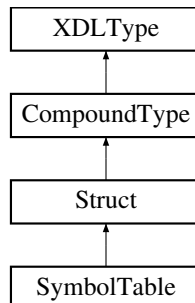
## Public Member Functions

- **String8** (const std::string &val)
- DataType **getDataType** () const override
- uint32\_t **size** () const override
- void **write** (Buffer &buf) const override
- void **display** (Buffer &binaryIn, Buffer &asciiOut) const
- void **format** (Buffer &binaryIn, Buffer &asciiOut, const char fmt[]) const

## Additional Inherited Members

### 3.171 Struct Class Reference

Inheritance diagram for Struct:



## Classes

- class [Member](#)

## Public Member Functions

- **Struct** (const char name[])
- void **add** (const char name[], DataType t)
- void **write** (char \*buf)
- void **read** (const char buf[])
- **Struct** (const [Struct](#) &orig)
- **Struct** ([XDLCompiler](#) \*compiler, const std::string &name)
- **Struct** ([XDLCompiler](#) \*c)
- void **addSym** (const string &name, const [XDLType](#) \*t)
- void **addSymCheckNull** (const string &name, const [XDLType](#) \*t)
- void **addSymCheckDup** (const string &name, const [XDLType](#) \*t)
- uint32\_t **addMemberName** (const char memberName[])
- void **addMember** (const std::string &name, const [XDLType](#) \*t)
- void **addBuiltin** (const std::string &name, DataType dt)
- void **addRegex** (const std::string &name, const std::string &regex)
- void **addTypedef** (const char name[], const char type[])
- void **addStructMember** (const std::string &memberName, const [Struct](#) \*memberStruct)
- const [XDLType](#) \* **getMemberType** (const std::string &memberName) const
- const [XDLType](#) \* **getMemberType** (uint32\_t index) const
- uint32\_t **getMemberCount** () const
- std::string **getMemberName** (uint32\_t index) const
- uint32\_t **size** () const override
- void **write** ([Buffer](#) &buf) const override
- void **writeMeta** ([Buffer](#) &buf) const override
- DataType **getDataType** () const
- void **display** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut) const
- void **format** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut, const char fmt[]) const

## Protected Attributes

- [XDLCompiler](#) \* **compiler**
- [DynArray](#)< [Member](#) > **members**

## Friends

- std::ostream & **operator**<< (std::ostream &s, const [Struct](#) &str)

## Additional Inherited Members

## 3.172 Student Class Reference

### Public Member Functions

- **Student** (const std::string &first, const std::string &last, uint16\_t id)
- uint32\_t **serializeSize** () const
- std::string const **getFirst** ()
- std::string const **getLast** ()
- uint32\_t const **getID** ()
- char \* **write** (char \*p)

## 3.173 Style Class Reference

### Public Member Functions

- **Style** (const char \*fontFamily, float fontSize, float fontWeight, float bgRed, float bgGreen, float bgBlue, float fgRed, float fgGreen, float fgBlue, int shaderIndex=0)
- **Style** (const char \*fontFamily, float fontSize, float fontWeight, float bgRed, float bgGreen, float bgBlue, float bgAlpha, float fgRed, float fgGreen, float fgBlue, float fgAlpha, int shaderIndex=0)
- **Style** (const [Font](#) \*font, float bgRed, float bgGreen, float bgBlue, float fgRed, float fgGreen, float fgBlue, int shaderIndex=0)
- **Style** (const [Font](#) \*font, float bgRed, float bgGreen, float bgBlue, float bgAlpha, float fgRed, float fgGreen, float fgBlue, float fgAlpha)
- **Style** (const [Font](#) \*font, const glm::vec4 &bgColor, const glm::vec4 &fgColor)
- const [Font](#) \* **lookup** (const char \*fontFamily, const float size, const float weight)
- void **apply** ()
- void **setShaderIndex** (uint32\_t val)
- uint32\_t **getShaderIndex** () const
- uint32\_t **getLineWidth** () const
- void **setLineWidth** (uint32\_t val)
- const glm::vec4 & **getBgColor** () const
- const glm::vec4 & **getFgColor** () const

### Static Public Member Functions

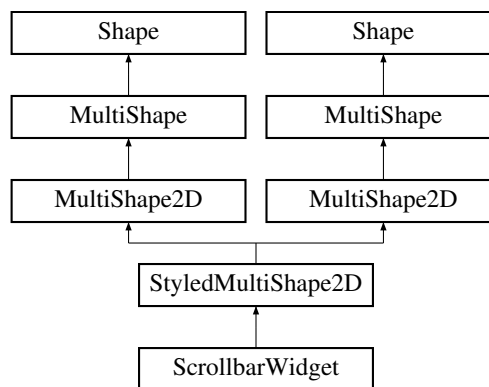
- static [Style](#) \* **getStyle** (uint8\_t a)

## Public Attributes

- const [Font](#) \* **f**
- glm::vec4 **bg**
- glm::vec4 **fg**
- float **lineWidth**
- int **shaderIndex**

## 3.174 StyledMultiShape2D Class Reference

Inheritance diagram for StyledMultiShape2D:



## Public Member Functions

- **StyledMultiShape2D** ([Canvas](#) \*parent, const [Style](#) \*s, float angle=0, float x=0, float y=0, uint32\_t vertCount=1024, uint32\_t solidIndCount=1024, uint32\_t lineIndCount=1024, uint32\_t pointIndCount=1024)
- uint32\_t **addSector** (float x, float y, float xRad, float yRad, float fromAngle, float toAngle, float angleInc, const glm::vec4 &c)
- void **addColor** (const glm::vec4 &rgb)
- void **addColor** (float r, float g, float b)
- void **setColors** (float cols[], uint32\_t size)
- void **setColors** (std::vector< float > &cols)
- void **addStyledPoint** (float x, float y, const glm::vec4 &rgb)
- void **clear** ()
- void **init** () override
- void **render** () override
- void **updateColors** (const uint64\_t pos, const float r, const float g, const float b)
- void **updatePoints** ()
- void **updateIndices** ()
- void **fillRectangle** (float x, float y, float w, float h, const glm::vec4 &c)
- void **fillRoundRect** (float x, float y, float w, float h, float rx, float ry, const glm::vec4 &c)
- void **fillTriangle** (float x1, float y1, float x2, float y2, float x3, float y3, const glm::vec4 &c)
- void **fillPolygon** (float x, float y, float xRad, float yRad, float n, const glm::vec4 &c)
- void **fillCircle** (float x, float y, float rad, float angleInc, const glm::vec4 &c)
- void **fillEllipse** (float x, float y, float xRad, float yRad, float angleInc, const glm::vec4 &c)
- void **drawRectangle** (float x, float y, float w, float h, const glm::vec4 &c)
- void **drawRoundRect** (float x, float y, float w, float h, float rx, float ry, const glm::vec4 &c)
- void **drawTriangle** (float x1, float y1, float x2, float y2, float x3, float y3, const glm::vec4 &c)
- void **drawPolygon** (const std::vector< float > &v, const glm::vec4 &c)



- void **drawPolygon** (float x, float y, float xRad, float yRad, float n, const glm::vec4 &c)
- void **drawCompletePolygon** (float x, float y, float xRad, float yRad, float n, const glm::vec4 &c)
- void **drawCircle** (float x, float y, float rad, float angleInc, const glm::vec4 &c)
- void **drawEllipse** (float x, float y, float xRad, float yRad, float angleInc, const glm::vec4 &c)
- void **drawLine** (float x1, float y1, float x2, float y2, const glm::vec4 &c)
- void **drawPolyline** (const float xy[], uint32\_t n, const glm::vec4 &c)
- void **fillPolyline** (const float xy[], uint32\_t n, const glm::vec4 &c)
- void **drawPolygon** (const float xy[], uint32\_t n, const glm::vec4 &c)
- void **fillPolygon** (const float xy[], uint32\_t n, const glm::vec4 &c)
- void **bezierSegment** (const [Bezier](#) \*b)
- void **bezierSegmentByPoints** (float p1x, float p1y, float p2x, float p2y, float p3x, float p3y, float p4x, float p4y, int n, bool end, const glm::vec4 &c)
- void **spline** (const std::vector< double > &points, int n, const glm::vec4 &c)
- void **drawGrid** (float x0, float y0, float w, float h, uint32\_t numHoriz, uint32\_t numVert, const glm::vec4 &c)
- void **fillGrid** (float x0, float y0, float w, float h, uint32\_t numHoriz, uint32\_t numVert, const glm::vec4 &lc, const glm::vec4 &bc)
- void **drawTriGrid** (float x, float y, float s, uint32\_t trianglesPerSide, const glm::vec4 &c)
- void **drawHexGrid** (float x, float y, float w, float h, uint32\_t numHorizHexagons, const glm::vec4 &c)
- void **rectanglePoints** (float x, float y, float w, float h, const glm::vec4 &c)
- void **roundRectPoints** (float x, float y, float w, float h, float rx, float ry, const glm::vec4 &c)
- void **trianglePoints** (float x1, float y1, float x2, float y2, float x3, float y3, const glm::vec4 &c)
- void **polygonPoints** (float x, float y, float xRad, float yRad, float n, const glm::vec4 &c)
- void **circlePoints** (float x, float y, float rad, float angleInc, const glm::vec4 &c)
- void **ellipsePoints** (float x, float y, float xRad, float yRad, float angleInc, const glm::vec4 &c)
- void **dump** ()
- **StyledMultiShape2D** ([Canvas](#) \*parent, const [Style](#) \*s, float angle=0, float x=0, float y=0, uint32\_t vertCount=1024, uint32\_t solidIndCount=1024, uint32\_t lineIndCount=1024, uint32\_t pointIndCount=1024)
- uint32\_t **addSector** (float x, float y, float xRad, float yRad, float fromAngle, float toAngle, float angleInc, const glm::vec4 &c)
- void **addColor** (const glm::vec4 &rgb)
- void **addColor** (float r, float g, float b)
- void **setColors** (float cols[], uint32\_t size)
- void **setColors** (std::vector< float > &cols)
- void **addStyledPoint** (float x, float y, const glm::vec4 &rgb)
- void **clear** ()
- void **init** () override
- void **render** () override
- void **updateColors** (const uint64\_t pos, const float r, const float g, const float b)
- void **updatePoints** ()
- void **updateIndices** ()
- void **fillRectangle** (float x, float y, float w, float h, const glm::vec4 &c)
- void **fillRoundRect** (float x, float y, float w, float h, float rx, float ry, const glm::vec4 &c)
- void **fillTriangle** (float x1, float y1, float x2, float y2, float x3, float y3, const glm::vec4 &c)
- void **fillPolygon** (float x, float y, float xRad, float yRad, float n, const glm::vec4 &c)
- void **fillCircle** (float x, float y, float rad, float angleInc, const glm::vec4 &c)
- void **fillEllipse** (float x, float y, float xRad, float yRad, float angleInc, const glm::vec4 &c)
- void **drawRectangle** (float x, float y, float w, float h, const glm::vec4 &c)
- void **drawRoundRect** (float x, float y, float w, float h, float rx, float ry, const glm::vec4 &c)
- void **drawTriangle** (float x1, float y1, float x2, float y2, float x3, float y3, const glm::vec4 &c)
- void **drawPolygon** (const std::vector< float > &v, const glm::vec4 &c)
- void **drawPolygon** (float x, float y, float xRad, float yRad, float n, const glm::vec4 &c)
- void **drawCompletePolygon** (float x, float y, float xRad, float yRad, float n, const glm::vec4 &c)
- void **drawCircle** (float x, float y, float rad, float angleInc, const glm::vec4 &c)
- void **drawEllipse** (float x, float y, float xRad, float yRad, float angleInc, const glm::vec4 &c)
- void **drawLine** (float x1, float y1, float x2, float y2, const glm::vec4 &c)

- void **drawPolyline** (const float xy[], uint32\_t n, const glm::vec4 &c)
- void **fillPolyline** (const float xy[], uint32\_t n, const glm::vec4 &c)
- void **drawPolygon** (const float xy[], uint32\_t n, const glm::vec4 &c)
- void **fillPolygon** (const float xy[], uint32\_t n, const glm::vec4 &c)
- void **bezierSegment** (const [Bezier](#) \*b)
- void **bezierSegmentByPoints** (float p1x, float p1y, float p2x, float p2y, float p3x, float p3y, float p4x, float p4y, int n, bool end, const glm::vec4 &c)
- void **spline** (const std::vector< double > &points, int n, const glm::vec4 &c)
- void **drawGrid** (float x0, float y0, float w, float h, uint32\_t numHoriz, uint32\_t numVert, const glm::vec4 &c)
- void **fillGrid** (float x0, float y0, float w, float h, uint32\_t numHoriz, uint32\_t numVert, const glm::vec4 &lc, const glm::vec4 &bc)
- void **drawTriGrid** (float x, float y, float s, uint32\_t trianglesPerSide, const glm::vec4 &c)
- void **drawHexGrid** (float x, float y, float w, float h, uint32\_t numHorizHexagons, const glm::vec4 &c)
- void **drawCircleMarker** (float x, float y, float size, glm::vec4 &color)
- void **drawTriangleMarker** (float x, float y, float size, glm::vec4 &color)
- void **drawSquareMarker** (float x, float y, float size, glm::vec4 &color)
- void **drawPentagonMarker** (float x, float y, float size, glm::vec4 &color)
- void **drawHexagonMarker** (float x, float y, float size, glm::vec4 &color)
- void **drawCrossMarker** (float x, float y, float size, glm::vec4 &color)
- void **rectanglePoints** (float x, float y, float w, float h, const glm::vec4 &c)
- void **roundRectPoints** (float x, float y, float w, float h, float rx, float ry, const glm::vec4 &c)
- void **trianglePoints** (float x1, float y1, float x2, float y2, float x3, float y3, const glm::vec4 &c)
- void **polygonPoints** (float x, float y, float xRad, float yRad, float n, const glm::vec4 &c)
- void **circlePoints** (float x, float y, float rad, float angleInc, const glm::vec4 &c)
- void **ellipsePoints** (float x, float y, float xRad, float yRad, float angleInc, const glm::vec4 &c)
- void **dump** ()

## Additional Inherited Members

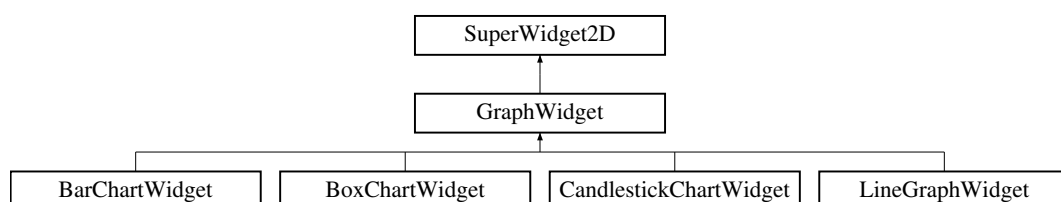
### 3.175 Stats1D< T >::Summary Struct Reference

#### Public Attributes

- double **min**
- double **max**
- double **q1**
- double **q3**
- double **median**

### 3.176 SuperWidget2D Class Reference

Inheritance diagram for SuperWidget2D:



## Public Member Functions

- **SuperWidget2D** ([Canvas](#) \*c, float x, float y, float w, float h)
- virtual void **init** ()=0

## Protected Attributes

- [Canvas](#) \* **c**
- float **x**
- float **y**
- float **w**
- float **h**

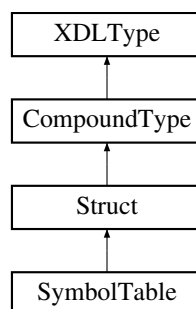
## 3.177 Symbol Class Reference

### Public Attributes

- uint32\_t **size**
- std::string **name**
- std::string **cppType**
- [Symbol](#) \* **assignCompatibleWith**

## 3.178 SymbolTable Class Reference

Inheritance diagram for SymbolTable:



## Public Member Functions

- **SymbolTable** ([XDLError](#) \*c)
- void **addRoot** (const [XDLError](#) \*t)
- const [XDLError](#) \* **getRoot** () const
- [Struct](#) \* **addStruct** (const string &name)
- void **addXDLError** (const std::string &name, [XDLError](#) \*xdLError)
- void **write** ([Buffer](#) &out)
- void **readMeta** ([Buffer](#) &metadataBuf)
- void **displayText** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut) const

## Additional Inherited Members

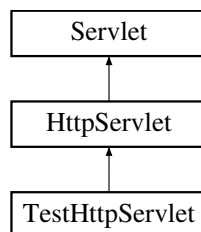
### 3.179 Tab Class Reference

#### Public Member Functions

- **Tab** ([GLWin](#) \*parent)
- [GLWin](#) \* **getParent** () const
- **Tab** (const [Tab](#) &orig)=delete
- [Tab](#) & **operator=** (const [Tab](#) &orig)=delete
- [Canvas](#) \* **addCanvas** (const [Style](#) \*style, uint32\_t vpX, uint32\_t vpY, uint32\_t vpW, uint32\_t vpH)
- [Canvas](#) \* **getCanvas** (uint32\_t i)
- [MainCanvas](#) \* **getMainCanvas** ()
- void **init** ()
- void **update** ()
- void **render** ()
- void **cleanup** ()

### 3.180 TestHttpServlet Class Reference

Inheritance diagram for TestHttpServlet:



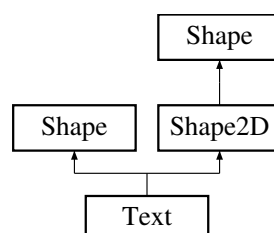
#### Public Member Functions

- void **request** ([HttpRequest](#) &req)

### 3.181 TestRecord Class Reference

### 3.182 Text Class Reference

Inheritance diagram for Text:



## Public Member Functions

- **Text** (float x, float y, [Style](#) \*style, const std::string &text)
- void **init** ()
- void **update** ()
- void **render** ()
- **Text** ([GLWin](#) \*w, float x, float y, const std::string &text)
- void **init** ()
- void **render** ()

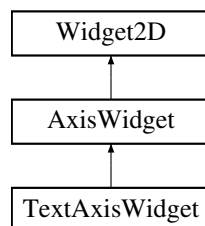
## Static Public Attributes

- static const uint32\_t **LINE\_LENGTH** = 256
- constexpr static uint32\_t **LINE\_LENGTH** = 256

## Additional Inherited Members

## 3.183 TextAxisWidget Class Reference

Inheritance diagram for TextAxisWidget:



## Public Member Functions

- **TextAxisWidget** ([StyledMultiShape2D](#) \*m, [MultiText](#) \*t, double x, double y, double w, double h)
- void **setTickLabels** (std::vector< std::string > tickLabels) override
- void **init** () override

## Additional Inherited Members

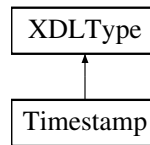
## 3.184 TextureArray Class Reference

## Public Member Functions

- **TextureArray** ([Shader](#) \*shader, uint8\_t allocSize=32)
- GLuint **loadImage** (const char \*imagePath, uint8\_t unit)
- GLuint **bindImage** (uint8\_t unit)

### 3.185 Timestamp Class Reference

Inheritance diagram for Timestamp:



#### Public Member Functions

- **Timestamp** (uint64\_t v=0)
- void **write** ([Buffer](#) &b) const override
- void **writeMeta** ([Buffer](#) &buf) const override
- uint32\_t **size** () const override
- DataType **getDataType** () const override
- void **display** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut) const
- void **format** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut, const char fmt[]) const

#### Additional Inherited Members

### 3.186 Transformation Class Reference

#### Public Member Functions

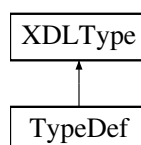
- void **ident** ()
- void **translate** (float x, float y, float z)
- void **scale** (float x, float y, float z)
- void **scale** (float s)
- void **setRotate** (float angleRad, float xAxis, float yAxis, float zAxis)
- void **rotate** (float angleRad, float xAxis, float yAxis, float zAxis)
- void **rotateZ** (float angleRad)
- const glm::mat4 & **getTransform** () const

#### Friends

- std::ostream & **operator**<< (std::ostream &s, const [Transformation](#) &t)

### 3.187 TypeDef Class Reference

Inheritance diagram for TypeDef:



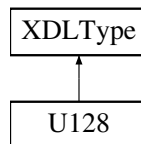
## Public Member Functions

- **TypeDef** (const std::string &name, const [XDLType](#) \*t)
- uint32\_t **size** () const override
- void **write** ([Buffer](#) &buf) const override
- void **writeMeta** ([Buffer](#) &buf) const override
- DataType **getDataType** () const
- void **display** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut) const
- void **format** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut, const char fmt[]) const

## Additional Inherited Members

## 3.188 U128 Class Reference

Inheritance diagram for U128:



## Public Member Functions

- **U128** (uint64\_t a=0, uint64\_t b=0)
- DataType **getDataType** () const override
- uint32\_t **size** () const override
- void **write** ([Buffer](#) &buf) const override
- void **display** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut) const
- void **format** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut, const char fmt[]) const

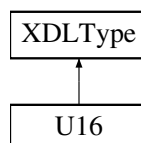
## Friends

- bool **operator==** (const [U128](#) &a, const [U128](#) &b)

## Additional Inherited Members

## 3.189 U16 Class Reference

Inheritance diagram for U16:



## Public Member Functions

- **U16** (uint16\_t val=0)
- DataType **getDataType** () const
- uint32\_t **size** () const override
- void **write** (Buffer &buf) const
- void **display** (Buffer &binaryIn, Buffer &asciiOut) const
- void **format** (Buffer &binaryIn, Buffer &asciiOut, const char fmt[]) const

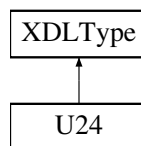
## Friends

- bool **operator==** (const U16 &a, const U16 &b)

## Additional Inherited Members

### 3.190 U24 Class Reference

Inheritance diagram for U24:



## Public Member Functions

- **U24** (uint32\_t val=0)
- DataType **getDataType** () const
- uint32\_t **size** () const override
- void **write** (Buffer &buf) const override
- void **display** (Buffer &binaryIn, Buffer &asciiOut) const
- void **format** (Buffer &binaryIn, Buffer &asciiOut, const char fmt[]) const

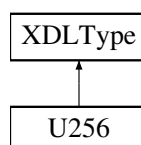
## Friends

- bool **operator==** (const U24 &a, const U24 &b)

## Additional Inherited Members

### 3.191 U256 Class Reference

Inheritance diagram for U256:





## Public Member Functions

- **U256** (uint64\_t a, uint64\_t b, uint64\_t c, uint64\_t d)
- DataType **getDataType** () const
- uint32\_t **size** () const override
- void **write** (Buffer &buf) const override
- void **display** (Buffer &binaryIn, Buffer &asciiOut) const
- void **format** (Buffer &binaryIn, Buffer &asciiOut, const char fmt[]) const

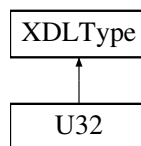
## Friends

- bool **operator==** (const U256 &a, const U256 &b)

## Additional Inherited Members

## 3.192 U32 Class Reference

Inheritance diagram for U32:



## Public Member Functions

- **U32** (uint32\_t val=0)
- DataType **getDataType** () const
- uint32\_t **size** () const override
- void **write** (Buffer &buf) const override
- void **display** (Buffer &binaryIn, Buffer &asciiOut) const
- void **format** (Buffer &binaryIn, Buffer &asciiOut, const char fmt[]) const

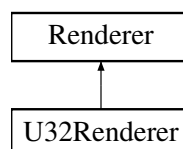
## Friends

- bool **operator==** (const U32 &a, const U32 &b)

## Additional Inherited Members

## 3.193 U32Renderer Class Reference

Inheritance diagram for U32Renderer:



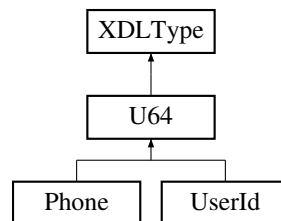
## Public Member Functions

- virtual void **display** (Buffer &in, MultiShape2d \*m, MultiText \*t, float x0, float y0, float \*w, float \*h) const override

## Additional Inherited Members

### 3.194 U64 Class Reference

Inheritance diagram for U64:



## Public Member Functions

- **U64** (uint64\_t val=0)
- DataType **getDataType** () const
- uint32\_t **size** () const override
- void **write** (Buffer &buf) const override
- void **display** (Buffer &binaryIn, Buffer &asciiOut) const
- void **format** (Buffer &binaryIn, Buffer &asciiOut, const char fmt[]) const

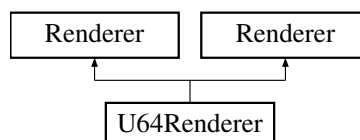
## Friends

- bool **operator==** (const U64 &a, const U64 &b)

## Additional Inherited Members

### 3.195 U64Renderer Class Reference

Inheritance diagram for U64Renderer:



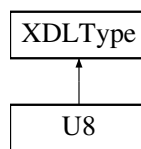
## Public Member Functions

- virtual void **display** ([Buffer](#) &in, MultiShape2d \*m, [MultiText](#) \*t, float x0, float y0, float \*w, float \*h) const override
- virtual void **display** ([Buffer](#) &in, MultiShape2d \*m, [MultiText](#) \*t, float x0, float y0, float \*w, float \*h) const override

## Additional Inherited Members

## 3.196 U8 Class Reference

Inheritance diagram for U8:



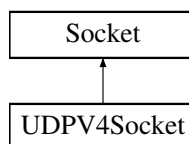
## Public Member Functions

- **U8** (uint8\_t val=0)
- DataType **getDataType** () const
- uint32\_t **size** () const override
- void **write** ([Buffer](#) &buf) const
- void **display** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut) const override
- void **format** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut, const char fmt[]) const

## Additional Inherited Members

## 3.197 UDPV4Socket Class Reference

Inheritance diagram for UDPV4Socket:



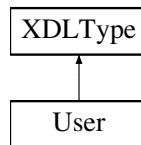
## Public Member Functions

- **UDP4Socket** (const char \*addr, uint16\_t port)
- **UDP4Socket** (uint16\_t port)
- void **listenOnPort** ()
- void **wait** ()
- void **send** (const char \*buf, uint32\_t len)
- void **send** (uint32\_t reqn)

## Additional Inherited Members

### 3.198 User Class Reference

Inheritance diagram for User:



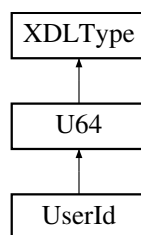
## Public Member Functions

- **User** (const [UserId](#) &userid, const char firstname[], const char lastname[], const [Address](#) &address, const [Phone](#) &phone, const [Email](#) &email)
- DataType **getDataType** () const override
- uint32\_t **size** () const override
- void **write** ([Buffer](#) &buf) const override
- void **writeMeta** ([Buffer](#) &buf) const override
- void **display** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut) const
- void **format** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut, const char fmt[]) const

## Additional Inherited Members

### 3.199 UserId Class Reference

Inheritance diagram for UserId:



## Public Member Functions

- **UserId** (uint64\_t v)
- void **writeMeta** ([Buffer](#) &buf) const override
- void **display** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut) const
- void **format** ([Buffer](#) &binaryIn, [Buffer](#) &asciiOut, const char fmt[]) const

## Additional Inherited Members

### 3.200 Vec3d Class Reference

#### Public Member Functions

- **Vec3d** (double x, double y, double z)

### 3.201 CSRGraph< VertexIndex\_t, EdgeIndex\_t, Weight\_t >::VertexCount Struct Reference

#### Public Member Functions

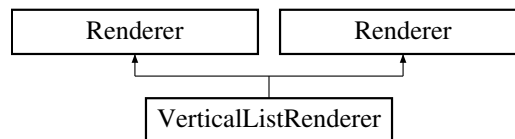
- **VertexCount** (VertexIndex\_t v, VertexIndex\_t countAdj)

#### Public Attributes

- VertexIndex\_t **v**
- VertexIndex\_t **countAdj**

### 3.202 VerticalListRenderer Class Reference

Inheritance diagram for VerticalListRenderer:



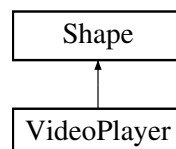
#### Public Member Functions

- virtual void **display** (Buffer &in, MultiShape2d \*m, MultiText \*t, float x0, float y0, float \*w, float \*h) const override
- virtual void **display** (Buffer &in, MultiShape2d \*m, MultiText \*t, float x0, float y0, float \*w, float \*h) const override

## Additional Inherited Members

### 3.203 VideoPlayer Class Reference

Inheritance diagram for VideoPlayer:



## Public Member Functions

- **VideoPlayer** ([Canvas](#) \*c, float x, float y, int width, int height)
- **VideoPlayer** (const [VideoPlayer](#) &orig)=delete
- [VideoPlayer](#) & **operator=** (const [VideoPlayer](#) &orig)=delete
- void **init** ()
- void **update** ()
- void **render** ()
- void **loadFile** (std::string filePath)
- void **loadPlaylist** (std::string filePath, bool append=false)
- void **setVolume** (int volume)
- void **seekLocation** (std::string time, std::string type="relative")
- void **revertSeek** ()
- void **playlistNext** ()
- void **playlistPrev** ()
- void **cropVideo** (float xLeft, float xRight, float yTop, float yBottom)
- void **setPaused** ()
- void **setPlaying** ()
- void **togglePause** ()

## Additional Inherited Members

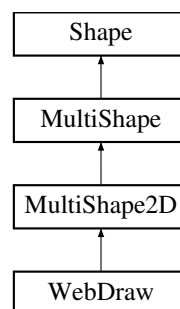
### 3.204 WebCursor Class Reference

## Public Member Functions

- **WebCursor** ([Canvas](#) \*c, [MultiShape2D](#) \*s)
- **WebCursor** ([Canvas](#) \*c, [MultiText](#) \*m)
- void **addText** ([Style](#) \*st, const char text[], uint32\_t len)
- void **moveRight** (float w, float h)
- void **moveLeft** (float w, float h)

### 3.205 WebDraw Class Reference

Inheritance diagram for WebDraw:



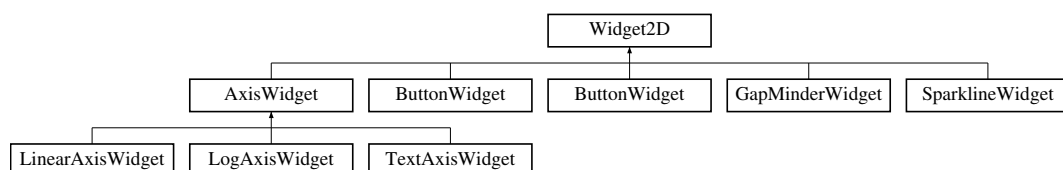
## Public Member Functions

- **WebDraw** (uint32\_t vertCount=1024, uint32\_t solidIndCount=1024, uint32\_t lineIndCount=1024, uint32\_t pointIndCount=1024)
- uint32\_t **addSector** (float x, float y, float xRad, float yRad, float fromAngle, float toAngle, float angleInc, const [Style](#) \*s)
- void **addColor** (const glm::vec4 &rgb)
- void **addColor** (float r, float g, float b)
- void **setColors** (float cols[], uint32\_t size)
- void **setColors** (std::vector< float > &cols)
- void **addStyledPoint** (float x, float y, const glm::vec4 &rgb)
- void **init** () override
- void **render** () override
- void **updateColors** (const uint64\_t pos, const float r, const float g, const float b)
- void **fillRectangle** (float x, float y, float w, float h, const [Style](#) \*s)
- void **fillRoundRect** (float x, float y, float w, float h, float rx, float ry, const [Style](#) \*s)
- void **fillTriangle** (float x1, float y1, float x2, float y2, float x3, float y3, const [Style](#) \*s)
- void **fillPolygon** (float x, float y, float xRad, float yRad, float n, const [Style](#) \*s)
- void **fillCircle** (float x, float y, float rad, float angleInc, const [Style](#) \*s)
- void **fillEllipse** (float x, float y, float xRad, float yRad, float angleInc, const [Style](#) \*s)
- void **drawRectangle** (float x, float y, float w, float h, const [Style](#) \*s)
- void **drawRoundRect** (float x, float y, float w, float h, float rx, float ry, const [Style](#) \*s)
- void **drawTriangle** (float x1, float y1, float x2, float y2, float x3, float y3, const [Style](#) \*s)
- void **drawPolygon** (float x, float y, float xRad, float yRad, float n, const [Style](#) \*s)
- void **drawCompletePolygon** (float x, float y, float xRad, float yRad, float n, const [Style](#) \*s)
- void **drawCircle** (float x, float y, float rad, float angleInc, const [Style](#) \*s)
- void **drawEllipse** (float x, float y, float xRad, float yRad, float angleInc, const [Style](#) \*s)
- void **drawLine** (float x1, float y1, float x2, float y2, const [Style](#) \*s)
- void **drawArc** (float x, float y, float r, float ang1, float ang2)
- void **drawCubic** (float xy[], uint32\_t length, uint32\_t numSegments)
- void **rectanglePoints** (float x, float y, float w, float h, const [Style](#) \*s)
- void **roundRectPoints** (float x, float y, float w, float h, float rx, float ry, const [Style](#) \*s)
- void **trianglePoints** (float x1, float y1, float x2, float y2, float x3, float y3, const [Style](#) \*s)
- void **polygonPoints** (float x, float y, float xRad, float yRad, float n, const [Style](#) \*s)
- void **circlePoints** (float x, float y, float rad, float angleInc, const [Style](#) \*s)
- void **ellipsePoints** (float x, float y, float xRad, float yRad, float angleInc, const [Style](#) \*s)
- void **drawImage** (float x, float y, float w, float h, uint32\_t textureId, float u1, float v1, float u2, float v2)
- void **drawImage** (float x, float y, float w, float h, uint32\_t textureId)
- void **drawText** (float x, float y, [Style](#) \*s, const char text[], uint32\_t len)
- void **drawText** (float x, float y, [Style](#) \*s, uint32\_t baseChar, const char text[], uint32\_t len)
- void **drawText** (float x, float y, [Style](#) \*s, const uint16\_t text[], uint32\_t len)
- float **getTextWidth** ([Style](#) \*s, const char text[], uint32\_t len) const
- float **getTextHeight** ([Style](#) \*s)
- void **addText** ([WebCursor](#) \*cursor, [Style](#) \*s, const char text[], uint32\_t len)

## Additional Inherited Members

## 3.206 Widget2D Class Reference

Inheritance diagram for Widget2D:



## Public Member Functions

- **Widget2D** ([StyledMultiShape2D](#) \*m, [MultiText](#) \*t, float x, float y, float w, float h)
- virtual void **init** ()=0

## Protected Attributes

- [StyledMultiShape2D](#) \* m
- [MultiText](#) \* t
- float **x**
- float **y**
- float **w**
- float **h**

## 3.207 X11Util Class Reference

### Static Public Member Functions

- static void **setCursor** (float w\_x, float w\_y, float dx, float dy)

## 3.208 XDLCompiler Class Reference

### Public Member Functions

- **XDLCompiler** (const char filename[ ])
- [SymbolTable](#) & **getSymbolTable** ()
- void **generateCode** ()
- void **error** (const std::string &msg)
- void **duplicateSymbol** (const std::string &name)
- void **undefinedSymbol** (const std::string &name)
- void **internalError** (const std::string &name)
- void **warning** (const std::string &msg)

## 3.209 XDIterator Class Reference

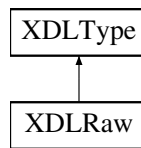
### Public Member Functions

- void **advance** ()
- void **advance** (uint32\_t d)
- uint32\_t **getPos** () const



## 3.210 XDLRaw Class Reference

Inheritance diagram for XDLRaw:



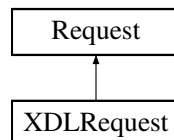
### Public Member Functions

- **XDLRaw** (const char \*p, size\_t len)
- DataType **getDataType** () const
- uint32\_t **size** () const override
- void **write** (Buffer &buf) const
- void **display** (Buffer &binaryIn, Buffer &asciiOut) const
- void **format** (Buffer &binaryIn, Buffer &asciiOut, const char fmt[]) const

### Additional Inherited Members

## 3.211 XDLRequest Class Reference

Inheritance diagram for XDLRequest:



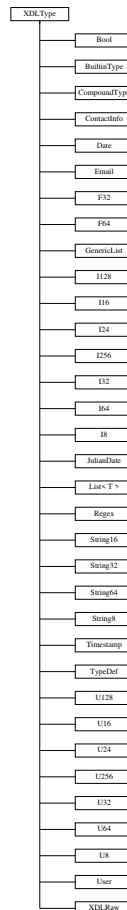
### Public Member Functions

- **XDLRequest** (const char filename[])
- **XDLRequest** (const XDLRequest &r)=delete
- XDLRequest & **operator=** (const XDLRequest &r)=delete
- void **addPage** (const char metaDataFilename[], const char filename[])
- void **addPage** (const char filename[])
- void **handle** (int fd) override
- void **handle** (int sckt, const char \*command) override

## Additional Inherited Members

### 3.212 XDType Class Reference

Inheritance diagram for XDType:



## Public Member Functions

- **XDType** (const std::string &typeName)
- **XDType** (DataType t)
- virtual void **write** (Buffer &b) const =0
- virtual void **writeMeta** (Buffer &buf) const
- virtual uint32\_t **size** () const =0
- virtual DataType **getDataType** () const =0
- const std::string & **getTypeName** () const
- virtual **XDIterator** \* **createIterator** ()
- virtual void **display** (Buffer &binaryIn, Buffer &asciiOut) const
- void **format** (Buffer &binaryIn, Buffer &asciiOut, const char fmt[]) const

## Static Public Member Functions

- static void **classInit** ()
- static void **classCleanup** ()
- static uint32\_t **computeNameOffset** (const std::string &typeName)
- static uint32\_t **computeNameOffset** (DataType t)
- static const [XDLType](#) \* **getBuiltinType** (DataType dt)
- static void **readMeta** ([XDLCompiler](#) \*compiler, [Buffer](#) &in, uint32\_t count, [Struct](#) \*s)
- static const [Struct](#) \* **read** ([Buffer](#) &in)
- static DataType **readType** ([Buffer](#) &in)

## Static Protected Member Functions

- static void **addType** (const [XDLType](#) \*type)

## Protected Attributes

- uint32\_t **nameOffset**

## Static Protected Attributes

- static const std::string **empty** = ""
- static [DynArray](#)< const [XDLType](#) \* > **types**
- static [DynArray](#)< std::string > **typeNames**
- static std::unordered\_map< std::string, uint32\_t > **byName**



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