Road To Zero

Generated by Doxygen 1.9.1

Chapter 1

Class Index

1.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

Chapter 2

File Index

2.1 File List

Here is a list of all files with brief descriptions:

Chapter 3

Class Documentation

3.1 AssetsManager Class Reference

A class which manages visual and sound assets.

`#include <AssetsManager.h>`

Public Member Functions

- AssetsManager (void)

  Constructor for the AssetsManager class.
- void loadFont (std::string, std::string)

  Method to load a font and insert it into the font map.
- void loadTexture (std::string, std::string)

  Method to load a texture and insert it into the texture map.
- void loadSound (std::string, std::string)

  Method to load a sound and insert it into the sound map. Automatically creates a corresponding sf::SoundBuffer.
- void loadTrack (std::string, std::string)

  Method to load a track (sf::Music) and insert it into the track map.
- sf::Font * getFont (std::string)

  Method to get font associated with given font key.
- sf::Texture * getTexture (std::string)

  Method to get texture associated with given texture key.
- sf::SoundBuffer * getSoundBuffer (std::string)

  Method to get soundbuffer associated with given sound key.
- sf::Sound * getSound (std::string)

  Method to get sound associated with given sound key.
- void playTrack (void)

  Method to play the current track.
- void pauseTrack (void)

  Method to pause the current track.
- void stopTrack (void)

  Method to stop the current track.
- void nextTrack (void)

  Method to advance to the next track. Wraps around if the end of the track map is reached.

- void previousTrack (void)

  Method to return to the previous track. Wraps around if the beginning of the track map is reached.
- std::string getCurrentTrackKey (void)

  Method to get track key for current track.
- sf::SoundSource::Status getTrackStatus (void)

  Method to get the status of the current track.
- void clear (void)

  Method to clear all loaded assets.
- ~AssetsManager (void)

  Destructor for the AssetsManager class.

Public Attributes

- std::map< std::string, sf::Font * > font_map

  A map of pointers to loaded fonts.
- std::map< std::string, sf::Texture * > texture_map

  A map of pointers to loaded textures.
- std::map< std::string, sf::SoundBuffer * > soundbuffer_map

  A map of pointers to sound buffers.
- std::map< std::string, sf::Sound * > sound_map

  A map of pointers to loaded sounds.
- std::map< std::string, sf::Music * >::iterator current_track

  A map iterator which corresponds to the current track (i.e., the track currently being played).
- std::map< std::string, sf::Music * > track_map

  A map of pointers to opened tracks (i.e. sf::Music).

Private Member Functions

- void __loadSoundBuffer (std::string, std::string)

  Helper method to load a soundbuffer and insert it into the soundbuffer map. Should only be called by loadSound(), to create an sf::SoundBuffer corresponding to the loaded sf::Sound.

3.1.1 Detailed Description

A class which manages visual and sound assets.

3.1.2 Constructor & Destructor Documentation

3.1.2.1 AssetsManager()

```
AssetsManager::AssetsManager (
            void  )
```

Constructor for the AssetsManager class.

```
110 {
111     //...
112
113     std::cout << "AssetsManager constructed at " << this << std::endl;
114
115     return;
116 }   /* AssetsManager() */
```

3.1.2.2 ~AssetsManager()

```
AssetsManager::~AssetsManager (
            void  )
```

Destructor for the AssetsManager class.

```
739 {
740     this->clear();
741
742     std::cout « "AssetsManager at " « this « " destroyed" « std::endl;
743
744     return;
745 }   /* ~AssetsManager() */
```

3.1.3 Member Function Documentation

3.1.3.1 __loadSoundBuffer()

```
void AssetsManager::__loadSoundBuffer (
            std::string path_2_sound,
            std::string sound_key )  [private]
```

Helper method to load a soundbuffer and insert it into the soundbuffer map. Should only be called by loadSound(), to create an sf::SoundBuffer corresponding to the loaded sf::Sound.

Parameters

path_2_sound	A path (either relative or absolute) to the sound file.
sound_key	A key associated with the sound (for indexing into the soundbuffer map).

```
47 {
48     //  1. check key, throw error if already in use
49     if (this->soundbuffer_map.count(sound_key) > 0) {
50         std::string error_str = "ERROR  AssetsManager::__loadSoundBuffer()  sound key ";
51         error_str += sound_key;
52         error_str += " is already in use";
53
54         this->clear();
55
56         #ifdef _WIN32
57             std::cout « error_str « std::endl;
58         #endif  /* _WIN32 */
59
60         throw std::runtime_error(error_str);
61     }
62
63
64     //  2. load from file, throw error on fail
65     sf::SoundBuffer* soundbuffer_ptr = new sf::SoundBuffer();
66
67     if (not soundbuffer_ptr->loadFromFile(path_2_sound)) {
68         std::string error_str = "ERROR  AssetsManager::__loadSoundBuffer()  could not load ";
69         error_str += "soundbuffer at ";
70         error_str += path_2_sound;
71
72         this->clear();
73
74         #ifdef _WIN32
75             std::cout « error_str « std::endl;
76         #endif  /* _WIN32 */
77
78         throw std::runtime_error(error_str);
79     }
80
81
```

```
82      //  3. insert into soundbuffer map
83      this->soundbuffer_map.insert(
84          std::pair<std::string, sf::SoundBuffer*>(sound_key, soundbuffer_ptr)
85      );
86
87      std::cout « "SoundBuffer " « sound_key « " inserted into soundbuffer map" «
88          std::endl;
89
90      return;
91  }   /* __loadSoundBuffer() */
```

3.1.3.2 clear()

```
void AssetsManager::clear (
            void  )
```

Method to clear all loaded assets.

```
646 {
647     //  1. clear fonts
648     std::map<std::string, sf::Font*>::iterator font_iter;
649     for (
650         font_iter = this->font_map.begin();
651         font_iter != this->font_map.end();
652         font_iter++
653     ) {
654         delete font_iter->second;
655
656         std::cout « "Font " « font_iter->first « " deleted from font map" «
657             std::endl;
658     }
659     this->font_map.clear();
660
661
662     //  2. clear textures
663     std::map<std::string, sf::Texture*>::iterator texture_iter;
664     for (
665         texture_iter = this->texture_map.begin();
666         texture_iter != this->texture_map.end();
667         texture_iter++
668     ) {
669         delete texture_iter->second;
670
671         std::cout « "Texture " « texture_iter->first « " deleted from texture map" «
672             std::endl;
673     }
674     this->texture_map.clear();
675
676
677     //  3. clear sound buffers
678     std::map<std::string, sf::SoundBuffer*>::iterator soundbuffer_iter;
679     for (
680         soundbuffer_iter = this->soundbuffer_map.begin();
681         soundbuffer_iter != this->soundbuffer_map.end();
682         soundbuffer_iter++
683     ) {
684         delete soundbuffer_iter->second;
685
686         std::cout « "SoundBuffer " « soundbuffer_iter->first «
687             " deleted from soundbuffer map" « std::endl;
688     }
689     this->soundbuffer_map.clear();
690
691
692     //  4. clear sounds
693     std::map<std::string, sf::Sound*>::iterator sound_iter;
694     for (
695         sound_iter = this->sound_map.begin();
696         sound_iter != this->sound_map.end();
697         sound_iter++
698     ) {
699         sound_iter->second->stop();
700         delete sound_iter->second;
701
702         std::cout « "Sound " « sound_iter->first « " deleted from sound map" «
703             std::endl;
704     }
705     this->sound_map.clear();
706
```

```
707
708     //  5. clear tracks
709     std::map<std::string, sf::Music*>::iterator track_iter;
710     for (
711         track_iter = this->track_map.begin();
712         track_iter != this->track_map.end();
713         track_iter++
714     ) {
715         track_iter->second->stop();
716         delete track_iter->second;
717
718         std::cout « "Track " « track_iter->first « " deleted from track map" «
719             std::endl;
720     }
721     this->track_map.clear();
722
723     return;
724 }   /* clear() */
```

3.1.3.3 getCurrentTrackKey()

```
std::string AssetsManager::getCurrentTrackKey (
             void  )
```

Method to get track key for current track.

Returns

The track key for the current track.

```
610 {
611     return this->current_track->first;
612 }   /* getCurrentTrackKey() */
```

3.1.3.4 getFont()

```
sf::Font * AssetsManager::getFont (
             std::string font_key )
```

Method to get font associated with given font key.

Parameters

font_key	A key associated with the font (for indexing into the font map).

Returns

A pointer to the corresponding font.

```
351 {
352     //  1. check key, throw error if not found
353     if (this->font_map.count(font_key) <= 0) {
354         std::string error_str = "ERROR  AssetsManager::getFont()  font key ";
355         error_str += font_key;
356         error_str += " is not contained in font map";
357
358         this->clear();
359
360         #ifdef _WIN32
```

```
361             std::cout « error_str « std::endl;
362         #endif  /* _WIN32 */
363
364         throw std::runtime_error(error_str);
365     }
366
367     return this->font_map[font_key];
368 }   /* getFont() */
```

3.1.3.5 getSound()

```
sf::Sound * AssetsManager::getSound (
            std::string sound_key )
```

Method to get sound associated with given sound key.

Parameters

sound_key	A key associated with the sound (for indexing into the sound map).

Returns

A pointer to the corresponding sound.

```
461 {
462     //  1. check key, throw error if not found
463     if (this->sound_map.count(sound_key) <= 0) {
464         std::string error_str = "ERROR  AssetsManager::getSound()  sound key ";
465         error_str += sound_key;
466         error_str += " is not contained in sound map";
467
468         this->clear();
469
470         #ifdef _WIN32
471             std::cout « error_str « std::endl;
472         #endif  /* _WIN32 */
473
474         throw std::runtime_error(error_str);
475     }
476
477     return this->sound_map[sound_key];
478 }   /* getSound() */
```

3.1.3.6 getSoundBuffer()

```
sf::SoundBuffer * AssetsManager::getSoundBuffer (
            std::string sound_key )
```

Method to get soundbuffer associated with given sound key.

Parameters

sound_key	A key associated with the soundbuffer (for indexing into the soundbuffer map).

Returns

A pointer to the corresponding soundbuffer.

```
425 {
426     //  1. check key, throw error if not found
427     if (this->soundbuffer_map.count(sound_key) <= 0) {
428         std::string error_str = "ERROR  AssetsManager::getSoundBuffer()  sound key ";
429         error_str += sound_key;
430         error_str += " is not contained in soundbuffer map";
431 
432         this->clear();
433 
434         #ifdef _WIN32
435             std::cout << error_str << std::endl;
436         #endif  /* _WIN32 */
437 
438         throw std::runtime_error(error_str);
439     }
440 
441     return this->soundbuffer_map[sound_key];
442 }   /* getSoundBuffer() */
```

3.1.3.7 getTexture()

```
sf::Texture * AssetsManager::getTexture (
            std::string texture_key )
```

Method to get texture associated with given texture key.

Parameters

texture_key	A key associated with the texture (for indexing into the texture map).

Returns

A pointer to the corresponding texture.

```
388 {
389     //  1. check key, throw error if not found
390     if (this->texture_map.count(texture_key) <= 0) {
391         std::string error_str = "ERROR  AssetsManager::getTexture()  texture key ";
392         error_str += texture_key;
393         error_str += " is not contained in texture map";
394 
395         this->clear();
396 
397         #ifdef _WIN32
398             std::cout << error_str << std::endl;
399         #endif  /* _WIN32 */
400 
401         throw std::runtime_error(error_str);
402     }
403 
404     return this->texture_map[texture_key];
405 }   /* getTexture() */
```

3.1.3.8 getTrackStatus()

```
sf::SoundSource::Status AssetsManager::getTrackStatus (
            void  )
```

Method to get the status of the current track.

Returns

The status of the current track.

```
629 {
630     return this->current_track->second->getStatus();
631 }   /* getTrackStatus */
```

3.1.3.9 loadFont()

```
void AssetsManager::loadFont (
            std::string path_2_font,
            std::string font_key )
```

Method to load a font and insert it into the font map.

Parameters

path_2_font	A path (either relative or absolute) to the font file.
font_key	A key associated with the font (for indexing into the font map).

```
135 {
136     //  1. check key, throw error if already in use
137     if (this->font_map.count(font_key) > 0) {
138         std::string error_str = "ERROR  AssetsManager::loadFont()  font key ";
139         error_str += font_key;
140         error_str += " is already in use";
141 
142         this->clear();
143 
144         #ifdef _WIN32
145             std::cout « error_str « std::endl;
146         #endif  /* _WIN32 */
147 
148         throw std::runtime_error(error_str);
149     }
150 
151 
152     //  2. load from file, throw error on fail
153     sf::Font* font_ptr = new sf::Font();
154 
155     if (not font_ptr->loadFromFile(path_2_font)) {
156         std::string error_str = "ERROR  AssetsManager::loadFont()  could not load ";
157         error_str += "font at ";
158         error_str += path_2_font;
159 
160         this->clear();
161 
162         #ifdef _WIN32
163             std::cout « error_str « std::endl;
164         #endif  /* _WIN32 */
165 
166         throw std::runtime_error(error_str);
167     }
168 
169 
170     //  3. insert into font map
171     this->font_map.insert(std::pair<std::string, sf::Font*>(font_key, font_ptr));
172 
173     std::cout « "Font " « font_key « " inserted into font map" « std::endl;
174 
175     return;
176 }   /* loadFont() */
```

3.1.3.10 loadSound()

```
void AssetsManager::loadSound (
```

```
            std::string path_2_sound,
            std::string sound_key )
```

Method to load a sound and insert it into the sound map. Automatically creates a corresponding sf::SoundBuffer.

Parameters

path_2_sound	A path (either relative or absolute) to the sound file.
sound_key	A key associated with the sound (for indexing into the sound map).

```
259 {
260     //  1. create an associated sf::SoundBuffer
261     this->__loadSoundBuffer(path_2_sound, sound_key);
262 
263     //  2. associate sf::Sound with sf::SoundBuffer
264     sf::Sound* sound_ptr = new sf::Sound();
265     sound_ptr->setBuffer(*(this->soundbuffer_map[sound_key]));
266 
267     //  3. insert into sound map
268     this->sound_map.insert(std::pair<std::string, sf::Sound*>(sound_key, sound_ptr));
269 
270     std::cout « "Sound " « sound_key « " inserted into sound map" « std::endl;
271 
272     return;
273 }   /* loadSound() */
```

3.1.3.11 loadTexture()

```
void AssetsManager::loadTexture (
            std::string path_2_texture,
            std::string texture_key )
```

Method to load a texture and insert it into the texture map.

Parameters

path_2_texture	A path (either relative or absolute) to the texture file.
texture_key	A key associated with the texture (for indexing into the texture map).

```
196 {
197     //  1. check key, throw error if already in use
198     if (this->texture_map.count(texture_key) > 0) {
199         std::string error_str = "ERROR  AssetsManager::loadTexture()  texture key ";
200         error_str += texture_key;
201         error_str += " is already in use";
202 
203         this->clear();
204 
205         #ifdef _WIN32
206             std::cout « error_str « std::endl;
207         #endif  /* _WIN32 */
208 
209         throw std::runtime_error(error_str);
210     }
211 
212 
213     //  2. load from file, throw error on fail
214     sf::Texture* texture_ptr = new sf::Texture();
215 
216     if (not texture_ptr->loadFromFile(path_2_texture)) {
217         std::string error_str = "ERROR  AssetsManager::loadTexture()  could not load ";
218         error_str += "texture at ";
219         error_str += path_2_texture;
220 
221         this->clear();
222 
223         #ifdef _WIN32
224             std::cout « error_str « std::endl;
```

```
225         #endif  /* _WIN32 */
226
227         throw std::runtime_error(error_str);
228     }
229
230
231     //  3. insert into texture map
232     this->texture_map.insert(
233         std::pair<std::string, sf::Texture*>(texture_key, texture_ptr)
234     );
235
236     std::cout « "Texture " « texture_key « " inserted into texture map" « std::endl;
237
238     return;
239 }   /* loadTexture() */
```

3.1.3.12 loadTrack()

```
void AssetsManager::loadTrack (
              std::string path_2_track,
              std::string track_key )
```

Method to load a track (sf::Music) and insert it into the track map.

Parameters

path_2_track	A path (either relative or absolute) to the track file.
track_key	A key associated with the track (for indexing into the track map).

```
292 {
293     //  1. check key, throw error if already in use
294     if (this->track_map.count(track_key) > 0) {
295         std::string error_str = "ERROR  AssetsManager::loadTrack()  track key ";
296         error_str += track_key;
297         error_str += " is already in use";
298
299         this->clear();
300
301         #ifdef _WIN32
302             std::cout « error_str « std::endl;
303         #endif  /* _WIN32 */
304
305         throw std::runtime_error(error_str);
306     }
307
308     //  2. open from file, throw error on fail
309     sf::Music* track_ptr = new sf::Music();
310
311     if (not track_ptr->openFromFile(path_2_track)) {
312         std::string error_str = "ERROR  AssetsManager::loadTrack()  could not open ";
313         error_str += "track at ";
314         error_str += path_2_track;
315
316         this->clear();
317
318         #ifdef _WIN32
319             std::cout « error_str « std::endl;
320         #endif  /* _WIN32 */
321
322         throw std::runtime_error(error_str);
323     }
324
325     //  3. insert into track map
326     this->track_map.insert(std::pair<std::string, sf::Music*>(track_key, track_ptr));
327     this->current_track = this->track_map.begin();
328
329     std::cout « "Track " « track_key « " inserted into track map" « std::endl;
330
331     return;
332 }   /* loadTrack() */
```

3.1.3.13 nextTrack()

```
void AssetsManager::nextTrack (
            void  )
```

Method to advance to the next track. Wraps around if the end of the track map is reached.

```
551 {
552     //  1. stop current track
553     this->stopTrack();
554 
555     //  2. increment current track
556     this->current_track++;
557 
558     //  3. handle wrap around
559     if (this->current_track == this->track_map.end()) {
560         this->current_track = this->track_map.begin();
561     }
562 
563     return;
564 }   /* nextTrack() */
```

3.1.3.14 pauseTrack()

```
void AssetsManager::pauseTrack (
            void  )
```

Method to pause the current track.

```
512 {
513     this->current_track->second->pause();
514 
515     return;
516 }   /* pauseTrack() */
```

3.1.3.15 playTrack()

```
void AssetsManager::playTrack (
            void  )
```

Method to play the current track.

```
493 {
494     this->current_track->second->play();
495 
496     return;
497 }   /* playTrack() */
```

3.1.3.16 previousTrack()

```
void AssetsManager::previousTrack (
            void  )
```

Method to return to the previous track. Wraps around if the beginning of the track map is reached.

```
580 {
581     //  1. stop current track
582     this->stopTrack();
583 
584     //  2. handle wrap around
585     if (this->current_track == this->track_map.begin()) {
586         this->current_track = this->track_map.end();
587     }
588 
589     //  3. decrement current track
590     this->current_track--;
591 
592     return;
593 }   /* previousTrack() */
```

3.1.3.17 stopTrack()

```
void AssetsManager::stopTrack (
            void  )
```

Method to stop the current track.

```
531 {
532     this->current_track->second->stop();
533
534     return;
535 }   /* stopTrack() */
```

3.1.4 Member Data Documentation

3.1.4.1 current_track

```
std::map<std::string, sf::Music*>::iterator AssetsManager::current_track
```

A map iterator which corresponds to the current track (i.e., the track currently being played).

3.1.4.2 font_map

```
std::map<std::string, sf::Font*> AssetsManager::font_map
```

A map of pointers to loaded fonts.

3.1.4.3 sound_map

```
std::map<std::string, sf::Sound*> AssetsManager::sound_map
```

A map of pointers to loaded sounds.

3.1.4.4 soundbuffer_map

```
std::map<std::string, sf::SoundBuffer*> AssetsManager::soundbuffer_map
```

A map of pointers to sound buffers.

3.1.4.5 texture_map

```
std::map<std::string, sf::Texture*> AssetsManager::texture_map
```

A map of pointers to loaded textures.

3.1.4.6 track_map

```
std::map<std::string, sf::Music*> AssetsManager::track_map
```

A map of pointers to opened tracks (i.e. sf::Music).

The documentation for this class was generated from the following files:

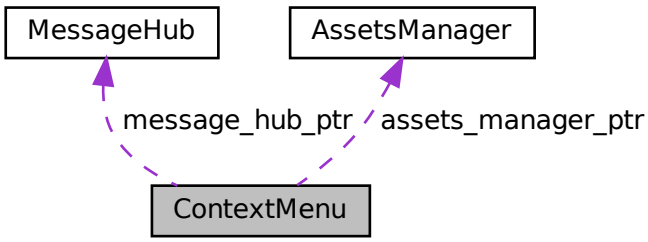
- header/ESC_core/AssetsManager.h
- source/ESC_core/AssetsManager.cpp

3.2 ContextMenu Class Reference

A class which defines a context menu for the game.

```
#include <ContextMenu.h>
```

Collaboration diagram for ContextMenu:



Public Member Functions

- ContextMenu (sf::Event *, sf::RenderWindow *, AssetsManager *, MessageHub *)

  Constructor for the ContextMenu class.
- void processEvent (void)

  Method to processEvent ContextMenu. To be called once per event.
- void processMessage (void)

  Method to processMessage ContextMenu. To be called once per message.
- void draw (void)

  Method to draw the hex tile to the render window. To be called once per frame.
- ~ContextMenu (void)

  Destructor for the ContextMenu class.

Public Attributes

- ConsoleState console_state

  The current state of the console screen.
- bool game_menu_up

  Indicates whether or not the game menu is up.
- int frame

  The current frame of this object.
- double position_x

  The position of the object.
- double position_y

  The position of the object.
- std::string console_string

  The string to be printed to the console screen.
- sf::RectangleShape menu_frame

  The frame of the context menu.
- sf::RectangleShape visual_screen

  The context menu screen for visuals.
- sf::ConvexShape visual_screen_frame_top

  The top framing of the visual screen.
- sf::ConvexShape visual_screen_frame_left

  The left framing of the visual screen.
- sf::ConvexShape visual_screen_frame_bottom

  The bottom framing of the visual screen.
- sf::ConvexShape visual_screen_frame_right

  The right framing of the visual screen.
- sf::RectangleShape console_screen

  The context menu console screen (for animated text output).
- sf::ConvexShape console_screen_frame_top

  The top framing of the console screen.
- sf::ConvexShape console_screen_frame_left

  The left framing of the console screen.
- sf::ConvexShape console_screen_frame_bottom

  The bottom framing of the console screen.
- sf::ConvexShape console_screen_frame_right

  The right framing of the console screen.

Private Member Functions

- void __setUpMenuFrame (void)

  Helper method to set up context menu frame (drawable).
- void __setUpVisualScreen (void)

  Helper method to set up context menu visual screen (drawable).
- void __setUpVisualScreenFrame (void)

  Helper method to set up framing for context menu visual screen (drawable).
- void __drawVisualScreenFrame (void)

  Helper method to draw visual screen frame.
- void __setUpConsoleScreen (void)

  Helper method to set up context menu console screen (drawable).
- void __setUpConsoleScreenFrame (void)

Helper method to set up framing for context menu console screen (drawable).

- void __drawConsoleScreenFrame (void)

  Helper method to draw console screen frame.
- void __setConsoleState (ConsoleState)

  Helper method to set state of console screen and update string if necessary.
- void __setConsoleString (void)

  Helper method to set console string depending on console state.
- void __drawConsoleText (void)

  Helper method to draw animated text to context menu console screen.
- void __handleKeyPressEvents (void)

  Helper method to handle key press events.
- void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.
- void __sendQuitGameMessage (void)

  Helper method to format and send a quit game message.
- void __sendRestartGameMessage (void)

  Helper method to format and send a restart game message.

Private Attributes

- sf::Event * event_ptr

  A pointer to the event class.
- sf::RenderWindow * render_window_ptr

  A pointer to the render window.
- AssetsManager * assets_manager_ptr

  A pointer to the assets manager.
- MessageHub * message_hub_ptr

  A pointer to the message hub.

3.2.1 Detailed Description

A class which defines a context menu for the game.

3.2.2 Constructor & Destructor Documentation

3.2.2.1 ContextMenu()

```
ContextMenu::ContextMenu (
            sf::Event * event_ptr,
            sf::RenderWindow * render_window_ptr,
            AssetsManager * assets_manager_ptr,
            MessageHub * message_hub_ptr )
```

Constructor for the ContextMenu class.

Parameters

event_ptr	Pointer to the event class.
render_window_ptr	Pointer to the render window.
assets_manager_ptr	Pointer to the assets manager.
message_hub_ptr	Pointer to the message hub.

```
782 {
783     //  1. set attributes
784 
785     //  1.1. private
786     this->event_ptr = event_ptr;
787     this->render_window_ptr = render_window_ptr;
788 
789     this->assets_manager_ptr = assets_manager_ptr;
790     this->message_hub_ptr = message_hub_ptr;
791 
792     //  1.2. public
793     this->console_state = ConsoleState :: NONE_STATE;
794     this->__setConsoleState(ConsoleState :: READY);
795 
796     this->game_menu_up = false;
797 
798     this->frame = 0;
799 
800     this->position_x = GAME_WIDTH;
801     this->position_y = 0;
802 
803     //  2. set up and position drawable attributes
804     this->__setUpMenuFrame();
805     this->__setUpVisualScreen();
806     this->__setUpVisualScreenFrame();
807     this->__setUpConsoleScreen();
808     this->__setUpConsoleScreenFrame();
809 
810     std::cout « "ContextMenu constructed at " « this « std::endl;
811 
812     return;
813 }   /* ContextMenu() */
```

3.2.2.2 ~ContextMenu()

```
ContextMenu::~ContextMenu (
            void  )
```

Destructor for the ContextMenu class.

```
952 {
953     std::cout « "ContextMenu at " « this « " destroyed" « std::endl;
954 
955     return;
956 }   /* ~ContextMenu() */
```

3.2.3 Member Function Documentation

3.2.3.1 __drawConsoleScreenFrame()

```
void ContextMenu::__drawConsoleScreenFrame (
            void  )  [private]
```

Helper method to draw console screen frame.

```
433 {
```

```
434     this->render_window_ptr->draw(this->console_screen_frame_top);
435     this->render_window_ptr->draw(this->console_screen_frame_left);
436     this->render_window_ptr->draw(this->console_screen_frame_bottom);
437     this->render_window_ptr->draw(this->console_screen_frame_right);
438 
439     return;
440 }   /* __drawContextScreenFrame() */
```

3.2.3.2 __drawConsoleText()

```
void ContextMenu::__drawConsoleText (
            void  )  [private]
```

Helper method to draw animated text to context menu console screen.

```
550 {
551     //  1. set up console text (drawable)
552     sf::Text console_text(
553         this->console_string,
554         *(this->assets_manager_ptr->getFont("Glass_TTY_VT220")),
555         16
556     );
557 
558     console_text.setFillColor(MONOCHROME_TEXT_GREEN);
559 
560     console_text.setPosition(
561         this->position_x - 50 - 300 + 16,
562         this->position_y + GAME_HEIGHT - 50 - 340 + 16
563     );
564 
565 
566     //  2. draw console text
567     this->render_window_ptr->draw(console_text);
568 
569 
570     //  3. assemble and draw blinking console cursor
571     if ((this->frame % FRAMES_PER_SECOND) > FRAMES_PER_SECOND / 2) {
572         sf::RectangleShape console_cursor(sf::Vector2f(10, 16));
573 
574         console_cursor.setFillColor(MONOCHROME_TEXT_GREEN);
575 
576         console_cursor.setPosition(
577             console_text.getPosition().x,
578             console_text.getPosition().y + console_text.getLocalBounds().height + 10
579         );
580 
581         this->render_window_ptr->draw(console_cursor);
582     }
583 
584     //  4. updating frame count if console is in menu state
585     if (this->console_state == ConsoleState :: MENU) {
586         std::string frame_count_string = "FRAME: ";
587         frame_count_string += std::to_string(this->frame);
588 
589         sf::Text frame_count_text(
590             frame_count_string,
591             *(this->assets_manager_ptr->getFont("Glass_TTY_VT220")),
592             16
593         );
594 
595         frame_count_text.setFillColor(MONOCHROME_TEXT_GREEN);
596 
597         frame_count_text.setPosition(
598             console_text.getPosition().x,
599             console_text.getPosition().y + console_text.getLocalBounds().height - 10
600         );
601 
602         this->render_window_ptr->draw(frame_count_text);
603     }
604 
605     return;
606 }   /* __drawConsoleText() */
```

3.2.3.3 __drawVisualScreenFrame()

```
void ContextMenu::__drawVisualScreenFrame (
            void  )  [private]
```

Helper method to draw visual screen frame.

```
208 {
209     this->render_window_ptr->draw(this->visual_screen_frame_top);
210     this->render_window_ptr->draw(this->visual_screen_frame_left);
211     this->render_window_ptr->draw(this->visual_screen_frame_bottom);
212     this->render_window_ptr->draw(this->visual_screen_frame_right);
213 
214     return;
215 }   /* __drawVisualScreenFrame() */
```

3.2.3.4 __handleKeyPressEvents()

```
void ContextMenu::__handleKeyPressEvents (
            void  )  [private]
```

Helper method to handle key press events.

```
621 {
622     switch (this->event_ptr->key.code) {
623         case (sf::Keyboard::Escape): {
624             if (this->console_state == ConsoleState :: MENU) {
625                 this->__setConsoleState(ConsoleState :: READY);
626             }
627 
628             else {
629                 this->__setConsoleState(ConsoleState :: MENU);
630             }
631 
632             break;
633         }
634 
635 
636         case (sf::Keyboard::Q): {
637             if (this->console_state == ConsoleState :: MENU) {
638                 this->__sendQuitGameMessage();
639             }
640         }
641 
642 
643         case (sf::Keyboard::R): {
644             if (this->console_state == ConsoleState :: MENU) {
645                 this->__sendRestartGameMessage();
646             }
647         }
648 
649 
650         default: {
651             // do nothing!
652 
653             break;
654         }
655     }
656 
657     return;
658 }   /* __handleKeyPressEvents() */
```

3.2.3.5 __handleMouseButtonEvents()

```
void ContextMenu::__handleMouseButtonEvents (
            void  )  [private]
```

Helper method to handle mouse button events.

```
673 {
674     switch (this->event_ptr->mouseButton.button) {
675         case (sf::Mouse::Left): {
676             //...
677 
678             break;
679         }
680 
681 
682         case (sf::Mouse::Right): {
683             //...
684 
685             break;
686         }
687 
688 
689         default: {
690             // do nothing!
691 
692             break;
693         }
694     }
695 
696     return;
697 }   /* __handleMouseButtonEvents() */
```

3.2.3.6 __sendQuitGameMessage()

```
void ContextMenu::__sendQuitGameMessage (
             void  )  [private]
```

Helper method to format and send a quit game message.

```
712 {
713     Message quit_game_message;
714 
715     quit_game_message.channel = GAME_CHANNEL;
716     quit_game_message.subject = "quit game";
717 
718     this->message_hub_ptr->sendMessage(quit_game_message);
719 
720     return;
721 }   /* __sendQuitGameMessage() */
```

3.2.3.7 __sendRestartGameMessage()

```
void ContextMenu::__sendRestartGameMessage (
             void  )  [private]
```

Helper method to format and send a restart game message.

```
736 {
737     Message restart_game_message;
738 
739     restart_game_message.channel = GAME_CHANNEL;
740     restart_game_message.subject = "restart game";
741 
742     this->message_hub_ptr->sendMessage(restart_game_message);
743 
744     return;
745 }   /* __sendRestartGameMessage() */
```

3.2.3.8 __setConsoleState()

```
void ContextMenu::__setConsoleState (
             ConsoleState console_state )  [private]
```

Helper method to set state of console screen and update string if necessary.

Parameters

console_state	The state (ConsoleState) to set the console to.

```
457 {
458     //  1. if no change, do nothing
459     if (this->console_state == console_state) {
460         return;
461     }
462 
463     //  2. update console state, set console string accordingly
464     this->console_state = console_state;
465     this->__setConsoleString();
466 
467     return;
468 }   /* __setConsoleState() */
```

3.2.3.9 __setConsoleString()

```
void ContextMenu::__setConsoleString (
            void  )  [private]
```

Helper method to set console string depending on console state.

```
483 {
484     this->console_string.clear();
485 
486     switch (this->console_state) {
487         case (ConsoleState :: MENU): {
488             //           32 char x 17 line console "--------------------------------\n";
489             this->console_string                = "         **** MENU ****         \n";
490             this->console_string               += "                                \n";
491             this->console_string               += "[R]:  RESTART                   \n";
492             this->console_string               += "                                \n";
493             this->console_string               += "[TAB]:  TOGGLE RESOURCE OVERLAY \n";
494             this->console_string               += "[T]:  TUTORIAL                  \n";
495             this->console_string               += "                                \n";
496             this->console_string               += "                                \n";
497             this->console_string               += "                                \n";
498             this->console_string               += "                                \n";
499             this->console_string               += "                                \n";
500             this->console_string               += "                                \n";
501             this->console_string               += "                                \n";
502             this->console_string               += "[Q]:    QUIT                    \n";
503             this->console_string               += "[ESC]:  CLOSE MENU              \n";
504             this->console_string               += "                                \n";
505 
506             break;
507         }
508 
509 
510         case (ConsoleState :: TILE): {
511             // take console string from tile state message
512 
513             break;
514         }
515 
516 
517         default: {
518             //           32 char x 17 line console "--------------------------------\n";
519             this->console_string                = "  **** RTZ 64 CONTEXT V12 ****  \n";
520             this->console_string               += "                                \n";
521             this->console_string               += "64K RAM SYSTEM  38911 BYTES FREE\n";
522             this->console_string               += "                                \n";
523             this->console_string               += "[TAB]:  TOGGLE RESOURCE OVERLAY \n";
524             this->console_string               += "                                \n";
525             this->console_string               += "[ESC]:        MENU              \n";
526             this->console_string               += "[LEFT CLICK]: TILE INFO/OPTIONS \n";
527             this->console_string               += "                                \n";
528             this->console_string               += "READY.                          ";
529 
530             break;
531         }
532     }
533 
534     return;
535 }   /* __setConsoleString() */
```

3.2.3.10 __setUpConsoleScreen()

```
void ContextMenu::__setUpConsoleScreen (
            void  )  [private]
```

Helper method to set up context menu console screen (drawable).

```
230 {
231     this->console_screen.setSize(sf::Vector2f(300, 340));
232     this->console_screen.setOrigin(300, 340);
233     this->console_screen.setPosition(
234         this->position_x - 50,
235         this->position_y + GAME_HEIGHT - 50
236     );
237     this->console_screen.setFillColor(MONOCHROME_SCREEN_BACKGROUND);
238 
239     return;
240 }   /* __setUpConsoleScreen() */
```

3.2.3.11 __setUpConsoleScreenFrame()

```
void ContextMenu::__setUpConsoleScreenFrame (
            void  )  [private]
```

Helper method to set up framing for context menu console screen (drawable).

```
255 {
256     int n_points = 4;
257 
258     //  1. top framing
259     this->console_screen_frame_top.setPointCount(n_points);
260 
261     this->console_screen_frame_top.setPoint(
262         0,
263         sf::Vector2f(
264             this->position_x - 50,
265             this->position_y + GAME_HEIGHT - 50 - 340
266         )
267     );
268     this->console_screen_frame_top.setPoint(
269         1,
270         sf::Vector2f(
271             this->position_x - 50 + 16,
272             this->position_y + GAME_HEIGHT - 50 - 340 - 16
273         )
274     );
275     this->console_screen_frame_top.setPoint(
276         2,
277         sf::Vector2f(
278             this->position_x - 350 - 16,
279             this->position_y + GAME_HEIGHT - 50 - 340 - 16
280         )
281     );
282     this->console_screen_frame_top.setPoint(
283         3,
284         sf::Vector2f(
285             this->position_x - 350,
286             this->position_y + GAME_HEIGHT - 50 - 340
287         )
288     );
289 
290     this->console_screen_frame_top.setFillColor(VISUAL_SCREEN_FRAME_GREY);
291 
292     this->console_screen_frame_top.setOutlineThickness(2);
293     this->console_screen_frame_top.setOutlineColor(sf::Color(0, 0, 0, 255));
294 
295     this->console_screen_frame_top.move(0, -2);
296 
297 
298     //  2. left framing
299     this->console_screen_frame_left.setPointCount(n_points);
300 
301     this->console_screen_frame_left.setPoint(
302         0,
303         sf::Vector2f(
304             this->position_x - 350,
305             this->position_y + GAME_HEIGHT - 50 - 340
```

```
306         )
307     );
308     this->console_screen_frame_left.setPoint(
309         1,
310         sf::Vector2f(
311             this->position_x - 350 - 16,
312             this->position_y + GAME_HEIGHT - 50 - 340 - 16
313         )
314     );
315     this->console_screen_frame_left.setPoint(
316         2,
317         sf::Vector2f(
318             this->position_x - 350 - 16,
319             this->position_y + GAME_HEIGHT - 50 + 16
320         )
321     );
322     this->console_screen_frame_left.setPoint(
323         3,
324         sf::Vector2f(
325             this->position_x - 350,
326             this->position_y + GAME_HEIGHT - 50
327         )
328     );
329 
330     this->console_screen_frame_left.setFillColor(VISUAL_SCREEN_FRAME_GREY);
331 
332     this->console_screen_frame_left.setOutlineThickness(2);
333     this->console_screen_frame_left.setOutlineColor(sf::Color(0, 0, 0, 255));
334 
335     this->console_screen_frame_left.move(-2, 0);
336 
337 
338     //  3. bottom framing
339     this->console_screen_frame_bottom.setPointCount(n_points);
340 
341     this->console_screen_frame_bottom.setPoint(
342         0,
343         sf::Vector2f(
344             this->position_x - 350,
345             this->position_y + GAME_HEIGHT - 50
346         )
347     );
348     this->console_screen_frame_bottom.setPoint(
349         1,
350         sf::Vector2f(
351             this->position_x - 350 - 16,
352             this->position_y + GAME_HEIGHT - 50 + 16
353         )
354     );
355     this->console_screen_frame_bottom.setPoint(
356         2,
357         sf::Vector2f(
358             this->position_x - 50 + 16,
359             this->position_y + GAME_HEIGHT - 50 + 16
360         )
361     );
362     this->console_screen_frame_bottom.setPoint(
363         3,
364         sf::Vector2f(
365             this->position_x - 50,
366             this->position_y + GAME_HEIGHT - 50
367         )
368     );
369 
370     this->console_screen_frame_bottom.setFillColor(VISUAL_SCREEN_FRAME_GREY);
371 
372     this->console_screen_frame_bottom.setOutlineThickness(2);
373     this->console_screen_frame_bottom.setOutlineColor(sf::Color(0, 0, 0, 255));
374 
375     this->console_screen_frame_bottom.move(0, 2);
376 
377 
378     //  4. right framing
379     this->console_screen_frame_right.setPointCount(n_points);
380 
381     this->console_screen_frame_right.setPoint(
382         0,
383         sf::Vector2f(
384             this->position_x - 50,
385             this->position_y + GAME_HEIGHT - 50
386         )
387     );
388     this->console_screen_frame_right.setPoint(
389         1,
390         sf::Vector2f(
391             this->position_x - 50 + 16,
392             this->position_y + GAME_HEIGHT - 50 + 16
```

```
393         )
394     );
395     this->console_screen_frame_right.setPoint(
396         2,
397         sf::Vector2f(
398             this->position_x - 50 + 16,
399             this->position_y + GAME_HEIGHT - 50 - 340 - 16
400         )
401     );
402     this->console_screen_frame_right.setPoint(
403         3,
404         sf::Vector2f(
405             this->position_x - 50,
406             this->position_y + GAME_HEIGHT - 50 - 340
407         )
408     );
409
410     this->console_screen_frame_right.setFillColor(VISUAL_SCREEN_FRAME_GREY);
411
412     this->console_screen_frame_right.setOutlineThickness(2);
413     this->console_screen_frame_right.setOutlineColor(sf::Color(0, 0, 0, 255));
414
415     this->console_screen_frame_right.move(2, 0);
416
417     return;
418 }   /* __setUpConsoleScreenFrame() */
```

3.2.3.12 __setUpMenuFrame()

```
void ContextMenu::__setUpMenuFrame (
            void  )  [private]
```

Helper method to set up context menu frame (drawable).

```
34 {
35     this->menu_frame.setSize(sf::Vector2f(400, GAME_HEIGHT));
36     this->menu_frame.setOrigin(400, 0);
37     this->menu_frame.setPosition(this->position_x, this->position_y);
38     this->menu_frame.setFillColor(MENU_FRAME_GREY);
39
40     return;
41 }   /* __setUpMenuFrame() */
```

3.2.3.13 __setUpVisualScreen()

```
void ContextMenu::__setUpVisualScreen (
            void  )  [private]
```

Helper method to set up context menu visual screen (drawable).

```
56 {
57     this->visual_screen.setSize(sf::Vector2f(300, 300));
58     this->visual_screen.setOrigin(300, 0);
59     this->visual_screen.setPosition(this->position_x - 50, this->position_y + 50);
60     this->visual_screen.setFillColor(MONOCHROME_SCREEN_BACKGROUND);
61
62     return;
63 }   /* __setUpVisualScreen() */
```

3.2.3.14 __setUpVisualScreenFrame()

```
void ContextMenu::__setUpVisualScreenFrame (
            void  )  [private]
```

Helper method to set up framing for context menu visual screen (drawable).

```
78 {
79     int n_points = 4;
80 
81     //  1. top framing
82     this->visual_screen_frame_top.setPointCount(n_points);
83 
84     this->visual_screen_frame_top.setPoint(
85         0,
86         sf::Vector2f(this->position_x - 50, this->position_y + 50)
87     );
88     this->visual_screen_frame_top.setPoint(
89         1,
90         sf::Vector2f(this->position_x - 50 + 16, this->position_y + 50 - 16)
91     );
92     this->visual_screen_frame_top.setPoint(
93         2,
94         sf::Vector2f(this->position_x - 350 - 16, this->position_y + 50 - 16)
95     );
96     this->visual_screen_frame_top.setPoint(
97         3,
98         sf::Vector2f(this->position_x - 350, this->position_y + 50)
99     );
100 
101     this->visual_screen_frame_top.setFillColor(VISUAL_SCREEN_FRAME_GREY);
102 
103     this->visual_screen_frame_top.setOutlineThickness(2);
104     this->visual_screen_frame_top.setOutlineColor(sf::Color(0, 0, 0, 255));
105 
106     this->visual_screen_frame_top.move(0, -2);
107 
108 
109     //  2. left framing
110     this->visual_screen_frame_left.setPointCount(n_points);
111 
112     this->visual_screen_frame_left.setPoint(
113         0,
114         sf::Vector2f(this->position_x - 350, this->position_y + 50)
115     );
116     this->visual_screen_frame_left.setPoint(
117         1,
118         sf::Vector2f(this->position_x - 350 - 16, this->position_y + 50 - 16)
119     );
120     this->visual_screen_frame_left.setPoint(
121         2,
122         sf::Vector2f(this->position_x - 350 - 16, this->position_y + 350 + 16)
123     );
124     this->visual_screen_frame_left.setPoint(
125         3,
126         sf::Vector2f(this->position_x - 350, this->position_y + 350)
127     );
128 
129     this->visual_screen_frame_left.setFillColor(VISUAL_SCREEN_FRAME_GREY);
130 
131     this->visual_screen_frame_left.setOutlineThickness(2);
132     this->visual_screen_frame_left.setOutlineColor(sf::Color(0, 0, 0, 255));
133 
134     this->visual_screen_frame_left.move(-2, 0);
135 
136 
137     //  3. bottom framing
138     this->visual_screen_frame_bottom.setPointCount(n_points);
139 
140     this->visual_screen_frame_bottom.setPoint(
141         0,
142         sf::Vector2f(this->position_x - 350, this->position_y + 350)
143     );
144     this->visual_screen_frame_bottom.setPoint(
145         1,
146         sf::Vector2f(this->position_x - 350 - 16, this->position_y + 350 + 16)
147     );
148     this->visual_screen_frame_bottom.setPoint(
149         2,
150         sf::Vector2f(this->position_x - 50 + 16, this->position_y + 350 + 16)
151     );
152     this->visual_screen_frame_bottom.setPoint(
153         3,
154         sf::Vector2f(this->position_x - 50, this->position_y + 350)
155     );
```

```
156
157     this->visual_screen_frame_bottom.setFillColor(VISUAL_SCREEN_FRAME_GREY);
158
159     this->visual_screen_frame_bottom.setOutlineThickness(2);
160     this->visual_screen_frame_bottom.setOutlineColor(sf::Color(0, 0, 0, 255));
161
162     this->visual_screen_frame_bottom.move(0, 2);
163
164
165     //  4. right framing
166     this->visual_screen_frame_right.setPointCount(n_points);
167
168     this->visual_screen_frame_right.setPoint(
169         0,
170         sf::Vector2f(this->position_x - 50, this->position_y + 350)
171     );
172     this->visual_screen_frame_right.setPoint(
173         1,
174         sf::Vector2f(this->position_x - 50 + 16, this->position_y + 350 + 16)
175     );
176     this->visual_screen_frame_right.setPoint(
177         2,
178         sf::Vector2f(this->position_x - 50 + 16, this->position_y + 50 - 16)
179     );
180     this->visual_screen_frame_right.setPoint(
181         3,
182         sf::Vector2f(this->position_x - 50, this->position_y + 50)
183     );
184
185     this->visual_screen_frame_right.setFillColor(VISUAL_SCREEN_FRAME_GREY);
186
187     this->visual_screen_frame_right.setOutlineThickness(2);
188     this->visual_screen_frame_right.setOutlineColor(sf::Color(0, 0, 0, 255));
189
190     this->visual_screen_frame_right.move(2, 0);
191
192     return;
193 }   /* __setUpVisualScreenFrame() */
```

3.2.3.15 draw()

```
void ContextMenu::draw (
            void  )
```

Method to draw the hex tile to the render window. To be called once per frame.

```
922 {
923     //  1. menu frame
924     this->render_window_ptr->draw(this->menu_frame);
925
926     //  2. visual screen
927     this->render_window_ptr->draw(this->visual_screen);
928     this->__drawVisualScreenFrame();
929
930     //  3. console screen
931     this->render_window_ptr->draw(this->console_screen);
932     this->__drawConsoleScreenFrame();
933     this->__drawConsoleText();
934
935     this->frame++;
936     return;
937 }   /* draw() */
```

3.2.3.16 processEvent()

```
void ContextMenu::processEvent (
            void  )
```

Method to processEvent ContextMenu. To be called once per event.

```
828 {
```

```
829     if (this->event_ptr->type == sf::Event::KeyPressed) {
830         this->__handleKeyPressEvents();
831     }
832 
833     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
834         this->__handleMouseButtonEvents();
835     }
836 
837     return;
838 }   /* processEvent() */
```

3.2.3.17 processMessage()

```
void ContextMenu::processMessage (
            void  )
```

Method to processMessage ContextMenu. To be called once per message.

```
853 {
854     switch (this->console_state) {
855         case (ConsoleState :: TILE): {
856             //  process no tile selected
857             if (not this->message_hub_ptr->isEmpty(NO_TILE_SELECTED_CHANNEL)) {
858                 Message no_tile_selected_message = this->message_hub_ptr->receiveMessage(
859                     NO_TILE_SELECTED_CHANNEL
860                 );
861 
862                 if (no_tile_selected_message.subject == "no tile selected") {
863                     this->__setConsoleState(ConsoleState :: READY);
864                     this->message_hub_ptr->popMessage(NO_TILE_SELECTED_CHANNEL);
865                 }
866             }
867 
868             //  process tile state
869             if (not this->message_hub_ptr->isEmpty(TILE_STATE_CHANNEL)) {
870                 Message tile_state_message = this->message_hub_ptr->receiveMessage(
871                     TILE_STATE_CHANNEL
872                 );
873 
874                 if (tile_state_message.subject == "tile state") {
875                     this->console_string = tile_state_message.string_payload;
876                     this->message_hub_ptr->popMessage(TILE_STATE_CHANNEL);
877                 }
878             }
879 
880             //  process tile selected (subsequent left clicks causing program to hang)
881             if (not this->message_hub_ptr->isEmpty(TILE_SELECTED_CHANNEL)) {
882                 this->message_hub_ptr->popMessage(TILE_SELECTED_CHANNEL);
883             }
884 
885             break;
886         }
887 
888         default: {
889             //  process tile selected
890             if (not this->message_hub_ptr->isEmpty(TILE_SELECTED_CHANNEL)) {
891                 Message tile_selected_message = this->message_hub_ptr->receiveMessage(
892                     TILE_SELECTED_CHANNEL
893                 );
894 
895                 if (tile_selected_message.subject == "tile selected") {
896                     this->__setConsoleState(ConsoleState :: TILE);
897                     this->message_hub_ptr->popMessage(TILE_SELECTED_CHANNEL);
898                 }
899             }
900 
901             break;
902         }
903     }
904 
905     return;
906 }   /* processMessage() */
```

3.2.4 Member Data Documentation

3.2.4.1 assets_manager_ptr

```
AssetsManager* ContextMenu::assets_manager_ptr  [private]
```

A pointer to the assets manager.

3.2.4.2 console_screen

```
sf::RectangleShape ContextMenu::console_screen
```

The context menu console screen (for animated text output).

3.2.4.3 console_screen_frame_bottom

```
sf::ConvexShape ContextMenu::console_screen_frame_bottom
```

The bottom framing of the console screen.

3.2.4.4 console_screen_frame_left

```
sf::ConvexShape ContextMenu::console_screen_frame_left
```

The left framing of the console screen.

3.2.4.5 console_screen_frame_right

```
sf::ConvexShape ContextMenu::console_screen_frame_right
```

The right framing of the console screen.

3.2.4.6 console_screen_frame_top

```
sf::ConvexShape ContextMenu::console_screen_frame_top
```

The top framing of the console screen.

3.2.4.7 console_state

```
ConsoleState ContextMenu::console_state
```

The current state of the console screen.

3.2.4.8 console_string

```
std::string ContextMenu::console_string
```

The string to be printed to the console screen.

3.2.4.9 event_ptr

```
sf::Event* ContextMenu::event_ptr  [private]
```

A pointer to the event class.

3.2.4.10 frame

```
int ContextMenu::frame
```

The current frame of this object.

3.2.4.11 game_menu_up

```
bool ContextMenu::game_menu_up
```

Indicates whether or not the game menu is up.

3.2.4.12 menu_frame

```
sf::RectangleShape ContextMenu::menu_frame
```

The frame of the context menu.

3.2.4.13 message_hub_ptr

```
MessageHub* ContextMenu::message_hub_ptr  [private]
```

A pointer to the message hub.

3.2.4.14 position_x

```
double ContextMenu::position_x
```

The position of the object.

3.2.4.15 position_y

```
double ContextMenu::position_y
```

The position of the object.

3.2.4.16 render_window_ptr

```
sf::RenderWindow* ContextMenu::render_window_ptr  [private]
```

A pointer to the render window.

3.2.4.17 visual_screen

```
sf::RectangleShape ContextMenu::visual_screen
```

The context menu screen for visuals.

3.2.4.18 visual_screen_frame_bottom

```
sf::ConvexShape ContextMenu::visual_screen_frame_bottom
```

The bottom framing of the visual screen.

3.2.4.19 visual_screen_frame_left

```
sf::ConvexShape ContextMenu::visual_screen_frame_left
```

The left framing of the visual screen.

3.2.4.20 visual_screen_frame_right

```
sf::ConvexShape ContextMenu::visual_screen_frame_right
```

The right framing of the visual screen.

3.2.4.21 visual_screen_frame_top

```
sf::ConvexShape ContextMenu::visual_screen_frame_top
```

The top framing of the visual screen.

The documentation for this class was generated from the following files:

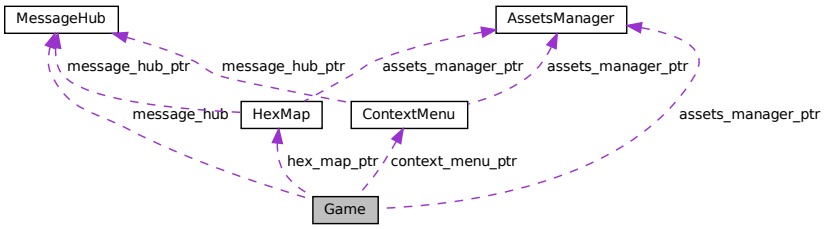
- header/ContextMenu.h
- source/ContextMenu.cpp

3.3 Game Class Reference

A class which acts as the central class for the game, by containing all other classes and implementing the game loop.

```
#include <Game.h>
```

Collaboration diagram for Game:



Public Member Functions

- Game (sf::RenderWindow *, AssetsManager *)

  Constructor for the Game class.
- bool run (void)

  Method to run game (defines game loop).
- ~Game (void)

  Destructor for the Game class.

Public Attributes

- bool quit_game

  Boolean indicating whether to quit (true) or create a new Game instance (false).
- bool game_loop_broken

  Boolean indicating whether or not the game loop is broken.
- bool show_frame_clock_overlay

  Boolean indicating whether or not to show frame and clock overlay.
- unsigned long long int frame

  The current frame of the game.
- double time_since_start_s

  The time elapsed [s] since the start of the game.
- unsigned int year

  Current game year.
- unsigned int month

  Current game month.
- unsigned int population

  Current population.
- unsigned int credits

  Current balance of credits.
- unsigned int demand_MWh

  Current energy demand [MWh].
- unsigned int cumulative_emissions_tonnes

  Cumulative emissions [tonnes] (1 tonne = 1000 kg).
- sf::Clock clock

  The game clock.
- sf::Event event

  The game events class.
- MessageHub message_hub

  The message hub (for inter-object message traffic).
- HexMap * hex_map_ptr

  Pointer to the hex map (defines game world).
- ContextMenu * context_menu_ptr

  Pointer to the context menu.

Private Member Functions

- void __toggleFrameClockOverlay (void)

  Helper method to toggle frame clock overlay.
- void __handleKeyPressEvents (void)

  Helper method to handle key press events.
- void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.
- void __processEvent (void)

  Helper method to process Game. To be called once per event.
- void __processMessage (void)

  Helper method to process Game. To be called once per message.
- void __drawFrameClockOverlay (void)

  Helper method to draw frame clock overlay.
- void __drawHUD (void)

  Helper method to heads-up display (HUD).
- void __draw (void)

  Helper method to draw game to the render window. To be called once per frame.

Private Attributes

- sf::RenderWindow * render_window_ptr

  A pointer to the render window.
- AssetsManager * assets_manager_ptr

  A pointer to the assets manager.

3.3.1 Detailed Description

A class which acts as the central class for the game, by containing all other classes and implementing the game loop.

3.3.2 Constructor & Destructor Documentation

3.3.2.1 Game()

```
Game::Game (
            sf::RenderWindow * render_window_ptr,
            AssetsManager * assets_manager_ptr )
```

Constructor for the Game class.

```
341 {
342     //  1. set attributes
343
344     //  1.1. private
345     this->render_window_ptr = render_window_ptr;
346
347     this->assets_manager_ptr = assets_manager_ptr;
348
349     //  1.2. public
350     this->quit_game = false;
```

```
351     this->game_loop_broken = false;
352     this->show_frame_clock_overlay = false;
353 
354     this->frame = 0;
355     this->time_since_start_s = 0;
356 
357     double seconds_since_epoch = time(NULL);
358     double years_since_epoch = seconds_since_epoch / SECONDS_PER_YEAR;
359 
360     this->year = 1970 + (int)years_since_epoch;
361     this->month = (years_since_epoch - (int)years_since_epoch) * 12 + 1;
362 
363     this->population = 0;
364     this->credits = 0;
365     this->demand_MWh = 0;
366     this->cumulative_emissions_tonnes = 0;
367 
368     this->hex_map_ptr = new HexMap(
369         6,
370         &(this->event),
371         this->render_window_ptr,
372         this->assets_manager_ptr,
373         &(this->message_hub)
374     );
375 
376     this->context_menu_ptr = new ContextMenu(
377         &(this->event),
378         this->render_window_ptr,
379         this->assets_manager_ptr,
380         &(this->message_hub)
381     );
382 
383     //  2. add message channel(s)
384     this->message_hub.addChannel(GAME_CHANNEL);
385 
386     std::cout << "Game constructed at " << this << std::endl;
387 
388     return;
389 }   /* Game() */
```

3.3.2.2 ~Game()

```
Game::~Game (
            void  )
```

Destructor for the Game class.

```
466 {
467     //  1. clean up attributes
468     delete this->hex_map_ptr;
469     delete this->context_menu_ptr;
470 
471     std::cout << "Game at " << this << " destroyed" << std::endl;
472 
473     return;
474 }   /* ~Game() */
```

3.3.3 Member Function Documentation

3.3.3.1 __draw()

```
void Game::__draw (
            void  )  [private]
```

Helper method to draw game to the render window. To be called once per frame.

```
308 {
```

```
309     this->__drawHUD();
310
311     if (this->show_frame_clock_overlay) {
312         this->__drawFrameClockOverlay();
313     }
314
315     return;
316 }   /* draw() */
```

3.3.3.2 __drawFrameClockOverlay()

```
void Game::__drawFrameClockOverlay (
            void  )  [private]
```

Helper method to draw frame clock overlay.

```
200 {
201     std::string frame_clock_string = "FRAME: ";
202     frame_clock_string += std::to_string(this->frame);
203     frame_clock_string += "\nTIME SINCE START [s]: ";
204     frame_clock_string += std::to_string(this->time_since_start_s);
205
206     sf::Text frame_clock_text(
207         frame_clock_string,
208         *(this->assets_manager_ptr->getFont("DroidSansMono")),
209         16
210     );
211
212     sf::RectangleShape frame_clock_backing(
213         sf::Vector2f(
214             1.02 * frame_clock_text.getLocalBounds().width,
215             1.20 * frame_clock_text.getLocalBounds().height
216         )
217     );
218     frame_clock_backing.setFillColor(sf::Color(0, 0, 0, 255));
219
220     this->render_window_ptr->draw(frame_clock_backing);
221     this->render_window_ptr->draw(frame_clock_text);
222
223     return;
224 }   /* __drawFrameClockOverlay() */
```

3.3.3.3 __drawHUD()

```
void Game::__drawHUD (
            void  )  [private]
```

Helper method to heads-up display (HUD).

```
239 {
240     //  1. first line
241     std::string HUD_string = "YEAR: ";
242     HUD_string += std::to_string(this->year);
243
244     HUD_string += "    MONTH: ";
245     HUD_string += std::to_string(this->month);
246
247     HUD_string += "    POPULATION: ";
248     HUD_string += std::to_string(this->population);
249
250     HUD_string += "    CREDITS: ";
251     HUD_string += std::to_string(this->credits);
252     HUD_string += " K";
253
254     HUD_string += "    CURRENT DEMAND: ";
255     HUD_string += std::to_string(this->demand_MWh);
256     HUD_string += " MWh";
257
258     sf::Text HUD_text(
259         HUD_string,
260         *(this->assets_manager_ptr->getFont("Glass_TTY_VT220")),
```

```
261         16
262     );
263
264     HUD_text.setPosition(
265         (800 - HUD_text.getLocalBounds().width) / 2,
266         8
267     );
268
269     HUD_text.setFillColor(MONOCHROME_TEXT_GREEN);
270
271     this->render_window_ptr->draw(HUD_text);
272
273
274     //  2. second line
275     HUD_string = "CUMULATIVE EMISSIONS: ";
276     HUD_string += std::to_string(this->cumulative_emissions_tonnes);
277     HUD_string += " tonnes (CO2e)";
278
279     HUD_string += "    LIFETIME LIMIT: ";
280     HUD_string += std::to_string(EMISSIONS_LIFETIME_LIMIT_TONNES);
281     HUD_string += " tonnes (CO2e)";
282
283     HUD_text.setString(HUD_string);
284
285     HUD_text.setPosition(
286         (800 - HUD_text.getLocalBounds().width) / 2,
287         35
288     );
289
290     this->render_window_ptr->draw(HUD_text);
291
292     return;
293 }   /* __drawHUD() */
```

3.3.3.4 __handleKeyPressEvents()

```
void Game::__handleKeyPressEvents (
            void  )  [private]
```

Helper method to handle key press events.

```
59 {
60     switch (this->event.key.code) {
61         case (sf::Keyboard::Tilde): {
62             this->__toggleFrameClockOverlay();
63
64             break;
65         }
66
67
68         case (sf::Keyboard::Tab): {
69             this->hex_map_ptr->toggleResourceOverlay();
70
71             break;
72         }
73
74
75         default: {
76             // do nothing!
77
78             break;
79         }
80     }
81
82     return;
83 }   /* __handleKeyPressEvents() */
```

3.3.3.5 __handleMouseButtonEvents()

```
void Game::__handleMouseButtonEvents (
            void  )  [private]
```

Helper method to handle mouse button events.

```
98 {
99     switch (this->event.mouseButton.button) {
100         case (sf::Mouse::Left): {
101             //...
102 
103             break;
104         }
105 
106 
107         case (sf::Mouse::Right): {
108             //...
109 
110             break;
111         }
112 
113 
114         default: {
115             // do nothing!
116 
117             break;
118         }
119     }
120 
121     return;
122 }   /* __handleMouseButtonEvents() */
```

3.3.3.6 __processEvent()

```
void Game::__processEvent (
              void  )  [private]
```

Helper method to process Game. To be called once per event.

```
138 {
139     if (this->event.type == sf::Event::Closed) {
140         this->quit_game = true;
141         this->game_loop_broken = true;
142     }
143 
144     if (this->event.type == sf::Event::KeyPressed) {
145         this->__handleKeyPressEvents();
146     }
147 
148     if (this->event.type == sf::Event::MouseButtonPressed) {
149         this->__handleMouseButtonEvents();
150     }
151 
152     return;
153 }   /* __processEvent() */
```

3.3.3.7 __processMessage()

```
void Game::__processMessage (
              void  )  [private]
```

Helper method to process Game. To be called once per message.

```
168 {
169     if (not this->message_hub.isEmpty(GAME_CHANNEL)) {
170         Message game_channel_message = this->message_hub.receiveMessage(GAME_CHANNEL);
171 
172         if (game_channel_message.subject == "quit game") {
173             this->quit_game = true;
174             this->game_loop_broken = true;
175             this->message_hub.popMessage(GAME_CHANNEL);
176         }
177 
178         if (game_channel_message.subject == "restart game") {
179             this->game_loop_broken = true;
180             this->message_hub.popMessage(GAME_CHANNEL);
181         }
182     }
183 
184     return;
185 }   /* __processMessage() */
```

3.3.3.8 __toggleFrameClockOverlay()

```
void Game::__toggleFrameClockOverlay (
            void  )  [private]
```

Helper method to toggle frame clock overlay.

```
34 {
35     if (this->show_frame_clock_overlay) {
36         this->show_frame_clock_overlay = false;
37     }
38
39     else {
40         this->show_frame_clock_overlay = true;
41     }
42
43     return;
44 }   /* __toggleFrameClockOverlay() */
```

3.3.3.9 run()

```
bool Game::run (
            void  )
```

Method to run game (defines game loop).

Returns

Boolean indicating whether to quit (true) or create a new Game instance (false).

```
407 {
408     //  1. play brand animation
409     //...
410
411     //  2. show splash screen
412     //...
413
414     //  3. start game loop
415     while (not this->game_loop_broken) {
416         this->time_since_start_s = this->clock.getElapsedTime().asSeconds();
417
418         if (this->time_since_start_s >= (this->frame + 1) * SECONDS_PER_FRAME) {
419             //  6.1. process events
420             while (this->render_window_ptr->pollEvent(this->event)) {
421                 this->hex_map_ptr->processEvent();
422                 this->context_menu_ptr->processEvent();
423                 this->__processEvent();
424             }
425
426
427             //  6.2. process messages
428             while (this->message_hub.hasTraffic()) {
429                 this->hex_map_ptr->processMessage();
430                 this->context_menu_ptr->processMessage();
431                 this->__processMessage();
432             }
433
434
435             //  6.3. draw frame
436             this->render_window_ptr->clear();
437
438             this->hex_map_ptr->draw();
439             this->context_menu_ptr->draw();
440             this->__draw();
441
442             this->render_window_ptr->display();
443
444
445             //  6.4. increment frame
446             this->frame++;
447         }
448     }
449
450     return this->quit_game;
451 }   /* run() */
```

3.3.4 Member Data Documentation

3.3.4.1 assets_manager_ptr

```
AssetsManager* Game::assets_manager_ptr  [private]
```

A pointer to the assets manager.

3.3.4.2 clock

```
sf::Clock Game::clock
```

The game clock.

3.3.4.3 context_menu_ptr

```
ContextMenu* Game::context_menu_ptr
```

Pointer to the context menu.

3.3.4.4 credits

```
unsigned int Game::credits
```

Current balance of credits.

3.3.4.5 cumulative_emissions_tonnes

```
unsigned int Game::cumulative_emissions_tonnes
```

Cumulative emissions [tonnes] (1 tonne = 1000 kg).

3.3.4.6 demand_MWh

```
unsigned int Game::demand_MWh
```

Current energy demand [MWh].

3.3.4.7 event

```
sf::Event Game::event
```

The game events class.

3.3.4.8 frame

```
unsigned long long int Game::frame
```

The current frame of the game.

3.3.4.9 game_loop_broken

```
bool Game::game_loop_broken
```

Boolean indicating whether or not the game loop is broken.

3.3.4.10 hex_map_ptr

```
HexMap* Game::hex_map_ptr
```

Pointer to the hex map (defines game world).

3.3.4.11 message_hub

```
MessageHub Game::message_hub
```

The message hub (for inter-object message traffic).

3.3.4.12 month

```
unsigned int Game::month
```

Current game month.

3.3.4.13 population

```
unsigned int Game::population
```

Current population.

3.3.4.14 quit_game

```
bool Game::quit_game
```

Boolean indicating whether to quit (true) or create a new Game instance (false).

3.3.4.15 render_window_ptr

```
sf::RenderWindow* Game::render_window_ptr  [private]
```

A pointer to the render window.

3.3.4.16 show_frame_clock_overlay

```
bool Game::show_frame_clock_overlay
```

Boolean indicating whether or not to show frame and clock overlay.

3.3.4.17 time_since_start_s

```
double Game::time_since_start_s
```

The time elapsed [s] since the start of the game.

3.3.4.18 year

```
unsigned int Game::year
```

Current game year.

The documentation for this class was generated from the following files:

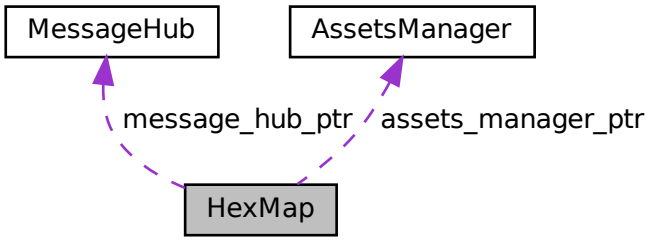
- header/Game.h
- source/Game.cpp

3.4 HexMap Class Reference

A class which defines a hex map of hex tiles.

```
#include <HexMap.h>
```

Collaboration diagram for HexMap:



Public Member Functions

- HexMap (int, sf::Event ∗, sf::RenderWindow ∗, AssetsManager ∗, MessageHub ∗)
  Constructor (intended) for the HexMap class.
- void assess (void)
  Method to assess the resource of the selected tile.
- void reroll (void)
  Method to re-roll the hex map.
- void toggleResourceOverlay (void)
  Method to toggle the hex map resource overlay.
- void processEvent (void)
  Method to process HexMap. To be called once per event.
- void processMessage (void)
  Method to process HexMap. To be called once per message.
- void draw (void)
  Method to draw the hex map to the render window. To be called once per frame.
- void clear (void)
  Method to clear the hex map.
- ∼HexMap (void)
  Destructor for the HexMap class.

Public Attributes

- bool tile_selected

  A boolean which indicates if a tile is currently selected.
- int n_layers

  The number of layers in the hex map.
- int n_tiles

  The number of tiles in the hex map.
- int frame

  The current frame of this object.
- double position_x

  The x position of the hex map's origin (i.e. central) tile.
- double position_y

  The y position of the hex map's origin (i.e. central) tile.
- sf::RectangleShape glass_screen

  To give the effect of an old glass screen over the hex map.
- std::vector< double > tile_position_x_vec

  A vector of tile x positions.
- std::vector< double > tile_position_y_vec

  A vector of tile y position.
- std::vector< HexTile * > border_tiles_vec

  A vector of pointers to the border tiles.
- std::map< double, std::map< double, HexTile * > > hex_map

  A position-indexed, nested map of hex tiles.
- std::vector< HexTile * > hex_draw_order_vec

  A vector of hex tiles, in drawing order.

Private Member Functions

- void __setUpGlassScreen (void)

  Helper method to set up glass screen effect (drawable).
- void __layTiles (void)

  Helper method to lay the hex tiles down to generate the game world.
- void __buildDrawOrderVector (void)

  Helper method to build tile drawing order vector.
- std::vector< double > __getNoise (int, int=128)

  Helper method to generate a vector of noise, with values mapped to the closed interval [0, 1]. Applies a random cosine series approach.
- void __procedurallyGenerateTileTypes (void)

  Helper method to procedurally generate tile types and set tiles accordingly.
- std::vector< double > __getValidMapIndexPositions (double, double)

  Helper method to translate given position into valid index position for a.
- std::vector< HexTile * > __getNeighboursVector (HexTile *)

  Helper method to assemble a vector pointers to all neighbours of the given tile.
- TileType __getMajorityTileType (HexTile *)

  Function to return majority tile type of a tile and its neighbours. If no clear majority, simply returns the type of the given tile.
- void __smoothTileTypes (void)

  Helper method to smooth tile types using a majority rules approach.
- bool __isLakeTouchingOcean (HexTile *)
- void __enforceOceanContinuity (void)

Helper method to scan tiles and enforce ocean continuity. That is to say, if a lake tile is found to be in contact with an ocean tile, then it becomes ocean.

- void __procedurallyGenerateTileResources (void)

  Helper method to procedurally generate tile resources and set tiles accordingly.
- void __assembleHexMap (void)

  Helper method to assemble the hex map.
- HexTile * __getSelectedTile (void)

  Helper method to get pointer to selected tile.
- void __handleKeyPressEvents (void)

  Helper method to handle key press events.
- void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.
- void __sendNoTileSelectedMessage (void)

  Helper method to format and send message on no tile selected.

Private Attributes

- sf::Event * event_ptr

  A pointer to the event class.
- sf::RenderWindow * render_window_ptr

  A pointer to the render window.
- AssetsManager * assets_manager_ptr

  A pointer to the assets manager.
- MessageHub * message_hub_ptr

  A pointer to the message hub.

3.4.1 Detailed Description

A class which defines a hex map of hex tiles.

3.4.2 Constructor & Destructor Documentation

3.4.2.1 HexMap()

```
HexMap::HexMap (
            int n_layers,
            sf::Event * event_ptr,
            sf::RenderWindow * render_window_ptr,
            AssetsManager * assets_manager_ptr,
            MessageHub * message_hub_ptr )
```

Constructor (intended) for the HexMap class.

Parameters

n_layers	The number of layers in the HexMap.
event_ptr	Pointer to the event class.
render_window_ptr	Pointer to the render window.
assets_manager_ptr	Pointer to the assets manager.
message_hub_ptr	Pointer to the message hub.

```
1056 {
1057     //  1. set attributes
1058
1059     //  1.1. private
1060     this->event_ptr = event_ptr;
1061     this->render_window_ptr = render_window_ptr;
1062
1063     this->assets_manager_ptr = assets_manager_ptr;
1064     this->message_hub_ptr = message_hub_ptr;
1065
1066     //  1.2. public
1067     this->tile_selected = false;
1068
1069     this->frame = 0;
1070
1071     this->n_layers = n_layers;
1072     if (this->n_layers < 0) {
1073         this->n_layers = 0;
1074     }
1075
1076     this->position_x = 400;
1077     this->position_y = 400;
1078
1079     //  2. assemble n layer hex map
1080     this->__assembleHexMap();
1081
1082     //  3. set up and position drawable attributes
1083     this->__setUpGlassScreen();
1084
1085     //  4. add message channel(s)
1086     this->message_hub_ptr->addChannel(TILE_SELECTED_CHANNEL);
1087     this->message_hub_ptr->addChannel(NO_TILE_SELECTED_CHANNEL);
1088     this->message_hub_ptr->addChannel(TILE_STATE_CHANNEL);
1089
1090     std::cout << "HexMap constructed at " << this << std::endl;
1091
1092     return;
1093 }   /* HexMap(), intended */
```

3.4.2.2 ~HexMap()

```
HexMap::~HexMap (
            void  )
```

Destructor for the HexMap class.

```
1345 {
1346     this->clear();
1347
1348     std::cout << "HexMap at " << this << " destroyed" << std::endl;
1349
1350     return;
1351 }   /* ~HexMap() */
```

3.4.3 Member Function Documentation

3.4.3.1 __assembleHexMap()

```
void HexMap::__assembleHexMap (
            void  )  [private]
```

Helper method to assemble the hex map.

```
841 {
842     //  1. seed RNG (using milliseconds since 1 Jan 1970)
843     unsigned long long int milliseconds_since_epoch =
844         std::chrono::duration_cast<std::chrono::milliseconds>(
```

```
845             std::chrono::system_clock::now().time_since_epoch()
846         ).count();
847     srand(milliseconds_since_epoch);
848 
849     //  2. lay tiles
850     this->__layTiles();
851     this->__buildDrawOrderVector();
852 
853     //  3. procedurally generate types
854     this->__procedurallyGenerateTileTypes();
855 
856     //  4. procedurally generate resources
857     this->__procedurallyGenerateTileResources();
858 
859     return;
860 }   /* __assembleHexMap() */
```

3.4.3.2 __buildDrawOrderVector()

```
void HexMap::__buildDrawOrderVector (
             void  )  [private]
```

Helper method to build tile drawing order vector.

```
239 {
240     //  1. build temp list of tiles
241     std::list<HexTile*> temp_list;
242 
243     std::map<double, std::map<double, HexTile*>::iterator hex_map_iter_x;
244     std::map<double, HexTile*>::iterator hex_map_iter_y;
245     for (
246         hex_map_iter_x = this->hex_map.begin();
247         hex_map_iter_x != this->hex_map.end();
248         hex_map_iter_x++
249     ) {
250         for (
251             hex_map_iter_y = hex_map_iter_x->second.begin();
252             hex_map_iter_y != hex_map_iter_x->second.end();
253             hex_map_iter_y++
254         ) {
255             temp_list.push_back(hex_map_iter_y->second);
256         }
257     }
258 
259     //  2. move elements from temp list to drawing order vector
260     double min_position_y = 0;
261     std::list<HexTile*>::iterator list_iter;
262 
263     while (not temp_list.empty()) {
264         //  2.1. determine min y position
265         min_position_y = std::numeric_limits<double>::infinity();
266 
267         for (
268             list_iter = temp_list.begin();
269             list_iter != temp_list.end();
270             list_iter++
271         ) {
272             if ((*list_iter)->position_y < min_position_y) {
273                 min_position_y = (*list_iter)->position_y;
274             }
275         }
276 
277         //  2.2 move min y list elements to drawing order vec
278         list_iter = temp_list.begin();
279         while (list_iter != temp_list.end()) {
280             if ((*list_iter)->position_y == min_position_y) {
281                 this->hex_draw_order_vec.push_back((*list_iter));
282                 list_iter = temp_list.erase(list_iter);
283             }
284 
285             else {
286                 list_iter++;
287             }
288         }
289     }
290 
291     return;
292 }   /* __buildDrawOrderVector() */
```

3.4.3.3 __enforceOceanContinuity()

```
void HexMap::__enforceOceanContinuity (
            void  )  [private]
```

Helper method to scan tiles and enforce ocean continuity. That is to say, if a lake tile is found to be in contact with an ocean tile, then it becomes ocean.

```
752 {
753     std::cout « "enforcing ocean continuity ..." « std::endl;
754 
755     bool tile_changed = false;
756 
757     //  1. scan tiles and enforce (where appropriate)
758     std::map<double, std::map<double, HexTile*»::iterator hex_map_iter_x;
759     std::map<double, HexTile*>::iterator hex_map_iter_y;
760     HexTile* hex_ptr;
761     for (
762         hex_map_iter_x = this->hex_map.begin();
763         hex_map_iter_x != this->hex_map.end();
764         hex_map_iter_x++
765     ) {
766         for (
767             hex_map_iter_y = hex_map_iter_x->second.begin();
768             hex_map_iter_y != hex_map_iter_x->second.end();
769             hex_map_iter_y++
770         ) {
771             hex_ptr = hex_map_iter_y->second;
772 
773             if (this->__isLakeTouchingOcean(hex_ptr)) {
774                 hex_ptr->setTileType(TileType :: OCEAN);
775                 tile_changed = true;
776             }
777         }
778     }
779 
780     if (tile_changed) {
781         this->__enforceOceanContinuity();
782     }
783     else {
784         return;
785     }
786 }   /* __enforceOceanContinuity() */
```

3.4.3.4 __getMajorityTileType()

```
TileType HexMap::__getMajorityTileType (
            HexTile * hex_ptr )  [private]
```

Function to return majority tile type of a tile and its neighbours. If no clear majority, simply returns the type of the given tile.

Parameters

hex_ptr	Pointer to the given tile.

Returns

The majority tile type of the tile and its neighbours. If no clear majority type, then the type of the given tile is simply returned.

```
608 {
609     //  1. init type count map
610     std::map<TileType, int> type_count_map;
611     type_count_map[hex_ptr->tile_type] = 1;
612 
613     //  2. survey neighbours, count type instances
```

```
614     std::vector<HexTile*> neighbours_vec = this->__getNeighboursVector(hex_ptr);
615
616     for (size_t i = 0; i < neighbours_vec.size(); i++) {
617         if (type_count_map.count(neighbours_vec[i]->tile_type) <= 0) {
618             type_count_map[neighbours_vec[i]->tile_type] = 1;
619         }
620         else {
621             type_count_map[neighbours_vec[i]->tile_type] += 1;
622         }
623     }
624
625     //  3. find majority tile type
626     int max_count = -1 * std::numeric_limits<int>::infinity();
627     TileType majority_tile_type = hex_ptr->tile_type;
628
629     std::map<TileType, int>::iterator map_iter;
630     for (
631         map_iter = type_count_map.begin();
632         map_iter != type_count_map.end();
633         map_iter++
634     ){
635         if (map_iter->second > max_count) {
636             max_count = map_iter->second;
637             majority_tile_type = map_iter->first;
638         }
639     }
640
641     //  4. detect ties
642     for (
643         map_iter = type_count_map.begin();
644         map_iter != type_count_map.end();
645         map_iter++
646     ){
647         if (
648             map_iter->second == max_count and
649             map_iter->first != majority_tile_type
650         ) {
651             majority_tile_type = hex_ptr->tile_type;
652             break;
653         }
654     }
655
656     return majority_tile_type;
657 }   /* __getMajorityTileType() */
```

3.4.3.5 __getNeighboursVector()

```
std::vector< HexTile * > HexMap::__getNeighboursVector (
            HexTile * hex_ptr )  [private]
```

Helper method to assemble a vector pointers to all neighbours of the given tile.

Parameters

hex_ptr	A pointer to the given tile.

Returns

A vector of pointers to all neighbours of the given tile.

```
550 {
551     std::vector<HexTile*> neighbours_vec;
552
553     //  1. build potential neighbour positions
554     std::vector<double> potential_neighbour_x_vec(6, 0);
555     std::vector<double> potential_neighbour_y_vec(6, 0);
556
557     for (int i = 0; i < 6; i++) {
558         potential_neighbour_x_vec[i] = hex_ptr->position_x +
559             2 * hex_ptr->minor_radius * cos((60 * i) * (M_PI / 180));
560
561         potential_neighbour_y_vec[i] = hex_ptr->position_y +
```

```
562             2 * hex_ptr->minor_radius * sin((60 * i) * (M_PI / 180));
563     }
564
565     //  2. populate neighbours vector
566     std::vector<double> map_index_positions;
567     double potential_x = 0;
568     double potential_y = 0;
569
570     for (int i = 0; i < 6; i++) {
571         potential_x = potential_neighbour_x_vec[i];
572         potential_y = potential_neighbour_y_vec[i];
573
574         map_index_positions = this->__getValidMapIndexPositions(
575             potential_x,
576             potential_y
577         );
578
579         if (not (map_index_positions[0] == -1)) {
580             neighbours_vec.push_back(
581                 this->hex_map[map_index_positions[0]][map_index_positions[1]]
582             );
583         }
584     }
585
586     return neighbours_vec;
587 }   /* __getNeighbourVector() */
```

3.4.3.6 __getNoise()

```
std::vector< double > HexMap::__getNoise (
            int n_elements,
            int n_components = 128 )  [private]
```

Helper method to generate a vector of noise, with values mapped to the closed interval [0, 1]. Applies a random cosine series approach.

Parameters

n_elements	The number of elements in the generated noise vector.
n_components	The number of components to use in the random cosine series. Defaults to 64.

Returns

A vector of noise, with values mapped to the closed interval [0, 1].

```
315 {
316     //  1. generate random amplitude, wave number, direction, and phase vectors
317     std::vector<double> random_amplitude_vec(n_components, 0);
318     std::vector<double> random_wave_number_vec(n_components, 0);
319     std::vector<double> random_frequency_vec(n_components, 0);
320     std::vector<double> random_direction_vec(n_components, 0);
321     std::vector<double> random_phase_vec(n_components, 0);
322
323     for (int i = 0; i < n_components; i++) {
324         random_amplitude_vec[i] = 10 * ((double)rand() / RAND_MAX);
325
326         random_wave_number_vec[i] = 2 * M_PI * ((double)rand() / RAND_MAX);
327
328         random_frequency_vec[i] = ((double)rand() / RAND_MAX);
329
330         random_direction_vec[i] = 2 * M_PI * ((double)rand() / RAND_MAX);
331
332         random_phase_vec[i] = 2 * M_PI * ((double)rand() / RAND_MAX);
333     }
334
335     //  2. generate noise vec
336     double amp = 0;
337     double wave_no = 0;
338     double freq = 0;
339     double dir = 0;
```

```
340     double phase = 0;
341
342     double x = 0;
343     double y = 0;
344     double t = time(NULL);
345
346     double max_noise = -1 * std::numeric_limits<double>::infinity();
347     double min_noise = std::numeric_limits<double>::infinity();
348
349     double noise = 0;
350     std::vector<double> noise_vec(n_elements, 0);
351
352     for (int i = 0; i < n_elements; i++) {
353         x = this->tile_position_x_vec[i] - this->position_x;
354         y = this->tile_position_y_vec[i] - this->position_y;
355
356         for (int j = 0; j < n_components; j++) {
357             amp = random_amplitude_vec[j];
358             wave_no = random_wave_number_vec[j];
359             freq = random_frequency_vec[j];
360             dir = random_direction_vec[j];
361             phase = random_phase_vec[j];
362
363             noise += (amp / (j + 1)) * cos(
364                 wave_no * (j + 1) * (x * sin(dir) + y * cos(dir)) +
365                 2 * M_PI * (j + 1) * freq * t +
366                 phase
367             );
368         }
369
370         noise_vec[i] = noise;
371
372         if (noise > max_noise) {
373             max_noise = noise;
374         }
375
376         else if (noise < min_noise) {
377             min_noise = noise;
378         }
379
380         noise = 0;
381     }
382
383     //  3. normalize noise vec
384     for (int i = 0; i < n_elements; i++) {
385         noise_vec[i] = (noise_vec[i] - min_noise) / (max_noise - min_noise);
386
387         if (noise_vec[i] < 0) {
388             noise_vec[i] = 0;
389         }
390         else if (noise_vec[i] > 1) {
391             noise_vec[i] = 1;
392         }
393     }
394
395     return noise_vec;
396 }   /* __getNoise() */
```

3.4.3.7 __getSelectedTile()

```
HexTile * HexMap::__getSelectedTile (
            void  )  [private]
```

Helper method to get pointer to selected tile.

Returns

Pointer to selected tile (or NULL if no tile selected).

```
877 {
878     HexTile* selected_tile_ptr = NULL;
879
880     bool break_flag = false;
881     std::map<double, std::map<double, HexTile*>>::iterator hex_map_iter_x;
882     std::map<double, HexTile*>::iterator hex_map_iter_y;
883
```

```
884     for (
885         hex_map_iter_x = this->hex_map.begin();
886         hex_map_iter_x != this->hex_map.end();
887         hex_map_iter_x++
888     ) {
889         for (
890             hex_map_iter_y = hex_map_iter_x->second.begin();
891             hex_map_iter_y != hex_map_iter_x->second.end();
892             hex_map_iter_y++
893         ) {
894             if (hex_map_iter_y->second->is_selected) {
895                 selected_tile_ptr = hex_map_iter_y->second;
896                 break_flag = true;
897             }
898
899             if (break_flag) {
900                 break;
901             }
902         }
903
904         if (break_flag) {
905             break;
906         }
907     }
908
909     return selected_tile_ptr;
910 }   /* __getSelectedTile() */
```

3.4.3.8 __getValidMapIndexPositions()

```
std::vector< double > HexMap::__getValidMapIndexPositions (
            double potential_x,
            double potential_y )  [private]
```

Helper method to translate given position into valid index position for a.

Parameters

potential_x	The potential x position of the tile.
potential_y	The potential y position of the tile.

Returns

A vector of positions, either valid for indexing into the hex map, or sentinel values (-1) if invalid.

```
496 {
497     std::vector<double> map_index_positions = {-1, -1};
498
499     std::map<double, std::map<double, HexTile*>>::iterator hex_map_iter_x;
500     std::map<double, HexTile*>::iterator hex_map_iter_y;
501     HexTile* hex_ptr;
502
503     double distance = 0;
504
505     for (
506         hex_map_iter_x = this->hex_map.begin();
507         hex_map_iter_x != this->hex_map.end();
508         hex_map_iter_x++
509     ) {
510         for (
511             hex_map_iter_y = hex_map_iter_x->second.begin();
512             hex_map_iter_y != hex_map_iter_x->second.end();
513             hex_map_iter_y++
514         ) {
515             hex_ptr = hex_map_iter_y->second;
516
517             distance = sqrt(
```

```
518                 pow(hex_ptr->position_x - potential_x, 2) +
519                 pow(hex_ptr->position_y - potential_y, 2)
520             );
521
522             if (distance <= hex_ptr->minor_radius / 4) {
523                 map_index_positions = {hex_ptr->position_x, hex_ptr->position_y};
524                 return map_index_positions;
525             }
526         }
527     }
528
529     return map_index_positions;
530 }   /* __isInHexMap() */
```

3.4.3.9 __handleKeyPressEvents()

```
void HexMap::__handleKeyPressEvents (
            void  )  [private]
```

Helper method to handle key press events.

```
925 {
926     switch (this->event_ptr->key.code) {
927         case (sf::Keyboard::Escape): {
928             this->tile_selected = false;
929         }
930
931
932         default: {
933             // do nothing!
934
935             break;
936         }
937     }
938
939     return;
940 }   /* __handleKeyPressEvents() */
```

3.4.3.10 __handleMouseButtonEvents()

```
void HexMap::__handleMouseButtonEvents (
            void  )  [private]
```

Helper method to handle mouse button events.

```
955 {
956     switch (this->event_ptr->mouseButton.button) {
957         case (sf::Mouse::Left): {
958             HexTile* hex_ptr = this->__getSelectedTile();
959
960             if (hex_ptr != NULL) {
961                 this->tile_selected = true;
962             }
963
964             else if (this->tile_selected) {
965                 this->tile_selected = false;
966                 this->__sendNoTileSelectedMessage();
967             }
968
969             break;
970         }
971
972
973         case (sf::Mouse::Right): {
974             if (this->tile_selected) {
975                 this->tile_selected = false;
976                 this->__sendNoTileSelectedMessage();
977             }
978
979             break;
980         }
```

```
981
982
983         default: {
984             // do nothing!
985
986             break;
987         }
988     }
989
990     return;
991 }   /* __handleMouseButtonEvents() */
```

3.4.3.11 __isLakeTouchingOcean()

```
bool HexMap::__isLakeTouchingOcean (
              HexTile * hex_ptr )  [private]
719 {
720     //  1. if not lake tile, return
721     if (not (hex_ptr->tile_type == TileType :: LAKE)) {
722         return false;
723     }
724
725     //  2. scan neighbours for ocean tiles
726     std::vector<HexTile*> neighbours_vec = this->__getNeighboursVector(hex_ptr);
727
728     for (size_t i = 0; i < neighbours_vec.size(); i++) {
729         if (neighbours_vec[i]->tile_type == TileType :: OCEAN) {
730             return true;
731         }
732     }
733
734     return false;
735 }   /* __isLakeTouchingOcean() */
```

3.4.3.12 __layTiles()

```
void HexMap::__layTiles (
              void  )  [private]
```

Helper method to lay the hex tiles down to generate the game world.

```
54 {
55     this->n_tiles = 0;
56
57     //  1. add origin tile
58     HexTile* hex_ptr = new HexTile(
59         this->position_x,
60         this->position_y,
61         this->event_ptr,
62         this->render_window_ptr,
63         this->assets_manager_ptr,
64         this->message_hub_ptr
65     );
66
67     this->hex_map[hex_ptr->position_x][hex_ptr->position_y] = hex_ptr;
68     this->tile_position_x_vec.push_back(hex_ptr->position_x);
69     this->tile_position_y_vec.push_back(hex_ptr->position_y);
70     this->n_tiles++;
71
72
73     //  2. fill out first row (reflect across origin tile)
74     for (int i = 0; i < this->n_layers; i++) {
75         hex_ptr = new HexTile(
76             this->position_x + 2 * (i + 1) * hex_ptr->minor_radius,
77             this->position_y,
78             this->event_ptr,
79             this->render_window_ptr,
80             this->assets_manager_ptr,
81             this->message_hub_ptr
82         );
83
```

```
84          this->hex_map[hex_ptr->position_x][hex_ptr->position_y] = hex_ptr;
85          this->tile_position_x_vec.push_back(hex_ptr->position_x);
86          this->tile_position_y_vec.push_back(hex_ptr->position_y);
87          this->n_tiles++;
88
89          if (i == this->n_layers - 1) {
90              this->border_tiles_vec.push_back(hex_ptr);
91          }
92
93          hex_ptr = new HexTile(
94              this->position_x - 2 * (i + 1) * hex_ptr->minor_radius,
95              this->position_y,
96              this->event_ptr,
97              this->render_window_ptr,
98              this->assets_manager_ptr,
99              this->message_hub_ptr
100         );
101
102         this->hex_map[hex_ptr->position_x][hex_ptr->position_y] = hex_ptr;
103         this->tile_position_x_vec.push_back(hex_ptr->position_x);
104         this->tile_position_y_vec.push_back(hex_ptr->position_y);
105         this->n_tiles++;
106
107         if (i == this->n_layers - 1) {
108             this->border_tiles_vec.push_back(hex_ptr);
109         }
110     }
111
112
113     //  3. fill out subsequent rows (reflect across first row)
114     HexTile* first_row_left_tile = hex_ptr;
115
116     int offset_count = 1;
117
118     double x_offset = 0;
119     double y_offset = 0;
120
121     for (
122         int row_width = 2 * this->n_layers;
123         row_width > this->n_layers;
124         row_width--
125     ) {
126         //  3.1. upper row
127         x_offset = first_row_left_tile->position_x +
128             2 * offset_count * first_row_left_tile->minor_radius *
129             cos(60 * (M_PI / 180));
130
131         y_offset = first_row_left_tile->position_y -
132             2 * offset_count * first_row_left_tile->minor_radius *
133             sin(60 * (M_PI / 180));
134
135         hex_ptr = new HexTile(
136             x_offset,
137             y_offset,
138             this->event_ptr,
139             this->render_window_ptr,
140             this->assets_manager_ptr,
141             this->message_hub_ptr
142         );
143
144         this->hex_map[hex_ptr->position_x][hex_ptr->position_y] = hex_ptr;
145         this->tile_position_x_vec.push_back(hex_ptr->position_x);
146         this->tile_position_y_vec.push_back(hex_ptr->position_y);
147         this->n_tiles++;
148
149         this->border_tiles_vec.push_back(hex_ptr);
150
151         for (int i = 1; i < row_width; i++) {
152             x_offset += 2 * first_row_left_tile->minor_radius;
153
154             hex_ptr = new HexTile(
155                 x_offset,
156                 y_offset,
157                 this->event_ptr,
158                 this->render_window_ptr,
159                 this->assets_manager_ptr,
160                 this->message_hub_ptr
161             );
162
163             this->hex_map[hex_ptr->position_x][hex_ptr->position_y] = hex_ptr;
164             this->tile_position_x_vec.push_back(hex_ptr->position_x);
165             this->tile_position_y_vec.push_back(hex_ptr->position_y);
166             this->n_tiles++;
167
168             if (row_width == this->n_layers + 1 or i == row_width - 1) {
169                 this->border_tiles_vec.push_back(hex_ptr);
170             }
```

```
171         }
172
173         //  3.2. lower row
174         x_offset = first_row_left_tile->position_x +
175             2 * offset_count * first_row_left_tile->minor_radius *
176             cos(60 * (M_PI / 180));
177
178         y_offset = first_row_left_tile->position_y +
179             2 * offset_count * first_row_left_tile->minor_radius *
180             sin(60 * (M_PI / 180));
181
182         hex_ptr = new HexTile(
183             x_offset,
184             y_offset,
185             this->event_ptr,
186             this->render_window_ptr,
187             this->assets_manager_ptr,
188             this->message_hub_ptr
189         );
190
191         this->hex_map[hex_ptr->position_x][hex_ptr->position_y] = hex_ptr;
192         this->tile_position_x_vec.push_back(hex_ptr->position_x);
193         this->tile_position_y_vec.push_back(hex_ptr->position_y);
194         this->n_tiles++;
195
196         this->border_tiles_vec.push_back(hex_ptr);
197
198         for (int i = 1; i < row_width; i++) {
199             x_offset += 2 * first_row_left_tile->minor_radius;
200
201             hex_ptr = new HexTile(
202                 x_offset,
203                 y_offset,
204                 this->event_ptr,
205                 this->render_window_ptr,
206                 this->assets_manager_ptr,
207                 this->message_hub_ptr
208             );
209
210             this->hex_map[hex_ptr->position_x][hex_ptr->position_y] = hex_ptr;
211             this->tile_position_x_vec.push_back(hex_ptr->position_x);
212             this->tile_position_y_vec.push_back(hex_ptr->position_y);
213             this->n_tiles++;
214
215             if (row_width == this->n_layers + 1 or i == row_width - 1) {
216                 this->border_tiles_vec.push_back(hex_ptr);
217             }
218         }
219
220         offset_count++;
221     }
222
223     return;
224 }   /* __layTiles() */
```

3.4.3.13 __procedurallyGenerateTileResources()

```
void HexMap::__procedurallyGenerateTileResources (
            void  )  [private]
```

Helper method to procedurally generate tile resources and set tiles accordingly.

```
801 {
802     //  1. get random cosine series noise vec
803     std::vector<double> noise_vec = this->__getNoise(this->n_tiles);
804
805     //  2. set tile resources based on random cosine series noise
806     int noise_idx = 0;
807
808     std::map<double, std::map<double, HexTile*>::iterator hex_map_iter_x;
809     std::map<double, HexTile*>::iterator hex_map_iter_y;
810     for (
811         hex_map_iter_x = this->hex_map.begin();
812         hex_map_iter_x != this->hex_map.end();
813         hex_map_iter_x++
814     ) {
815         for (
816             hex_map_iter_y = hex_map_iter_x->second.begin();
817             hex_map_iter_y != hex_map_iter_x->second.end();
```

```
818             hex_map_iter_y++
819         ) {
820             hex_map_iter_y->second->setTileResource(noise_vec[noise_idx]);
821             noise_idx++;
822         }
823     }
824
825     return;
826 }   /* __procedurallyGenerateTileResources() */
```

3.4.3.14 __procedurallyGenerateTileTypes()

```
void HexMap::__procedurallyGenerateTileTypes (
            void  )  [private]
```

Helper method to procedurally generate tile types and set tiles accordingly.

```
411 {
412     //  1. get random cosine series noise vec
413     std::vector<double> noise_vec = this->__getNoise(this->n_tiles);
414
415     //  2. set initial tile types based on either random cosine series noise or white
416     //     noise (decided by coin toss)
417     int noise_idx = 0;
418
419     std::map<double, std::map<double, HexTile*>::iterator hex_map_iter_x;
420     std::map<double, HexTile*>::iterator hex_map_iter_y;
421     for (
422         hex_map_iter_x = this->hex_map.begin();
423         hex_map_iter_x != this->hex_map.end();
424         hex_map_iter_x++
425     ) {
426         for (
427             hex_map_iter_y = hex_map_iter_x->second.begin();
428             hex_map_iter_y != hex_map_iter_x->second.end();
429             hex_map_iter_y++
430         ) {
431             if ((double)rand() / RAND_MAX > 0.5) {
432                 hex_map_iter_y->second->setTileType(noise_vec[noise_idx]);
433             }
434             else {
435                 hex_map_iter_y->second->setTileType((double)rand() / RAND_MAX);
436             }
437             noise_idx++;
438         }
439     }
440
441     //  3. smooth tile types (majority rules)
442     this->__smoothTileTypes();
443
444     //  4. set border tile type to ocean
445     for (size_t i = 0; i < this->border_tiles_vec.size(); i++) {
446         this->border_tiles_vec[i]->setTileType(TileType :: OCEAN);
447     }
448
449     //  5. enforce ocean continuity (i.e. all lake tiles touching ocean become ocean)
450     this->__enforceOceanContinuity();
451
452     //  6. decorate tiles
453     for (
454         hex_map_iter_x = this->hex_map.begin();
455         hex_map_iter_x != this->hex_map.end();
456         hex_map_iter_x++
457     ) {
458         for (
459             hex_map_iter_y = hex_map_iter_x->second.begin();
460             hex_map_iter_y != hex_map_iter_x->second.end();
461             hex_map_iter_y++
462         ) {
463             hex_map_iter_y->second->decorateTile();
464         }
465     }
466
467     return;
468 }   /* __procedurallyGenerateTileTypes() */
```

3.4.3.15 __sendNoTileSelectedMessage()

```
void HexMap::__sendNoTileSelectedMessage (
            void  )  [private]
```

Helper method to format and send message on no tile selected.

```
1006 {
1007     Message no_tile_selected_message;
1008 
1009     no_tile_selected_message.channel = NO_TILE_SELECTED_CHANNEL;
1010     no_tile_selected_message.subject = "no tile selected";
1011 
1012     this->message_hub_ptr->sendMessage(no_tile_selected_message);
1013 
1014     return;
1015 }   /* __sendNoTileSelectedMessage() */
```

3.4.3.16 __setUpGlassScreen()

```
void HexMap::__setUpGlassScreen (
            void  )  [private]
```

Helper method to set up glass screen effect (drawable).

```
34 {
35     this->glass_screen.setSize(sf::Vector2f(GAME_WIDTH, GAME_HEIGHT));
36     this->glass_screen.setFillColor(sf::Color(MONOCHROME_SCREEN_BACKGROUND));
37 
38     return;
39 }   /* __setUpGlassScreen() */
```

3.4.3.17 __smoothTileTypes()

```
void HexMap::__smoothTileTypes (
            void  )  [private]
```

Helper method to smooth tile types using a majority rules approach.

```
672 {
673     std::cout << "smoothing ..." << std::endl;
674 
675     std::map<double, std::map<double, HexTile*>::iterator hex_map_iter_x;
676     std::map<double, HexTile*>::iterator hex_map_iter_y;
677     HexTile* hex_ptr;
678     TileType majority_tile_type;
679 
680     for (
681         hex_map_iter_x = this->hex_map.begin();
682         hex_map_iter_x != this->hex_map.end();
683         hex_map_iter_x++
684     ) {
685         for (
686             hex_map_iter_y = hex_map_iter_x->second.begin();
687             hex_map_iter_y != hex_map_iter_x->second.end();
688             hex_map_iter_y++
689         ) {
690             hex_ptr = hex_map_iter_y->second;
691             majority_tile_type = this->__getMajorityTileType(hex_ptr);
692 
693             if (majority_tile_type != hex_ptr->tile_type) {
694                 hex_ptr->setTileType(majority_tile_type);
695             }
696         }
697     }
698 
699     return;
700 }   /* __smoothTileTypes() */
```

3.4.3.18 assess()

```
void HexMap::assess (
            void  )
```

Method to assess the resource of the selected tile.

```
1108 {
1109     HexTile* selected_tile_ptr = this->__getSelectedTile();
1110     if (selected_tile_ptr != NULL) {
1111         selected_tile_ptr->assess();
1112     }
1113
1114     return;
1115 }   /* assess() */
```

3.4.3.19 clear()

```
void HexMap::clear (
            void  )
```

Method to clear the hex map.

```
1307 {
1308     std::map<double, std::map<double, HexTile*>::iterator hex_map_iter_x;
1309     std::map<double, HexTile*>::iterator hex_map_iter_y;
1310     for (
1311         hex_map_iter_x = this->hex_map.begin();
1312         hex_map_iter_x != this->hex_map.end();
1313         hex_map_iter_x++
1314     ) {
1315         for (
1316             hex_map_iter_y = hex_map_iter_x->second.begin();
1317             hex_map_iter_y != hex_map_iter_x->second.end();
1318             hex_map_iter_y++
1319         ) {
1320             delete hex_map_iter_y->second;
1321         }
1322     }
1323     this->hex_map.clear();
1324
1325     this->tile_position_x_vec.clear();
1326     this->tile_position_y_vec.clear();
1327     this->border_tiles_vec.clear();
1328
1329     return;
1330 }   /* clear() */
```

3.4.3.20 draw()

```
void HexMap::draw (
            void  )
```

Method to draw the hex map to the render window. To be called once per frame.

```
1264 {
1265     //  1. draw background
1266     sf::Color glass_screen_colour = this->glass_screen.getFillColor();
1267     glass_screen_colour.a = 255;
1268     this->glass_screen.setFillColor(glass_screen_colour);
1269
1270     this->render_window_ptr->draw(this->glass_screen);
1271
1272     //  2. draw tiles in drawing order
1273     for (size_t i = 0; i < this->hex_draw_order_vec.size(); i++) {
1274         this->hex_draw_order_vec[i]->draw();
1275     }
1276
1277     //  3. redraw selected tile
```

```
1278     HexTile* selected_tile_ptr = this->__getSelectedTile();
1279     if (selected_tile_ptr != NULL) {
1280         selected_tile_ptr->draw();
1281     }
1282 
1283     //  4. draw glass screen
1284     glass_screen_colour = this->glass_screen.getFillColor();
1285     glass_screen_colour.a = 40;
1286     this->glass_screen.setFillColor(glass_screen_colour);
1287 
1288     this->render_window_ptr->draw(this->glass_screen);
1289 
1290     this->frame++;
1291     return;
1292 }   /* draw() */
```

3.4.3.21 processEvent()

```
void HexMap::processEvent (
             void  )
```

Method to process HexMap. To be called once per event.

```
1183 {
1184     //  1. process HexTile events
1185     std::map<double, std::map<double, HexTile*»::iterator hex_map_iter_x;
1186     std::map<double, HexTile*>::iterator hex_map_iter_y;
1187     for (
1188         hex_map_iter_x = this->hex_map.begin();
1189         hex_map_iter_x != this->hex_map.end();
1190         hex_map_iter_x++
1191     ) {
1192         for (
1193             hex_map_iter_y = hex_map_iter_x->second.begin();
1194             hex_map_iter_y != hex_map_iter_x->second.end();
1195             hex_map_iter_y++
1196         ) {
1197             hex_map_iter_y->second->processEvent();
1198         }
1199     }
1200 
1201     //  2. process HexMap events
1202     if (this->event_ptr->type == sf::Event::KeyPressed) {
1203         this->__handleKeyPressEvents();
1204     }
1205 
1206     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
1207         this->__handleMouseButtonEvents();
1208     }
1209 
1210     return;
1211 }   /* processEvent() */
```

3.4.3.22 processMessage()

```
void HexMap::processMessage (
             void  )
```

Method to process HexMap. To be called once per message.

```
1226 {
1227     //  1. process HexTile messages
1228     std::map<double, std::map<double, HexTile*»::iterator hex_map_iter_x;
1229     std::map<double, HexTile*>::iterator hex_map_iter_y;
1230     for (
1231         hex_map_iter_x = this->hex_map.begin();
1232         hex_map_iter_x != this->hex_map.end();
1233         hex_map_iter_x++
1234     ) {
1235         for (
1236             hex_map_iter_y = hex_map_iter_x->second.begin();
```

```
1237             hex_map_iter_y != hex_map_iter_x->second.end();
1238             hex_map_iter_y++
1239         ) {
1240             hex_map_iter_y->second->processMessage();
1241         }
1242     }
1243
1244     //  2. process HexMap messages
1245     //...
1246
1247     return;
1248 }   /* processMessage() */
```

3.4.3.23 reroll()

```
void HexMap::reroll (
              void  )
```

Method to re-roll the hex map.

```
1130 {
1131     this->clear();
1132     this->__assembleHexMap();
1133
1134     return;
1135 }   /* reroll() */
```

3.4.3.24 toggleResourceOverlay()

```
void HexMap::toggleResourceOverlay (
              void  )
```

Method to toggle the hex map resource overlay.

```
1150 {
1151     std::map<double, std::map<double, HexTile*>>::iterator hex_map_iter_x;
1152     std::map<double, HexTile*>::iterator hex_map_iter_y;
1153     for (
1154         hex_map_iter_x = this->hex_map.begin();
1155         hex_map_iter_x != this->hex_map.end();
1156         hex_map_iter_x++
1157     ) {
1158         for (
1159             hex_map_iter_y = hex_map_iter_x->second.begin();
1160             hex_map_iter_y != hex_map_iter_x->second.end();
1161             hex_map_iter_y++
1162         ) {
1163             hex_map_iter_y->second->toggleResourceOverlay();
1164         }
1165     }
1166
1167     return;
1168 }   /* toggleResourceOverlay() */
```

3.4.4 Member Data Documentation

3.4.4.1 assets_manager_ptr

```
AssetsManager* HexMap::assets_manager_ptr  [private]
```

A pointer to the assets manager.

3.4.4.2 border_tiles_vec

```
std::vector<HexTile*> HexMap::border_tiles_vec
```

A vector of pointers to the border tiles.

3.4.4.3 event_ptr

```
sf::Event* HexMap::event_ptr  [private]
```

A pointer to the event class.

3.4.4.4 frame

```
int HexMap::frame
```

The current frame of this object.

3.4.4.5 glass_screen

```
sf::RectangleShape HexMap::glass_screen
```

To give the effect of an old glass screen over the hex map.

3.4.4.6 hex_draw_order_vec

```
std::vector<HexTile*> HexMap::hex_draw_order_vec
```

A vector of hex tiles, in drawing order.

3.4.4.7 hex_map

```
std::map<double, std::map<double, HexTile*> > HexMap::hex_map
```

A position-indexed, nested map of hex tiles.

3.4.4.8 message_hub_ptr

```
MessageHub* HexMap::message_hub_ptr  [private]
```

A pointer to the message hub.

3.4.4.9 n_layers

```
int HexMap::n_layers
```

The number of layers in the hex map.

3.4.4.10 n_tiles

```
int HexMap::n_tiles
```

The number of tiles in the hex map.

3.4.4.11 position_x

```
double HexMap::position_x
```

The x position of the hex map's origin (i.e. central) tile.

3.4.4.12 position_y

```
double HexMap::position_y
```

The y position of the hex map's origin (i.e. central) tile.

3.4.4.13 render_window_ptr

```
sf::RenderWindow* HexMap::render_window_ptr  [private]
```

A pointer to the render window.

3.4.4.14 tile_position_x_vec

```
std::vector<double> HexMap::tile_position_x_vec
```

A vector of tile x positions.

3.4.4.15 tile_position_y_vec

```
std::vector<double> HexMap::tile_position_y_vec
```

A vector of tile y position.

3.4.4.16 tile_selected

```
bool HexMap::tile_selected
```

A boolean which indicates if a tile is currently selected.

The documentation for this class was generated from the following files:

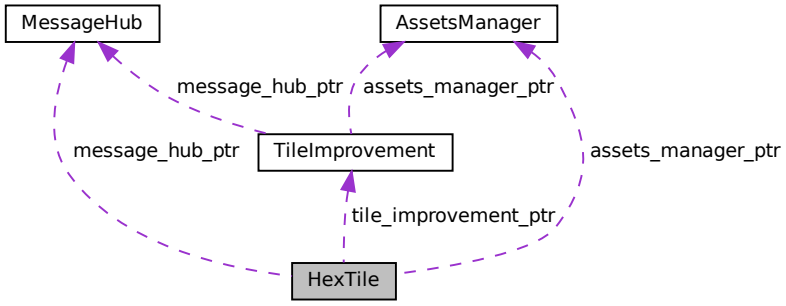
- header/HexMap.h
- source/HexMap.cpp

3.5 HexTile Class Reference

A class which defines a hex tile of the hex map.

```
#include <HexTile.h>
```

Collaboration diagram for HexTile:



Public Member Functions

- HexTile (double, double, sf::Event *, sf::RenderWindow *, AssetsManager *, MessageHub *)

  Constructor for the HexTile class.
- void setTileType (TileType)

  Method to set the tile type (by enum value).
- void setTileType (double)

  Method to set the tile type (by numeric input).
- void setTileResource (TileResource)

  Method to set the tile resource (by enum value).
- void setTileResource (double)

  Method to set the tile resource (by numeric input).
- void decorateTile (void)

  Method to decorate tile.
- void toggleResourceOverlay (void)

  Method to toggle the tile resource overlay.
- void assess (void)

  Method to assess the tile's resource.
- void processEvent (void)

  Method to process HexTile. To be called once per event.
- void processMessage (void)

  Method to process HexTile. To be called once per message.
- void draw (void)

  Method to draw the hex tile to the render window. To be called once per frame.
- ~HexTile (void)

  Destructor for the HexTile class.

Public Attributes

- TileType tile_type
- TileResource tile_resource
- bool show_node

  A boolean which indicates whether or not to show the tile node.
- bool show_resource

  A boolean which indicates whether or not to show resource value.
- bool resource_assessed

  A boolean which indicates whether or not the resource has been assessed.
- bool is_selected

  A boolean which indicates whether or not the tile is selected.
- bool has_improvement

  A boolean which indicates if tile has improvement or not.
- TileImprovement * tile_improvement_ptr

  A pointer to the improvement for this tile.
- int frame

  The current frame of this object.
- double position_x

  The x position of the tile.
- double position_y

  The y position of the tile.
- double major_radius

The radius of the smallest bounding circle.

- double minor_radius

  The radius of the largest inscribed circle.

- sf::CircleShape node_sprite

  A circle shape to mark the tile node.

- sf::ConvexShape tile_sprite

  A convex shape which represents the tile.

- sf::ConvexShape select_outline_sprite

  A convex shape which outlines the tile when selected.

- sf::CircleShape resource_chip_sprite

  A circle shape which represents a resource chip.

- sf::Text resource_text

  A text representation of the resource.

- sf::Sprite tile_decoration_sprite

  A tile decoration sprite.

Private Member Functions

- void __setUpNodeSprite (void)

  Helper method to set up node sprite.

- void __setUpTileSprite (void)

  Helper method to set up tile sprite.

- void __setUpSelectOutlineSprite (void)

  Helper method to set up select outline sprite.

- void __setUpResourceChipSprite (void)

  Helper method to set up resource chip sprite.

- void __setResourceText (void)

  Helper method to set up resource text.

- bool __isClicked (void)

  Helper method to determine if tile was clicked on.

- void __handleKeyPressEvents (void)

  Helper method to handle key press events.

- void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.

- void __sendTileSelectedMessage (void)

  Helper method to format and send message on tile selection.

- std::string __getTileCoordsSubstring (void)

  Helper method to assemble and return tile coordinates substring.

- std::string __getTileTypeSubstring (void)

  Helper method to assemble and return tile type substring.

- std::string __getTileResourceSubstring (void)

  Helper method to assemble and return tile resource substring.

- std::string __getTileImprovementSubstring (void)

- void __sendTileStateMessage (void)

  Helper method to format and send tile state message.

Private Attributes

- sf::Event * event_ptr

  A pointer to the event class.
- sf::RenderWindow * render_window_ptr

  A pointer to the render window.
- AssetsManager * assets_manager_ptr

  A pointer to the assets manager.
- MessageHub * message_hub_ptr

  A pointer to the message hub.

3.5.1 Detailed Description

A class which defines a hex tile of the hex map.

3.5.2 Constructor & Destructor Documentation

3.5.2.1 HexTile()

```
HexTile::HexTile (
            double position_x,
            double position_y,
            sf::Event * event_ptr,
            sf::RenderWindow * render_window_ptr,
            AssetsManager * assets_manager_ptr,
            MessageHub * message_hub_ptr )
```

Constructor for the HexTile class.

Ref: Wikipedia [2023]

Parameters

position_x	The x position of the tile.
position_y	The y position of the tile.
event_ptr	Pointer to the event class.
render_window_ptr	Pointer to the render window.
assets_manager_ptr	Pointer to the assets manager.
message_hub_ptr	Pointer to the message hub.

```
606 {
607     //  1. set attributes
608
609     //  1.1. private
610     this->event_ptr = event_ptr;
611     this->render_window_ptr = render_window_ptr;
612
613     this->assets_manager_ptr = assets_manager_ptr;
614     this->message_hub_ptr = message_hub_ptr;
615
```

```
616     //  1.2. public
617     this->show_node = false;
618     this->show_resource = false;
619     this->resource_assessed = false;
620     this->is_selected = false;
621 
622     this->has_improvement = false;
623     this->tile_improvement_ptr = NULL;
624 
625     this->frame = 0;
626 
627     this->position_x = position_x;
628     this->position_y = position_y;
629 
630     this->major_radius = 32;
631     this->minor_radius = (sqrt(3) / 2) * this->major_radius;
632 
633     //  2. set up and position drawable attributes
634     this->__setUpNodeSprite();
635     this->__setUpTileSprite();
636     this->__setUpSelectOutlineSprite();
637     this->__setUpResourceChipSprite();
638     this->__setResourceText();
639 
640     //  3. set tile type and resource (default to none type and average)
641     this->setTileType(TileType :: NONE_TYPE);
642     this->setTileResource(TileResource :: AVERAGE);
643 
644     std::cout << "HexTile constructed at " << this << std::endl;
645 
646     return;
647 }   /* HexTile() */
```

3.5.2.2 ~HexTile()

```
HexTile::~HexTile (
            void  )
```

Destructor for the HexTile class.

```
1090 {
1091     if (this->tile_improvement_ptr != NULL) {
1092         delete this->tile_improvement_ptr;
1093     }
1094 
1095     std::cout << "HexTile at " << this << " destroyed" << std::endl;
1096 
1097     return;
1098 }   /* ~HexTile() */
```

3.5.3 Member Function Documentation

3.5.3.1 __getTileCoordsSubstring()

```
std::string HexTile::__getTileCoordsSubstring (
            void  )  [private]
```

Helper method to assemble and return tile coordinates substring.

Returns

Tile coordinates substring.

```
375 {
376     std::string coords_substring = "TILE COORDS:  (";
377     coords_substring += std::to_string(int(this->position_x - 400));
378     coords_substring += ", ";
379     coords_substring += std::to_string(int(this->position_y - 400));
380     coords_substring += ")\n";
381 
382     return coords_substring;
383 }   /* __getTileCoordsSubstring() */
```

3.5.3.2 __getTileImprovementSubstring()

```
std::string HexTile::__getTileImprovementSubstring (
            void  )  [private]
```

```
497 {
498     std::string improvement_substring = "TILE IMPROVEMENT:  ";
499 
500     if (this->has_improvement) {
501         //...
502     }
503 
504     else {
505         improvement_substring += "NONE\n";
506     }
507 
508     return improvement_substring;
509 }   /* __getTileImprovementSubstring() */
```

3.5.3.3 __getTileResourceSubstring()

```
std::string HexTile::__getTileResourceSubstring (
            void  )  [private]
```

Helper method to assemble and return tile resource substring.

Returns

Tile resource substring.

```
464 {
465     std::string resource_substring = "TILE RESOURCE:     ";
466 
467     if (this->resource_assessed) {
468         switch (this->tile_resource) {
469             //...
470 
471 
472             default: {
473                 resource_substring += "???\n";
474 
475                 break;
476             }
477         }
478     }
479 
480     else {
481         resource_substring += "[A]: ASSESS\n";
482     }
483 
484     return resource_substring;
485 }   /* __getTileResourceSubstring() */
```

3.5.3.4 __getTileTypeSubstring()

```
std::string HexTile::__getTileTypeSubstring (
            void  )  [private]
```

Helper method to assemble and return tile type substring.

Returns

Tile type substring.

```
400 {
401     std::string type_substring = "TILE TYPE:         ";
402 
403     switch (this->tile_type) {
404         case (TileType :: FOREST): {
405             type_substring += "FOREST\n";
406 
407             break;
408         }
409 
410 
411         case (TileType :: LAKE): {
412             type_substring += "LAKE\n";
413 
414             break;
415         }
416 
417 
418         case (TileType :: MOUNTAINS): {
419             type_substring += "MOUNTAINS\n";
420 
421             break;
422         }
423 
424 
425         case (TileType :: OCEAN): {
426             type_substring += "OCEAN\n";
427 
428             break;
429         }
430 
431 
432         case (TileType :: PLAINS): {
433             type_substring += "PLAINS\n";
434 
435             break;
436         }
437 
438 
439         default: {
440             type_substring += "???\n";
441 
442             break;
443         }
444     }
445 
446     return type_substring;
447 }   /* __getTileTypeSubstring() */
```

3.5.3.5 __handleKeyPressEvents()

```
void HexTile::__handleKeyPressEvents (
              void  )  [private]
```

Helper method to handle key press events.

```
268 {
269     switch (this->event_ptr->key.code) {
270         case (sf::Keyboard::Escape): {
271             this->is_selected = false;
272         }
273 
274 
275         default: {
276             // do nothing!
277 
278             break;
279         }
280     }
281 
282     return;
283 }   /* __handleKeyPressEvents() */
```

3.5.3.6 __handleMouseButtonEvents()

```
void HexTile::__handleMouseButtonEvents (
            void  )  [private]
```

Helper method to handle mouse button events.

```
298 {
299     switch (this->event_ptr->mouseButton.button) {
300         case (sf::Mouse::Left): {
301             if (this->__isClicked()) {
302                 std::cout « "Tile (" « this->position_x « ", " «
303                     this->position_y « ") was selected" « std::endl;
304 
305                 this->is_selected = true;
306 
307                 this->__sendTileSelectedMessage();
308                 this->__sendTileStateMessage();
309             }
310 
311             else {
312                 this->is_selected = false;
313             }
314 
315             break;
316         }
317 
318 
319         case (sf::Mouse::Right): {
320             this->is_selected = false;
321 
322             break;
323         }
324 
325 
326         default: {
327             // do nothing!
328 
329             break;
330         }
331     }
332 
333     return;
334 }   /* __handleMouseButtonEvents() */
```

3.5.3.7 __isClicked()

```
bool HexTile::__isClicked (
            void  )  [private]
```

Helper method to determine if tile was clicked on.

Returns

Boolean indicating whether or not tile was clicked on.

```
236 {
237     sf::Vector2i mouse_position = sf::Mouse::getPosition(*render_window_ptr);
238 
239     double mouse_x = mouse_position.x;
240     double mouse_y = mouse_position.y;
241 
242     double distance = sqrt(
243         pow(this->position_x - mouse_x, 2) +
244         pow(this->position_y - mouse_y, 2)
245     );
246 
247     if (distance < this->minor_radius) {
248         return true;
249     }
250     else {
251         return false;
252     }
253 }   /* __isClicked() */
```

3.5.3.8 __sendTileSelectedMessage()

```
void HexTile::__sendTileSelectedMessage (
            void  )  [private]
```

Helper method to format and send message on tile selection.

```
349 {
350     Message tile_selected_message;
351 
352     tile_selected_message.channel = TILE_SELECTED_CHANNEL;
353     tile_selected_message.subject = "tile selected";
354 
355     this->message_hub_ptr->sendMessage(tile_selected_message);
356 
357     return;
358 }   /* __sendTileSelectedMessage() */
```

3.5.3.9 __sendTileStateMessage()

```
void HexTile::__sendTileStateMessage (
            void  )  [private]
```

Helper method to format and send tile state message.

```
524 {
525     Message tile_state_message;
526 
527     tile_state_message.channel = TILE_STATE_CHANNEL;
528     tile_state_message.subject = "tile state";
529 
530 
531     //                  32 char x 17 line console "--------------------------------\n";
532     std::string string_payload                   = "  **** TILE INFO/OPTIONS ****   \n";
533     string_payload                              += "                                \n";
534 
535     string_payload                              += this->__getTileCoordsSubstring();
536     string_payload                              += "                                \n";
537 
538     string_payload                              += this->__getTileTypeSubstring();
539     string_payload                              += this->__getTileResourceSubstring();
540     string_payload                              += this->__getTileImprovementSubstring();
541 
542     string_payload                              += "                                \n";
543     string_payload                              += "                                \n";
544     string_payload                              += "                                \n";
545     string_payload                              += "                                \n";
546     string_payload                              += "                                \n";
547     string_payload                              += "                                \n";
548     string_payload                              += "                                \n";
549     string_payload                              += "                                \n";
550     string_payload                              += "                                \n";
551     string_payload                              += "                                ";
552 
553 
554     tile_state_message.string_payload = string_payload;
555 
556     this->message_hub_ptr->sendMessage(tile_state_message);
557 
558     return;
559 }   /* __sendTileStateMessage() */
```

3.5.3.10 __setResourceText()

```
void HexTile::__setResourceText (
            void  )  [private]
```

Helper method to set up resource text.

```
159 {
160     this->resource_text.setFont(*(assets_manager_ptr->getFont("DroidSansMono")));
161 
162     switch (this->tile_resource) {
163         case (TileResource :: POOR): {
164             this->resource_text.setString("-2");
165 
166             break;
167         }
168 
169         case (TileResource :: BELOW_AVERAGE): {
170             this->resource_text.setString("-1");
171 
172             break;
173         }
174 
175         case (TileResource :: AVERAGE): {
176             this->resource_text.setString("0");
177 
178             break;
179         }
180 
181         case (TileResource :: ABOVE_AVERAGE): {
182             this->resource_text.setString("+1");
183 
184             break;
185         }
186 
187         case (TileResource :: GOOD): {
188             this->resource_text.setString("+2");
189 
190             break;
191         }
192 
193         default: {
194             this->resource_text.setString("?");
195 
196             break;
197         }
198     }
199 
200     if (not this->resource_assessed) {
201         this->resource_text.setString("?");
202     }
203 
204     this->resource_text.setCharacterSize(16);
205 
206     this->resource_text.setOrigin(
207         this->resource_text.getLocalBounds().width / 2,
208         this->resource_text.getLocalBounds().height / 2
209     );
210 
211     this->resource_text.setFillColor(sf::Color(0, 0, 0, 255));
212 
213     this->resource_text.setPosition(
214         this->position_x,
215         this->position_y - 4
216     );
217 
218     return;
219 }   /* __setResourceText() */
```

3.5.3.11 __setUpNodeSprite()

```
void HexTile::__setUpNodeSprite (
             void  )  [private]
```

Helper method to set up node sprite.

```
34 {
35     this->node_sprite.setRadius(4);
36 
37     this->node_sprite.setOrigin(
38         this->node_sprite.getLocalBounds().width / 2,
39         this->node_sprite.getLocalBounds().height / 2
40     );
41 
42     this->node_sprite.setPosition(this->position_x, this->position_y);
43 
```

```
44      this->node_sprite.setFillColor(sf::Color(255, 0, 0, 255));
45
46      return;
47  }   /* __setUpNodeSprite() */
```

3.5.3.12 __setUpResourceChipSprite()

```
void HexTile::__setUpResourceChipSprite (
            void  )  [private]
```

Helper method to set up resource chip sprite.

```
132 {
133     this->resource_chip_sprite.setRadius(2 * this->minor_radius / 3);
134
135     this->resource_chip_sprite.setOrigin(
136         this->resource_chip_sprite.getLocalBounds().width / 2,
137         this->resource_chip_sprite.getLocalBounds().height / 2
138     );
139
140     this->resource_chip_sprite.setPosition(this->position_x, this->position_y);
141
142     this->resource_chip_sprite.setFillColor(sf::Color(175, 175, 175, 175));
143
144     return;
145 }   /* __setUpResourceChip() */
```

3.5.3.13 __setUpSelectOutlineSprite()

```
void HexTile::__setUpSelectOutlineSprite (
            void  )  [private]
```

Helper method to set up select outline sprite.

```
96 {
97      int n_points = 6;
98
99      this->select_outline_sprite.setPointCount(n_points);
100
101     for (int i = 0; i < n_points; i++) {
102         this->select_outline_sprite.setPoint(
103             i,
104             sf::Vector2f(
105                 this->position_x + this->major_radius * cos((30 + 60 * i) * (M_PI / 180)),
106                 this->position_y + this->major_radius * sin((30 + 60 * i) * (M_PI / 180))
107             )
108         );
109     }
110
111     this->select_outline_sprite.setOutlineThickness(4);
112     this->select_outline_sprite.setOutlineColor(MONOCHROME_TEXT_RED);
113
114     this->select_outline_sprite.setFillColor(sf::Color(0, 0, 0, 0));
115
116     return;
117 }   /* __setUpSelectOutline() */
```

3.5.3.14 __setUpTileSprite()

```
void HexTile::__setUpTileSprite (
            void  )  [private]
```

Helper method to set up tile sprite.

```
62 {
63     int n_points = 6;
64 
65     this->tile_sprite.setPointCount(n_points);
66 
67     for (int i = 0; i < n_points; i++) {
68         this->tile_sprite.setPoint(
69             i,
70             sf::Vector2f(
71                 this->position_x + this->major_radius * cos((30 + 60 * i) * (M_PI / 180)),
72                 this->position_y + this->major_radius * sin((30 + 60 * i) * (M_PI / 180))
73             )
74         );
75     }
76 
77     this->tile_sprite.setOutlineThickness(1);
78     this->tile_sprite.setOutlineColor(sf::Color(175, 175, 175, 255));
79 
80     return;
81 }   /* __setUpTileSprite() */
```

3.5.3.15 assess()

```
void HexTile::assess (
            void  )
```

Method to assess the tile's resource.

```
966 {
967     this->resource_assessed = true;
968     this->__setResourceText();
969 
970     return;
971 }   /* assess() */
```

3.5.3.16 decorateTile()

```
void HexTile::decorateTile (
            void  )
```

Method to decorate tile.

```
844 {
845     switch (this->tile_type) {
846         case (TileType :: FOREST): {
847             this->tile_decoration_sprite.setTexture(
848                 *(this->assets_manager_ptr->getTexture("pine_tree_64x64_1"))
849             );
850 
851             break;
852         }
853 
854         case (TileType :: LAKE): {
855             this->tile_decoration_sprite.setTexture(
856                 *(this->assets_manager_ptr->getTexture("water_shimmer_64x64_1"))
857             );
858 
859             break;
860         }
861 
862         case (TileType :: MOUNTAINS): {
863             this->tile_decoration_sprite.setTexture(
```

```
864                 *(this->assets_manager_ptr->getTexture("mountain_64x64_1"))
865             );
866 
867             break;
868         }
869 
870         case (TileType :: OCEAN): {
871             this->tile_decoration_sprite.setTexture(
872                 *(this->assets_manager_ptr->getTexture("water_waves_64x64_1"))
873             );
874 
875             break;
876         }
877 
878         case (TileType :: PLAINS): {
879             this->tile_decoration_sprite.setTexture(
880                 *(this->assets_manager_ptr->getTexture("wheat_64x64_1"))
881             );
882 
883             break;
884         }
885 
886         default: {
887             // do nothing!
888 
889             break;
890         }
891     }
892 
893 
894     if (this->tile_type == TileType :: OCEAN or this->tile_type == TileType :: LAKE) {
895         this->tile_decoration_sprite.setOrigin(
896             this->tile_decoration_sprite.getLocalBounds().width / 2,
897             this->tile_decoration_sprite.getLocalBounds().height / 2
898         );
899 
900         this->tile_decoration_sprite.setPosition(
901             this->position_x,
902             this->position_y
903         );
904 
905         if ((double)rand() / RAND_MAX > 0.5) {
906             this->tile_decoration_sprite.setScale(sf::Vector2f(-1, 1));
907         }
908     }
909 
910     else {
911         this->tile_decoration_sprite.setOrigin(
912             this->tile_decoration_sprite.getLocalBounds().width / 2,
913             this->tile_decoration_sprite.getLocalBounds().height
914         );
915 
916         this->tile_decoration_sprite.setPosition(
917             this->position_x,
918             this->position_y + 12
919         );
920 
921         if ((double)rand() / RAND_MAX > 0.5) {
922             this->tile_decoration_sprite.setScale(sf::Vector2f(-1, 1));
923         }
924     }
925 
926     return;
927 }   /* decorateTile(void) */
```

3.5.3.17 draw()

```
void HexTile::draw (
            void  )
```

Method to draw the hex tile to the render window. To be called once per frame.

```
1043 {
1044     //  1. draw hex
1045     this->render_window_ptr->draw(this->tile_sprite);
1046 
1047     //  2. draw node
1048     if (this->show_node) {
1049         this->render_window_ptr->draw(this->node_sprite);
```

```
1050     }
1051
1052     //  3. draw tile decoration
1053     this->render_window_ptr->draw(this->tile_decoration_sprite);
1054
1055     //  4. draw resource
1056     if (this->show_resource) {
1057         this->render_window_ptr->draw(this->resource_chip_sprite);
1058         this->render_window_ptr->draw(this->resource_text);
1059     }
1060
1061     //  5. draw selection outline
1062     if (this->is_selected) {
1063         sf::Color outline_colour = this->select_outline_sprite.getOutlineColor();
1064
1065         outline_colour.a =
1066             255 * pow(cos((M_PI * this->frame) / (1.5 * FRAMES_PER_SECOND)), 2);
1067
1068         this->select_outline_sprite.setOutlineColor(outline_colour);
1069
1070         this->render_window_ptr->draw(this->select_outline_sprite);
1071     }
1072
1073     this->frame++;
1074     return;
1075 }   /* draw() */
```

3.5.3.18 processEvent()

```
void HexTile::processEvent (
              void  )
```

Method to process HexTile. To be called once per event.

```
986 {
987     //  1. process TileImprovement events
988     if (this->tile_improvement_ptr != NULL) {
989         this->tile_improvement_ptr->processEvent();
990     }
991
992     //  2. process HexTile events
993     if (this->event_ptr->type == sf::Event::KeyPressed) {
994         this->__handleKeyPressEvents();
995     }
996
997     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
998         this->__handleMouseButtonEvents();
999     }
1000
1001     return;
1002 }   /* processEvent() */
```

3.5.3.19 processMessage()

```
void HexTile::processMessage (
              void  )
```

Method to process HexTile. To be called once per message.

```
1017 {
1018     //  1. process TileImprovement messages
1019     if (this->tile_improvement_ptr != NULL) {
1020         this->tile_improvement_ptr->processMessage();
1021     }
1022
1023     //  2. process HexTile messages
1024     //...
1025
1026     return;
1027 }   /* processMessage() */
```

3.5.3.20 setTileResource() [1/2]

```
void HexTile::setTileResource (
            double input_value )
```

Method to set the tile resource (by numeric input).

Parameters

input_value	A numerical input in the closed interval [0, 1].

```
793 {
794     //  1. check input
795     if (input_value < 0 or input_value > 1) {
796         std::string error_str = "ERROR  HexTile::setTileResource()  given input value is ";
797         error_str += "not in the closed interval [0, 1]";
798 
799         #ifdef _WIN32
800             std::cout « error_str « std::endl;
801         #endif  /* _WIN32 */
802 
803         throw std::runtime_error(error_str);
804     }
805 
806     //  2. convert input value to tile resource
807     TileResource tile_resource;
808 
809     if (input_value <= TILE_RESOURCE_CUMULATIVE_PROBABILITIES[0]) {
810         tile_resource = TileResource :: POOR;
811     }
812     else if (input_value <= TILE_RESOURCE_CUMULATIVE_PROBABILITIES[1]) {
813         tile_resource = TileResource :: BELOW_AVERAGE;
814     }
815     else if (input_value <= TILE_RESOURCE_CUMULATIVE_PROBABILITIES[2]) {
816         tile_resource = TileResource :: AVERAGE;
817     }
818     else if (input_value <= TILE_RESOURCE_CUMULATIVE_PROBABILITIES[3]) {
819         tile_resource = TileResource :: ABOVE_AVERAGE;
820     }
821     else {
822         tile_resource = TileResource :: GOOD;
823     }
824 
825     //  3. call alternate method
826     this->setTileResource(tile_resource);
827 
828     return;
829 }   /* setTileResource(double) */
```

3.5.3.21 setTileResource() [2/2]

```
void HexTile::setTileResource (
            TileResource tile_resource )
```

Method to set the tile resource (by enum value).

Parameters

tile_resource	The resource (TileResource) value to attribute to the tile.

```
771 {
772     this->tile_resource = tile_resource;
773     this->__setResourceText();
774 
775     return;
776 }   /* setTileResource(TileResource) */
```

3.5.3.22 setTileType() [1/2]

```
void HexTile::setTileType (
            double input_value )
```

Method to set the tile type (by numeric input).

Parameters

input_value	A numerical input in the closed interval [0, 1].

```
721 {
722     //  1. check input
723     if (input_value < 0 or input_value > 1) {
724         std::string error_str = "ERROR  HexTile::setTileType()  given input value is ";
725         error_str += "not in the closed interval [0, 1]";
726 
727         #ifdef _WIN32
728             std::cout « error_str « std::endl;
729         #endif  /* _WIN32 */
730 
731         throw std::runtime_error(error_str);
732     }
733 
734     //  2. convert input value to tile type
735     TileType tile_type;
736 
737     if (input_value <= TILE_TYPE_CUMULATIVE_PROBABILITIES[0]) {
738         tile_type = TileType :: LAKE;
739     }
740     else if (input_value <= TILE_TYPE_CUMULATIVE_PROBABILITIES[1]) {
741         tile_type = TileType :: PLAINS;
742     }
743     else if (input_value <= TILE_TYPE_CUMULATIVE_PROBABILITIES[2]) {
744         tile_type = TileType :: FOREST;
745     }
746     else {
747         tile_type = TileType :: MOUNTAINS;
748     }
749 
750     //  3. call alternate method
751     this->setTileType(tile_type);
752 
753     return;
754 }   /* setTileType(double) */
```

3.5.3.23 setTileType() [2/2]

```
void HexTile::setTileType (
            TileType tile_type )
```

Method to set the tile type (by enum value).

Parameters

tile_type	The type (TileType) to set the tile to.

```
662 {
663     this->tile_type = tile_type;
664 
665     switch (this->tile_type) {
666         case (TileType :: FOREST): {
667             this->tile_sprite.setFillColor(FOREST_GREEN);
668 
669             break;
670         }
671 
672         case (TileType :: LAKE): {
```

```
673             this->tile_sprite.setFillColor(LAKE_BLUE);
674
675             break;
676         }
677
678         case (TileType :: MOUNTAINS): {
679             this->tile_sprite.setFillColor(MOUNTAINS_GREY);
680
681             break;
682         }
683
684         case (TileType :: OCEAN): {
685             this->tile_sprite.setFillColor(OCEAN_BLUE);
686
687             break;
688         }
689
690         case (TileType :: PLAINS): {
691             this->tile_sprite.setFillColor(PLAINS_YELLOW);
692
693             break;
694         }
695
696         default: {
697             // do nothing!
698
699             break;
700         }
701     }
702
703     return;
704 }   /* setTileType(TileType) */
```

3.5.3.24 toggleResourceOverlay()

```
void HexTile::toggleResourceOverlay (
              void  )
```

Method to toggle the tile resource overlay.

```
942 {
943     if (this->show_resource) {
944         this->show_resource = false;
945     }
946     else {
947         this->show_resource = true;
948     }
949
950     return;
951 }   /* toggleResourceOverlay() */
```

3.5.4 Member Data Documentation

3.5.4.1 assets_manager_ptr

```
AssetsManager* HexTile::assets_manager_ptr  [private]
```

A pointer to the assets manager.

3.5.4.2 event_ptr

```
sf::Event* HexTile::event_ptr  [private]
```

A pointer to the event class.

3.5.4.3 frame

```
int HexTile::frame
```

The current frame of this object.

3.5.4.4 has_improvement

```
bool HexTile::has_improvement
```

A boolean which indicates if tile has improvement or not.

3.5.4.5 is_selected

```
bool HexTile::is_selected
```

A boolean which indicates whether or not the tile is selected.

3.5.4.6 major_radius

```
double HexTile::major_radius
```

The radius of the smallest bounding circle.

3.5.4.7 message_hub_ptr

```
MessageHub* HexTile::message_hub_ptr  [private]
```

A pointer to the message hub.

3.5.4.8 minor_radius

```
double HexTile::minor_radius
```

The radius of the largest inscribed circle.

3.5.4.9 node_sprite

```
sf::CircleShape HexTile::node_sprite
```

A circle shape to mark the tile node.

3.5.4.10 position_x

```
double HexTile::position_x
```

The x position of the tile.

3.5.4.11 position_y

```
double HexTile::position_y
```

The y position of the tile.

3.5.4.12 render_window_ptr

```
sf::RenderWindow* HexTile::render_window_ptr  [private]
```

A pointer to the render window.

3.5.4.13 resource_assessed

```
bool HexTile::resource_assessed
```

A boolean which indicates whether or not the resource has been assessed.

3.5.4.14 resource_chip_sprite

```
sf::CircleShape HexTile::resource_chip_sprite
```

A circle shape which represents a resource chip.

3.5.4.15 resource_text

```
sf::Text HexTile::resource_text
```

A text representation of the resource.

3.5.4.16 select_outline_sprite

```
sf::ConvexShape HexTile::select_outline_sprite
```

A convex shape which outlines the tile when selected.

3.5.4.17 show_node

```
bool HexTile::show_node
```

A boolean which indicates whether or not to show the tile node.

3.5.4.18 show_resource

```
bool HexTile::show_resource
```

A boolean which indicates whether or not to show resource value.

3.5.4.19 tile_decoration_sprite

```
sf::Sprite HexTile::tile_decoration_sprite
```

A tile decoration sprite.

3.5.4.20 tile_improvement_ptr

```
TileImprovement* HexTile::tile_improvement_ptr
```

A pointer to the improvement for this tile.

3.5.4.21 tile_resource

```
TileResource HexTile::tile_resource
```

3.5.4.22 tile_sprite

```
sf::ConvexShape HexTile::tile_sprite
```

A convex shape which represents the tile.

3.5.4.23 tile_type

```
TileType HexTile::tile_type
```

The documentation for this class was generated from the following files:

- header/HexTile.h
- source/HexTile.cpp

3.6 Message Struct Reference

A structure which defines a standard message format.

```
#include <MessageHub.h>
```

Public Attributes

- std::string channel = ""
  A string identifying the appropriate channel for this message.
- std::string subject = ""
  A string describing the message subject.
- std::vector< bool > bool_payload_vec = {}
  A vector <bool> payload.
- std::vector< int > int_payload_vec = {}
  A vector <int> payload.
- std::vector< double > double_payload_vec = {}
  A vector <double> payload.
- std::string string_payload = ""
  A string payload.

3.6.1 Detailed Description

A structure which defines a standard message format.

3.6.2 Member Data Documentation

3.6.2.1 bool_payload_vec

```
std::vector<bool> Message::bool_payload_vec = {}
```

A vector <bool> payload.

3.6.2.2 channel

```
std::string Message::channel = ""
```

A string identifying the appropriate channel for this message.

3.6.2.3 double_payload_vec

```
std::vector<double> Message::double_payload_vec = {}
```

A vector <double> payload.

3.6.2.4 int_payload_vec

```
std::vector<int> Message::int_payload_vec = {}
```

A vector <int> payload.

3.6.2.5 string_payload

```
std::string Message::string_payload = ""
```

A string payload.

3.6.2.6 subject

```
std::string Message::subject = ""
```

A string describing the message subject.

The documentation for this struct was generated from the following file:

- header/ESC_core/MessageHub.h

3.7 MessageHub Class Reference

A class which acts as a central hub for inter-object message traffic.

```
#include <MessageHub.h>
```

Public Member Functions

- MessageHub (void)
  Constructor for the MessageHub class.
- bool hasTraffic (void)
  Method to determine if there remains any message traffic.
- void addChannel (std::string)
  Method to add channel to message map.
- void removeChannel (std::string)
  Method to remove channel from message map.
- void sendMessage (Message)
  Method to send a message to the message map.
- bool isEmpty (std::string)
  Method to check if channel is empty.
- Message receiveMessage (std::string)
  Method to receive the latest message in the given channel.
- void popMessage (std::string)
  Method to pop latest message off of the given channel.
- void clearMessages (void)
  Method to clear messages from the MessageHub.
- void clear (void)
  Method to clear the MessageHub.
- ~MessageHub (void)
  Destructor for the MessageHub class.

Private Attributes

- std::map< std::string, std::list< Message > > message_map
  A map <string, list of Message> for sending and receiving messages. Here the key is the channel, and each channel maintains a list (history) of messages.

3.7.1 Detailed Description

A class which acts as a central hub for inter-object message traffic.

3.7.2 Constructor & Destructor Documentation

3.7.2.1 MessageHub()

```
MessageHub::MessageHub (
            void  )
```

Constructor for the MessageHub class.

```
46 {
47     //...
48
49     std::cout « "MessageHub constructed at " « this « std::endl;
50
51     return;
52 }   /* MessageHub() */
```

3.7.2.2 ~MessageHub()

```
MessageHub::~MessageHub (
            void  )
```

Destructor for the MessageHub class.

```
386 {
387     this->clear();
388
389     std::cout « "MessageHub at " « this « " destroyed" « std::endl;
390
391     return;
392 }   /* ~MessageHub() */
```

3.7.3 Member Function Documentation

3.7.3.1 addChannel()

```
void MessageHub::addChannel (
            std::string channel )
```

Method to add channel to message map.

Parameters

channel	The key for the message channel being added.

```
97 {
98     //  1. check if channel is in map (if so, throw error)
99     if (this->message_map.count(channel) > 0) {
100         std::string error_str = "ERROR  MessageHub::addChannel()  channel ";
101         error_str += channel;
102         error_str += " is already in message map";
103 
104         #ifdef _WIN32
105             std::cout « error_str « std::endl;
106         #endif  /* _WIN32 */
107 
108         throw std::runtime_error(error_str);
109     }
110 
111     //  2. add channel to map
112     this->message_map[channel] = {};
113 
114     return;
115 }   /* addChannel() */
```

3.7.3.2 clear()

```
void MessageHub::clear (
             void  )
```

Method to clear the MessageHub.

```
366 {
367 
368     this->clearMessages();
369     this->message_map.clear();
370 
371     return;
372 }   /* clear() */
```

3.7.3.3 clearMessages()

```
void MessageHub::clearMessages (
             void  )
```

Method to clear messages from the MessageHub.

```
340 {
341     std::map<std::string, std::list<Message»::iterator map_iter;
342     for (
343         map_iter = this->message_map.begin();
344         map_iter != this->message_map.end();
345         map_iter++
346     ) {
347         map_iter->second.clear();
348     }
349 
350     return;
351 }   /* clearMessages() */
```

3.7.3.4 hasTraffic()

```
bool MessageHub::hasTraffic (
            void  )
```

Method to determine if there remains any message traffic.

```
67 {
68     std::map<std::string, std::list<Message>::iterator map_iter;
69     for (
70         map_iter = this->message_map.begin();
71         map_iter != this->message_map.end();
72         map_iter++
73     ) {
74         if (not map_iter->second.empty()) {
75             return true;
76         }
77     }
78
79     return false;
80 }   /* hasTraffic() */
```

3.7.3.5 isEmpty()

```
bool MessageHub::isEmpty (
            std::string channel )
```

Method to check if channel is empty.

Parameters

channel	The key for the message channel being checked.

Returns

A boolean indicating whether the channel is empty or not.

```
207 {
208     //  1. check if channel is in map (if not, throw error)
209     if (this->message_map.count(channel) <= 0) {
210         std::string error_str = "ERROR  MessageHub::isEmpty()  channel ";
211         error_str += channel;
212         error_str += " is not in message map";
213
214         #ifdef _WIN32
215             std::cout « error_str « std::endl;
216         #endif  /* _WIN32 */
217
218         throw std::runtime_error(error_str);
219     }
220
221     if (this->message_map[channel].empty()) {
222         return true;
223     }
224     else {
225         return false;
226     }
227 }   /* isEmpty() */
```

3.7.3.6 popMessage()

```
void MessageHub::popMessage (
            std::string channel )
```

Method to pop latest message off of the given channel.

Parameters

channel	The key for the message channel being popped.

```
294 {
295     //  1. check if channel is in map (if not, throw error)
296     if (this->message_map.count(channel) <= 0) {
297         std::string error_str = "ERROR  MessageHub::receiveMessage()  channel ";
298         error_str += channel;
299         error_str += " is not in message map";
300 
301         #ifdef _WIN32
302             std::cout « error_str « std::endl;
303         #endif  /* _WIN32 */
304 
305         throw std::runtime_error(error_str);
306     }
307 
308     //  2. check if channel is empty (if so, throw error)
309     if (this->message_map[channel].empty()) {
310         std::string error_str = "ERROR  MessageHub::receiveMessage()  channel ";
311         error_str += channel;
312         error_str += " is empty";
313 
314         #ifdef _WIN32
315             std::cout « error_str « std::endl;
316         #endif  /* _WIN32 */
317 
318         throw std::runtime_error(error_str);
319     }
320 
321     //  3. pop message
322     this->message_map[channel].pop_back();
323 
324     return;
325 }   /* popMessage() */
```

3.7.3.7 receiveMessage()

```
Message MessageHub::receiveMessage (
            std::string channel )
```

Method to receive the latest message in the given channel.

Parameters

channel	The key for the message channel being received from.

Returns

The latest message in the given channel.

```
246 {
247     //  1. check if channel is in map (if not, throw error)
248     if (this->message_map.count(channel) <= 0) {
249         std::string error_str = "ERROR  MessageHub::receiveMessage()  channel ";
250         error_str += channel;
251         error_str += " is not in message map";
252 
253         #ifdef _WIN32
254             std::cout « error_str « std::endl;
255         #endif  /* _WIN32 */
256 
257         throw std::runtime_error(error_str);
258     }
259 
260     //  2. check if channel is empty (if so, throw error)
261     if (this->message_map[channel].empty()) {
262         std::string error_str = "ERROR  MessageHub::receiveMessage()  channel ";
```

```
263         error_str += channel;
264         error_str += " is empty";
265 
266         #ifdef _WIN32
267             std::cout « error_str « std::endl;
268         #endif  /* _WIN32 */
269 
270         throw std::runtime_error(error_str);
271     }
272 
273     //  3. receive message
274     Message message = this->message_map[channel].back();
275 
276     return message;
277 }   /* receiveMessage() */
```

3.7.3.8 removeChannel()

```
void MessageHub::removeChannel (
            std::string channel )
```

Method to remove channel from message map.

Parameters

channel	The key for the message channel being removed.

```
132 {
133     //  1. check if channel is in map (if not, throw error)
134     if (this->message_map.count(channel) <= 0) {
135         std::string error_str = "ERROR  MessageHub::removeChannel()  channel ";
136         error_str += channel;
137         error_str += " is not in message map";
138 
139         #ifdef _WIN32
140             std::cout « error_str « std::endl;
141         #endif  /* _WIN32 */
142 
143         throw std::runtime_error(error_str);
144     }
145 
146     //  2. remove channel from map
147     this->message_map[channel].clear();
148     this->message_map.erase(channel);
149 
150     return;
151 }   /* removeChannel() */
```

3.7.3.9 sendMessage()

```
void MessageHub::sendMessage (
            Message message )
```

Method to send a message to the message map.

Parameters

message	The message to be sent.

```
168 {
169     //  1. check if channel is in map (if not, throw error)
170     std::string channel = message.channel;
```

```
171
172     if (this->message_map.count(channel) <= 0) {
173         std::string error_str = "ERROR  MessageHub::sendMessage()  channel ";
174         error_str += channel;
175         error_str += " is not in message map";
176
177         #ifdef _WIN32
178             std::cout « error_str « std::endl;
179         #endif  /* _WIN32 */
180
181         throw std::runtime_error(error_str);
182     }
183
184     //  2. send message to message map
185     this->message_map[channel].push_back(message);
186
187     return;
188 }   /* sendMessage() */
```

3.7.4 Member Data Documentation

3.7.4.1 message_map

```
std::map<std::string, std::list<Message> > MessageHub::message_map  [private]
```

A map <string, list of Message> for sending and receiving messages. Here the key is the channel, and each channel maintains a list (history) of messages.

The documentation for this class was generated from the following files:

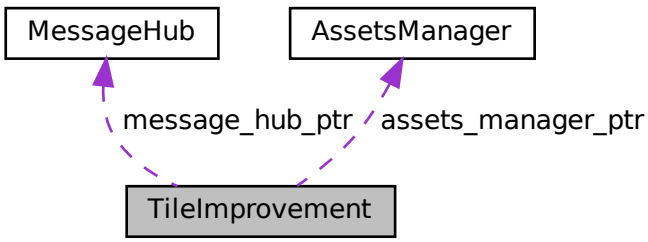
- header/ESC_core/MessageHub.h
- source/ESC_core/MessageHub.cpp

3.8 TileImprovement Class Reference

A base class for the tile improvement hierarchy.

```
#include <TileImprovement.h>
```

Collaboration diagram for TileImprovement:



Public Member Functions

- TileImprovement (double, double, sf::Event ∗, sf::RenderWindow ∗, AssetsManager ∗, MessageHub ∗)

  Constructor for the TileImprovement class.
- virtual void processEvent (void)

  Method to process TileImprovement. To be called once per event.
- virtual void processMessage (void)

  Method to process TileImprovement. To be called once per message.
- virtual void draw (void)

  Method to draw the hex tile to the render window. To be called once per frame.
- virtual ∼TileImprovement (void)

  Destructor for the TileImprovement class.

Public Attributes

- int frame

  The current frame of this object.
- double position_x

  The x position of the tile improvement.
- double position_y

  The y position of the tile improvement.

Private Member Functions

- virtual void __handleKeyPressEvents (void)

  Helper method to handle key press events.
- virtual void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.

Private Attributes

- sf::Event ∗ event_ptr

  A pointer to the event class.
- sf::RenderWindow ∗ render_window_ptr

  A pointer to the render window.
- AssetsManager ∗ assets_manager_ptr

  A pointer to the assets manager.
- MessageHub ∗ message_hub_ptr

  A pointer to the message hub.

3.8.1 Detailed Description

A base class for the tile improvement hierarchy.

3.8.2 Constructor & Destructor Documentation

3.8.2.1 TileImprovement()

```
TileImprovement::TileImprovement (
            double position_x,
            double position_y,
            sf::Event * event_ptr,
            sf::RenderWindow * render_window_ptr,
            AssetsManager * assets_manager_ptr,
            MessageHub * message_hub_ptr )
```

Constructor for the TileImprovement class.

Ref: Wikipedia [2023]

Parameters

position_x	The x position of the tile.
position_y	The y position of the tile.
event_ptr	Pointer to the event class.
render_window_ptr	Pointer to the render window.
assets_manager_ptr	Pointer to the assets manager.
message_hub_ptr	Pointer to the message hub.

```
133 {
134     //  1. set attributes
135 
136     //  1.1. private
137     this->event_ptr = event_ptr;
138     this->render_window_ptr = render_window_ptr;
139 
140     this->assets_manager_ptr = assets_manager_ptr;
141     this->message_hub_ptr = message_hub_ptr;
142 
143     //  1.2. public
144     this->frame = 0;
145 
146     this->position_x = position_x;
147     this->position_y = position_y;
148 
149     std::cout « "TileImprovement constructed at " « this « std::endl;
150 
151     return;
152 }   /* TileImprovement() */
```

3.8.2.2 ~TileImprovement()

```
TileImprovement::~TileImprovement (
            void  )  [virtual]
```

Destructor for the TileImprovement class.

```
232 {
233     std::cout « "TileImprovement at " « this « " destroyed" « std::endl;
234 
235     return;
236 }   /* ~TileImprovement() */
```

3.8.3 Member Function Documentation

3.8.3.1 __handleKeyPressEvents()

```
void TileImprovement::__handleKeyPressEvents (
            void  )  [private], [virtual]
```

Helper method to handle key press events.

```
34 {
35     switch (this->event_ptr->key.code) {
36         //...
37 
38 
39         default: {
40             // do nothing!
41 
42             break;
43         }
44     }
45 
46     return;
47 }   /* __handleKeyPressEvents() */
```

3.8.3.2 __handleMouseButtonEvents()

```
void TileImprovement::__handleMouseButtonEvents (
            void  )  [private], [virtual]
```

Helper method to handle mouse button events.

```
62 {
63     switch (this->event_ptr->mouseButton.button) {
64         case (sf::Mouse::Left): {
65             //...
66 
67             break;
68         }
69 
70 
71         case (sf::Mouse::Right): {
72             //...
73 
74             break;
75         }
76 
77 
78         default: {
79             // do nothing!
80 
81             break;
82         }
83     }
84 
85     return;
86 }   /* __handleMouseButtonEvents() */
```

3.8.3.3 draw()

```
void TileImprovement::draw (
            void  )  [virtual]
```

Method to draw the hex tile to the render window. To be called once per frame.

```
212 {
213     //...
214 
215     this->frame++;
216     return;
217 }   /* draw() */
```

3.8.3.4 processEvent()

```
void TileImprovement::processEvent (
            void  )  [virtual]
```

Method to process TileImprovement. To be called once per event.

```
167 {
168     if (this->event_ptr->type == sf::Event::KeyPressed) {
169         this->__handleKeyPressEvents();
170     }
171
172     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
173         this->__handleMouseButtonEvents();
174     }
175
176     return;
177 }   /* processEvent() */
```

3.8.3.5 processMessage()

```
void TileImprovement::processMessage (
            void  )  [virtual]
```

Method to process TileImprovement. To be called once per message.

```
192 {
193     //...
194
195     return;
196 }   /* processMessage() */
```

3.8.4 Member Data Documentation

3.8.4.1 assets_manager_ptr

```
AssetsManager* TileImprovement::assets_manager_ptr  [private]
```

A pointer to the assets manager.

3.8.4.2 event_ptr

```
sf::Event* TileImprovement::event_ptr  [private]
```

A pointer to the event class.

3.8.4.3 frame

```
int TileImprovement::frame
```

The current frame of this object.

3.8.4.4 message_hub_ptr

```
MessageHub* TileImprovement::message_hub_ptr  [private]
```

A pointer to the message hub.

3.8.4.5 position_x

```
double TileImprovement::position_x
```

The x position of the tile improvement.

3.8.4.6 position_y

```
double TileImprovement::position_y
```

The y position of the tile improvement.

3.8.4.7 render_window_ptr

```
sf::RenderWindow* TileImprovement::render_window_ptr  [private]
```

A pointer to the render window.

The documentation for this class was generated from the following files:

- header/TileImprovement.h
- source/TileImprovement.cpp

Chapter 4

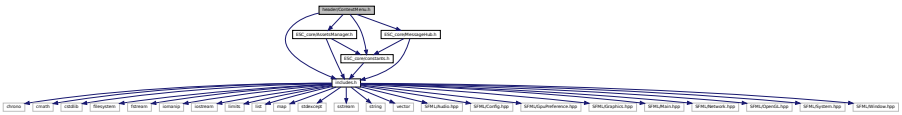
File Documentation

4.1 header/ContextMenu.h File Reference

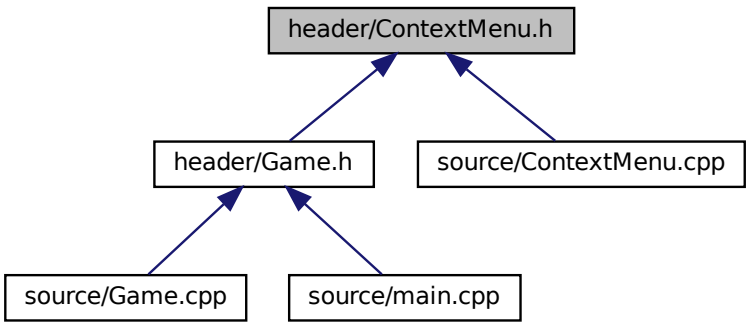
Header file for the ContextMenu class.

```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
#include "ESC_core/MessageHub.h"
```

Include dependency graph for ContextMenu.h:



This graph shows which files directly or indirectly include this file:



Classes

- class ContextMenu

  A class which defines a context menu for the game.

Enumerations

- enum ConsoleState {
  NONE_STATE , READY , MENU , TILE ,
  N_CONSOLE_STATES }

  An enumeration of the different console screen states.

4.1.1 Detailed Description

Header file for the ContextMenu class.

4.1.2 Enumeration Type Documentation

4.1.2.1 ConsoleState

```
enum ConsoleState
```

An enumeration of the different console screen states.

Enumerator

NONE_STATE	None state (for initialization)
READY	Ready (default) state.
MENU	Game menu state.
TILE	Tile context state.
N_CONSOLE_STATES	A simple hack to get the number of console screen states.

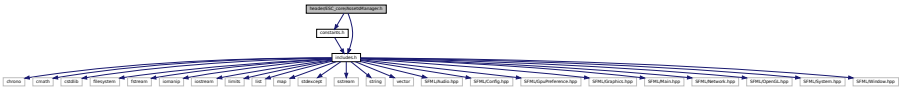
```
34                  {
35     NONE_STATE,
36     READY,
37     MENU,
38     TILE,
39     N_CONSOLE_STATES
40 };
```

4.2 header/ESC_core/AssetsManager.h File Reference

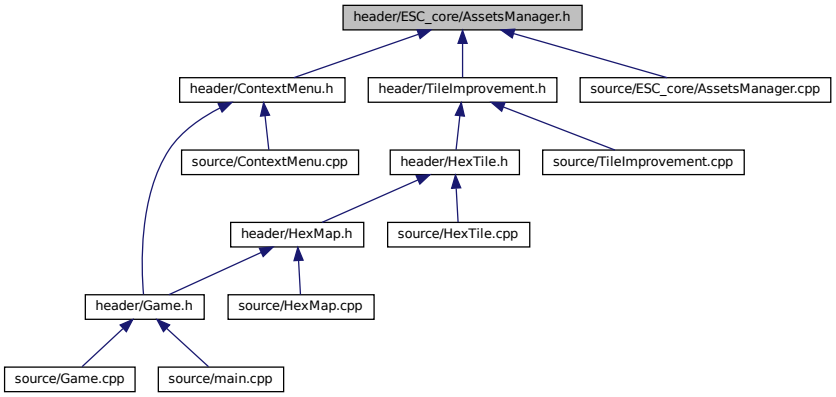
Header file for the AssetsManager class.

```
#include "constants.h"
#include "includes.h"
```

Include dependency graph for AssetsManager.h:



This graph shows which files directly or indirectly include this file:



Classes

- class AssetsManager

  A class which manages visual and sound assets.

4.2.1 Detailed Description

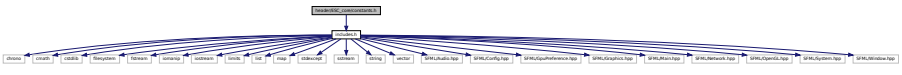
Header file for the AssetsManager class.

4.3 header/ESC_core/constants.h File Reference

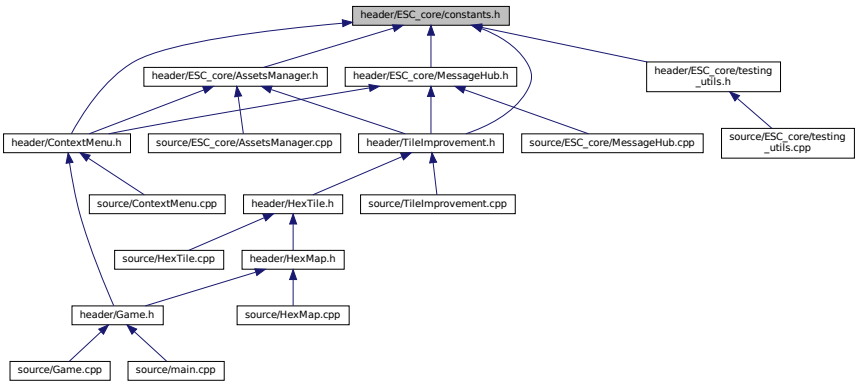
Header file for various constants.

```
#include "includes.h"
```

Include dependency graph for constants.h:



This graph shows which files directly or indirectly include this file:



Functions

- const sf::Color FOREST_GREEN (34, 139, 34)

  The base colour of a forest tile.
- const sf::Color LAKE_BLUE (0, 102, 204)

  The base colour of a lake (water) tile.
- const sf::Color MOUNTAINS_GREY (97, 110, 113)

  The base colour of a mountains tile.
- const sf::Color OCEAN_BLUE (0, 51, 102)

  The base colour of an ocean (water) tile.
- const sf::Color PLAINS_YELLOW (245, 222, 133)

  The base colour of a plains tile.
- const sf::Color MENU_FRAME_GREY (185, 187, 182)

  The base colour of the context menu frame.
- const sf::Color MONOCHROME_SCREEN_BACKGROUND (40, 40, 40)

  The base colour of old monochrome screens.
- const sf::Color VISUAL_SCREEN_FRAME_GREY (151, 151, 143)

  The base colour of the framing of the visual screen.
- const sf::Color MONOCHROME_TEXT_GREEN (0, 255, 102)

  The base colour of old monochrome text (green).
- const sf::Color MONOCHROME_TEXT_AMBER (255, 176, 0)

  The base colour of old monochrome text (amber).
- const sf::Color MONOCHROME_TEXT_RED (255, 44, 0)

  The base colour of old monochrome text (red).

Variables

- const double FLOAT_TOLERANCE = 1e-6

  Tolerance for floating point equality tests.
- const unsigned long long int SECONDS_PER_YEAR = 31537970
- const unsigned long long int SECONDS_PER_MONTH = 2628164
- const int FRAMES_PER_SECOND = 60

  Target frames per second.

- const double SECONDS_PER_FRAME = 1.0 / 60

  Target seconds per frame (just reciprocal of target frames per second).
- const int GAME_WIDTH = 1200

  Width of the game space.
- const int GAME_HEIGHT = 800

  Height of the game space.
- const std::vector< double > TILE_TYPE_CUMULATIVE_PROBABILITIES

  Cumulative probabilities for each tile type (to support procedural generation).
- const std::vector< double > TILE_RESOURCE_CUMULATIVE_PROBABILITIES

  Cumulative probabilities for each tile resource (to support procedural generation).
- const std::string TILE_SELECTED_CHANNEL = "TILE SELECTED CHANNEL"

  A message channel for tile selection messages.
- const std::string NO_TILE_SELECTED_CHANNEL = "NO TILE SELECTED CHANNEL"

  A message channel for no tile selected messages.
- const std::string TILE_STATE_CHANNEL = "TILE STATE CHANNEL"

  A message channel for tile state messages.
- const unsigned int EMISSIONS_LIFETIME_LIMIT_TONNES = 1500

  The CO2-equivalent mass of emissions that would result from burning 1,000,000 L of diesel fuel.
- const double CO2E_KG_PER_LITRE_DIESEL = 3.1596

  The CO2-equivalent mass of emissions that result from burning one litre of diesel fuel.
- const std::string GAME_CHANNEL = "GAME CHANNEL"

  A message channel for game messages.

4.3.1 Detailed Description

Header file for various constants.

4.3.2 Function Documentation

4.3.2.1 FOREST_GREEN()

```
const sf::Color FOREST_GREEN (
            34 ,
            139 ,
            34  )
```

The base colour of a forest tile.

4.3.2.2 LAKE_BLUE()

```
const sf::Color LAKE_BLUE (
            0 ,
            102 ,
            204  )
```

The base colour of a lake (water) tile.

4.3.2.3 MENU_FRAME_GREY()

```
const sf::Color MENU_FRAME_GREY (
            185 ,
            187 ,
            182  )
```

The base colour of the context menu frame.

4.3.2.4 MONOCHROME_SCREEN_BACKGROUND()

```
const sf::Color MONOCHROME_SCREEN_BACKGROUND (
            40 ,
            40 ,
            40  )
```

The base colour of old monochrome screens.

4.3.2.5 MONOCHROME_TEXT_AMBER()

```
const sf::Color MONOCHROME_TEXT_AMBER (
            255 ,
            176 ,
            0  )
```

The base colour of old monochrome text (amber).

4.3.2.6 MONOCHROME_TEXT_GREEN()

```
const sf::Color MONOCHROME_TEXT_GREEN (
            0 ,
            255 ,
            102  )
```

The base colour of old monochrome text (green).

4.3.2.7 MONOCHROME_TEXT_RED()

```
const sf::Color MONOCHROME_TEXT_RED (
            255 ,
            44 ,
            0  )
```

The base colour of old monochrome text (red).

4.3.2.8 MOUNTAINS_GREY()

```
const sf::Color MOUNTAINS_GREY (
            97 ,
            110 ,
            113  )
```

The base colour of a mountains tile.

4.3.2.9 OCEAN_BLUE()

```
const sf::Color OCEAN_BLUE (
            0 ,
            51 ,
            102  )
```

The base colour of an ocean (water) tile.

4.3.2.10 PLAINS_YELLOW()

```
const sf::Color PLAINS_YELLOW (
            245 ,
            222 ,
            133  )
```

The base colour of a plains tile.

4.3.2.11 VISUAL_SCREEN_FRAME_GREY()

```
const sf::Color VISUAL_SCREEN_FRAME_GREY (
            151 ,
            151 ,
            143  )
```

The base colour of the framing of the visual screen.

4.3.3 Variable Documentation

4.3.3.1 CO2E_KG_PER_LITRE_DIESEL

```
const double CO2E_KG_PER_LITRE_DIESEL = 3.1596
```

The CO2-equivalent mass of emissions that result from burning one litre of diesel fuel.

4.3.3.2 EMISSIONS_LIFETIME_LIMIT_TONNES

```
const unsigned int EMISSIONS_LIFETIME_LIMIT_TONNES = 1500
```

The CO2-equivalent mass of emissions that would result from burning 1,000,000 L of diesel fuel.

4.3.3.3 FLOAT_TOLERANCE

```
const double FLOAT_TOLERANCE = 1e-6
```

Tolerance for floating point equality tests.

4.3.3.4 FRAMES_PER_SECOND

```
const int FRAMES_PER_SECOND = 60
```

Target frames per second.

4.3.3.5 GAME_CHANNEL

```
const std::string GAME_CHANNEL = "GAME CHANNEL"
```

A message channel for game messages.

4.3.3.6 GAME_HEIGHT

```
const int GAME_HEIGHT = 800
```

Height of the game space.

4.3.3.7 GAME_WIDTH

```
const int GAME_WIDTH = 1200
```

Width of the game space.

4.3.3.8 NO_TILE_SELECTED_CHANNEL

```
const std::string NO_TILE_SELECTED_CHANNEL = "NO TILE SELECTED CHANNEL"
```

A message channel for no tile selected messages.

4.3.3.9 SECONDS_PER_FRAME

```
const double SECONDS_PER_FRAME = 1.0 / 60
```

Target seconds per frame (just reciprocal of target frames per second).

4.3.3.10 SECONDS_PER_MONTH

```
const unsigned long long int SECONDS_PER_MONTH = 2628164
```

4.3.3.11 SECONDS_PER_YEAR

```
const unsigned long long int SECONDS_PER_YEAR = 31537970
```

4.3.3.12 TILE_RESOURCE_CUMULATIVE_PROBABILITIES

```
const std::vector<double> TILE_RESOURCE_CUMULATIVE_PROBABILITIES
```

Initial value:

```
= {
    0.10,
    0.30,
    0.70,
    0.90,
    1.00
}
```

Cumulative probabilities for each tile resource (to support procedural generation).

4.3.3.13 TILE_SELECTED_CHANNEL

```
const std::string TILE_SELECTED_CHANNEL = "TILE SELECTED CHANNEL"
```

A message channel for tile selection messages.

4.3.3.14 TILE_STATE_CHANNEL

```
const std::string TILE_STATE_CHANNEL = "TILE STATE CHANNEL"
```

A message channel for tile state messages.

4.3.3.15 TILE_TYPE_CUMULATIVE_PROBABILITIES

```
const std::vector<double> TILE_TYPE_CUMULATIVE_PROBABILITIES
```

Initial value:

```
= {
    0.25,
    0.50,
    0.75,
    1.00
}
```

Cumulative probabilities for each tile type (to support procedural generation).

4.4 header/ESC_core/doxygen_cite.h File Reference

Header file which simply cites the doxygen tool.

4.4.1 Detailed Description

Header file which simply cites the doxygen tool.

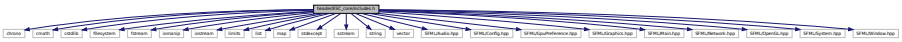
Ref: van Heesch. [2023]

4.5 header/ESC_core/includes.h File Reference

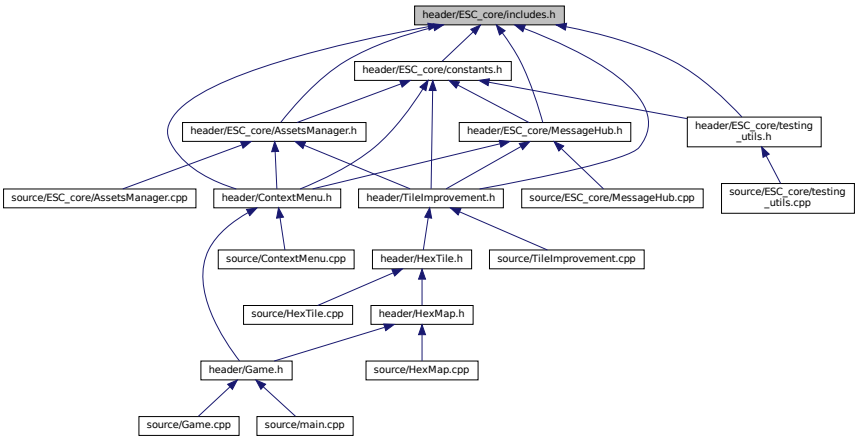
Header file for various includes.

```
#include <chrono>
#include <cmath>
#include <cstdlib>
#include <filesystem>
#include <fstream>
#include <iomanip>
#include <iostream>
#include <limits>
#include <list>
#include <map>
#include <stdexcept>
#include <sstream>
#include <string>
#include <vector>
#include <SFML/Audio.hpp>
#include <SFML/Config.hpp>
#include <SFML/GpuPreference.hpp>
#include <SFML/Graphics.hpp>
#include <SFML/Main.hpp>
#include <SFML/Network.hpp>
#include <SFML/OpenGL.hpp>
#include <SFML/System.hpp>
#include <SFML/Window.hpp>
```

Include dependency graph for includes.h:



This graph shows which files directly or indirectly include this file:



4.5.1 Detailed Description

Header file for various includes.

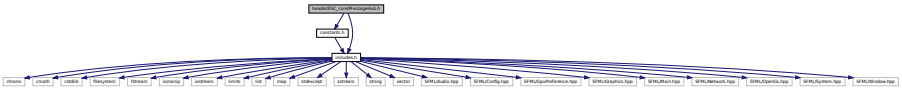
Ref: Gomila [2023]

4.6 header/ESC_core/MessageHub.h File Reference

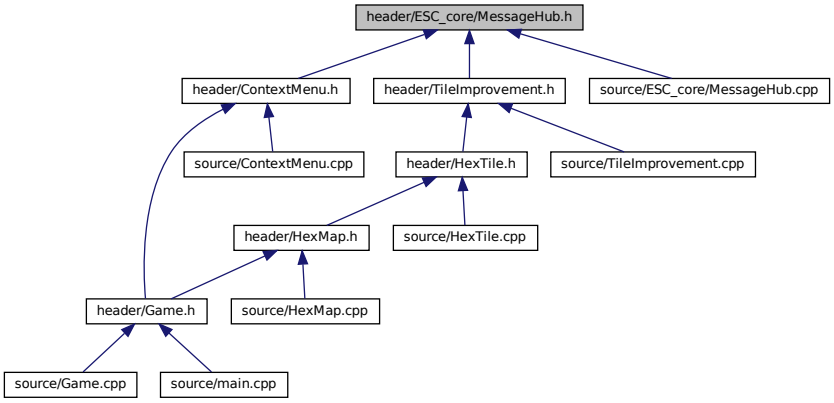
Header file for the MessageHub class.

```
#include "constants.h"
#include "includes.h"
```

Include dependency graph for MessageHub.h:



This graph shows which files directly or indirectly include this file:



Classes

- struct Message

  A structure which defines a standard message format.
- class MessageHub

  A class which acts as a central hub for inter-object message traffic.

4.6.1 Detailed Description

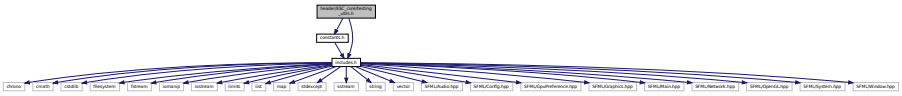
Header file for the MessageHub class.

4.7 header/ESC_core/testing_utils.h File Reference

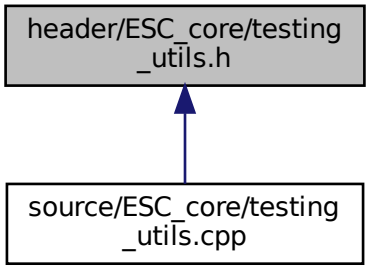
Header file for various testing utilities.

```
#include "constants.h"
#include "includes.h"
```

Include dependency graph for testing_utils.h:



This graph shows which files directly or indirectly include this file:



Functions

- void printGreen (std::string)

  A function that sends green text to std::cout.
- void printGold (std::string)

  A function that sends gold text to std::cout.
- void printRed (std::string)

  A function that sends red text to std::cout.
- void testFloatEquals (double, double, std::string, int)

  Tests for the equality of two floating point numbers x and y (to within FLOAT_TOLERANCE).
- void testGreaterThan (double, double, std::string, int)

  Tests if x > y.
- void testGreaterThanOrEqualTo (double, double, std::string, int)

  Tests if x >= y.
- void testLessThan (double, double, std::string, int)

  Tests if x < y.
- void testLessThanOrEqualTo (double, double, std::string, int)

  Tests if x <= y.
- void testTruth (bool, std::string, int)

  Tests if the given statement is true.
- void expectedErrorNotDetected (std::string, int)

  A utility function to print out a meaningful error message whenever an expected error fails to be thrown/caught/detected.

4.7.1 Detailed Description

Header file for various testing utilities.

This is a library of utility functions used throughout the various test suites.

4.7.2 Function Documentation

4.7.2.1 expectedErrorNotDetected()

```
void expectedErrorNotDetected (
            std::string file,
            int line )
```

A utility function to print out a meaningful error message whenever an expected error fails to be thrown/caught/detected.

Parameters

file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
430 {
431     std::string error_str = "\n ERROR  failed to throw expected error prior to line ";
432     error_str += std::to_string(line);
433     error_str += " of ";
434     error_str += file;
435 
436     #ifdef _WIN32
437         std::cout « error_str « std::endl;
438     #endif
439 
440     throw std::runtime_error(error_str);
441     return;
442 }   /* expectedErrorNotDetected() */
```

4.7.2.2 printGold()

```
void printGold (
            std::string input_str )
```

A function that sends gold text to std::cout.

Parameters

input_str	The text of the string to be sent to std::cout.

```
82 {
83     std::cout « "\x1B[33m" « input_str « "\033[0m";
84     return;
85 }   /* printGold() */
```

4.7.2.3 printGreen()

```
void printGreen (
            std::string input_str )
```

A function that sends green text to std::cout.

Parameters

input_str	The text of the string to be sent to std::cout.

```
62 {
63     std::cout « "\x1B[32m" « input_str « "\033[0m";
64     return;
65 }   /* printGreen() */
```

4.7.2.4 printRed()

```
void printRed (
            std::string input_str )
```

A function that sends red text to std::cout.

Parameters

input_str	The text of the string to be sent to std::cout.

```
102 {
103     std::cout « "\x1B[31m" « input_str « "\033[0m";
104     return;
105 }   /* printRed() */
```

4.7.2.5 testFloatEquals()

```
void testFloatEquals (
            double x,
            double y,
            std::string file,
            int line )
```

Tests for the equality of two floating point numbers *x* and *y* (to within FLOAT_TOLERANCE).

Parameters

x	The first of two numbers to test.
y	The second of two numbers to test.
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
136 {
137     if (fabs(x - y) <= FLOAT_TOLERANCE) {
138         return;
```

```
139     }
140
141     std::string error_str = "ERROR: testFloatEquals():\t in ";
142     error_str += file;
143     error_str += "\tline ";
144     error_str += std::to_string(line);
145     error_str += ":\t\n";
146     error_str += std::to_string(x);
147     error_str += " and ";
148     error_str += std::to_string(y);
149     error_str += " are not equal to within +/- ";
150     error_str += std::to_string(FLOAT_TOLERANCE);
151     error_str += "\n";
152
153     #ifdef _WIN32
154         std::cout « error_str « std::endl;
155     #endif
156
157     throw std::runtime_error(error_str);
158     return;
159 }   /* testFloatEquals() */
```

4.7.2.6 testGreaterThan()

```
void testGreaterThan (
             double x,
             double y,
             std::string file,
             int line )
```

Tests if x > y.

Parameters

x	The first of two numbers to test.
y	The second of two numbers to test.
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
189 {
190     if (x > y) {
191         return;
192     }
193
194     std::string error_str = "ERROR: testGreaterThan():\t in ";
195     error_str += file;
196     error_str += "\tline ";
197     error_str += std::to_string(line);
198     error_str += ":\t\n";
199     error_str += std::to_string(x);
200     error_str += " is not greater than ";
201     error_str += std::to_string(y);
202     error_str += "\n";
203
204     #ifdef _WIN32
205         std::cout « error_str « std::endl;
206     #endif
207
208     throw std::runtime_error(error_str);
209     return;
210 }   /* testGreaterThan() */
```

4.7.2.7 testGreaterThanOrEqualTo()

```
void testGreaterThanOrEqualTo (
             double x,
```

```
            double y,
            std::string file,
            int line )
```

Tests if x >= y.

Parameters

x	The first of two numbers to test.
y	The second of two numbers to test.
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
240 {
241     if (x >= y) {
242         return;
243     }
244
245     std::string error_str = "ERROR: testGreaterThanOrEqualTo():\t in ";
246     error_str += file;
247     error_str += "\tline ";
248     error_str += std::to_string(line);
249     error_str += ":\t\n";
250     error_str += std::to_string(x);
251     error_str += " is not greater than or equal to ";
252     error_str += std::to_string(y);
253     error_str += "\n";
254
255     #ifdef _WIN32
256         std::cout << error_str << std::endl;
257     #endif
258
259     throw std::runtime_error(error_str);
260     return;
261 }   /* testGreaterThanOrEqualTo() */
```

4.7.2.8 testLessThan()

```
void testLessThan (
            double x,
            double y,
            std::string file,
            int line )
```

Tests if x < y.

Parameters

x	The first of two numbers to test.
y	The second of two numbers to test.
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
291 {
292     if (x < y) {
293         return;
294     }
295
296     std::string error_str = "ERROR: testLessThan():\t in ";
297     error_str += file;
298     error_str += "\tline ";
299     error_str += std::to_string(line);
300     error_str += ":\t\n";
```

```
301     error_str += std::to_string(x);
302     error_str += " is not less than ";
303     error_str += std::to_string(y);
304     error_str += "\n";
305 
306     #ifdef _WIN32
307         std::cout « error_str « std::endl;
308     #endif
309 
310     throw std::runtime_error(error_str);
311     return;
312 }   /* testLessThan() */
```

4.7.2.9 testLessThanOrEqualTo()

```
void testLessThanOrEqualTo (
             double x,
             double y,
             std::string file,
             int line )
```

Tests if x <= y.

Parameters

x	The first of two numbers to test.
y	The second of two numbers to test.
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
342 {
343     if (x <= y) {
344         return;
345     }
346 
347     std::string error_str = "ERROR: testLessThanOrEqualTo():\t in ";
348     error_str += file;
349     error_str += "\tline ";
350     error_str += std::to_string(line);
351     error_str += ":\t\n";
352     error_str += std::to_string(x);
353     error_str += " is not less than or equal to ";
354     error_str += std::to_string(y);
355     error_str += "\n";
356 
357     #ifdef _WIN32
358         std::cout « error_str « std::endl;
359     #endif
360 
361     throw std::runtime_error(error_str);
362     return;
363 }   /* testLessThanOrEqualTo() */
```

4.7.2.10 testTruth()

```
void testTruth (
             bool statement,
             std::string file,
             int line )
```

Tests if the given statement is true.

Parameters

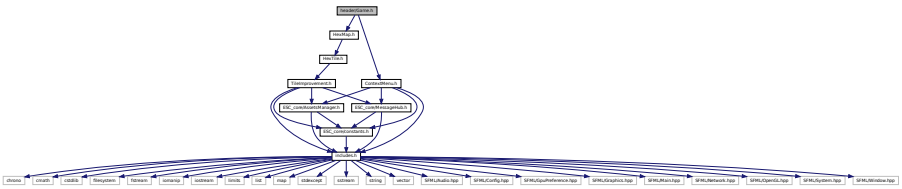
statement	The statement whose truth is to be tested ("1 == 0", for example).
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
390 {
391     if (statement) {
392         return;
393     }
394
395     std::string error_str = "ERROR: testTruth():\t in ";
396     error_str += file;
397     error_str += "\tline ";
398     error_str += std::to_string(line);
399     error_str += ":\t\n";
400     error_str += "Given statement is not true";
401
402     #ifdef _WIN32
403         std::cout « error_str « std::endl;
404     #endif
405
406     throw std::runtime_error(error_str);
407     return;
408 }   /* testTruth() */
```

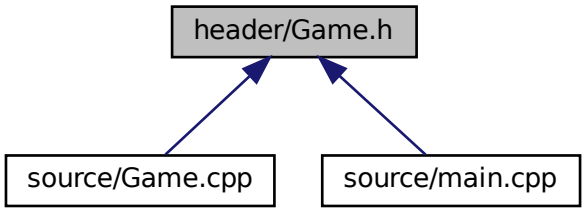
4.8 header/Game.h File Reference

```
#include "HexMap.h"
#include "ContextMenu.h"
```

Include dependency graph for Game.h:



This graph shows which files directly or indirectly include this file:



Classes

- class Game

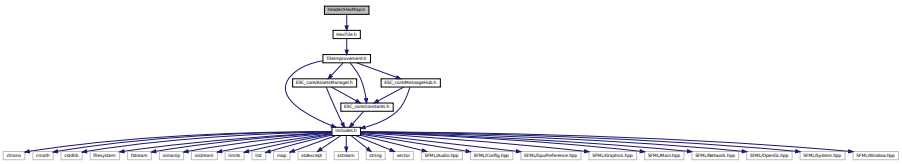
  A class which acts as the central class for the game, by containing all other classes and implementing the game loop.

4.9 header/HexMap.h File Reference

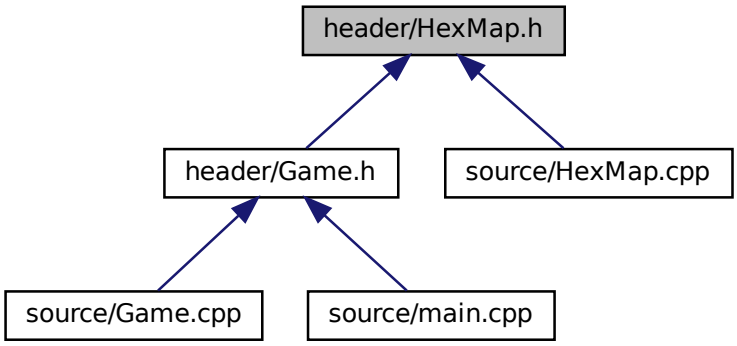
Header file for the HexMap class.

```
#include "HexTile.h"
```

Include dependency graph for HexMap.h:



This graph shows which files directly or indirectly include this file:



Classes

- class HexMap

  A class which defines a hex map of hex tiles.

4.9.1 Detailed Description

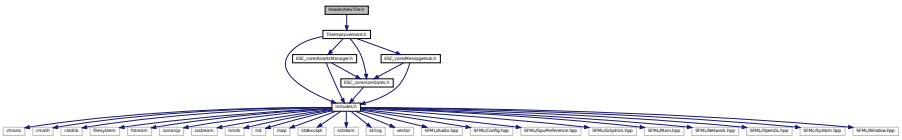
Header file for the HexMap class.

4.10 header/HexTile.h File Reference

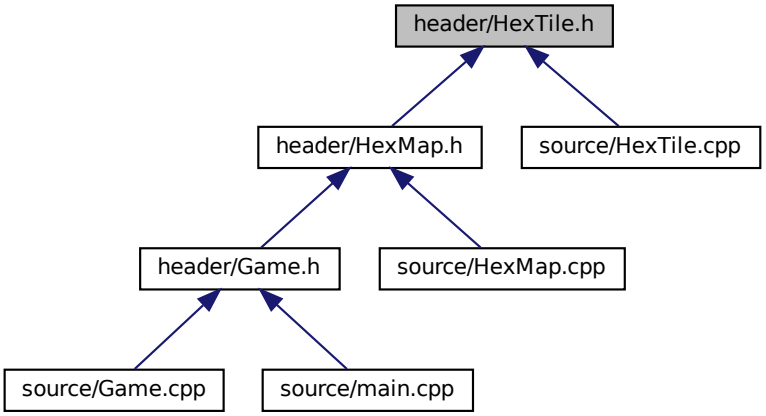
Header file for the Game class.

```
#include "TileImprovement.h"
```

Include dependency graph for HexTile.h:



This graph shows which files directly or indirectly include this file:



Classes

- class HexTile

  A class which defines a hex tile of the hex map.

Enumerations

- enum TileType {
  NONE_TYPE , FOREST , LAKE , MOUNTAINS ,
  OCEAN , PLAINS , N_TILE_TYPES }

  An enumeration of the different tile types.
- enum TileResource {
  POOR , BELOW_AVERAGE , AVERAGE , ABOVE_AVERAGE ,
  GOOD , N_TILE_RESOURCES }

  An enumeration of the different tile resource values.

4.10.1 Detailed Description

Header file for the Game class.

Header file for the HexTile class.

4.10.2 Enumeration Type Documentation

4.10.2.1 TileResource

```
enum TileResource
```

An enumeration of the different tile resource values.

Enumerator

POOR	A poor resource value.
BELOW_AVERAGE	A below average resource value.
AVERAGE	An average resource value.
ABOVE_AVERAGE	An above average resource value.
GOOD	A good resource value.
N_TILE_RESOURCES	A simple hack to get the number of elements in TileResource.

```
48                  {
49     POOR,
50     BELOW_AVERAGE,
51     AVERAGE,
52     ABOVE_AVERAGE,
53     GOOD,
54     N_TILE_RESOURCES
55 };  /* TileResource */
```

4.10.2.2 TileType

```
enum TileType
```

An enumeration of the different tile types.

Enumerator

NONE_TYPE	A dummy tile (for initialization).
FOREST	A forest tile.
LAKE	A lake tile.
MOUNTAINS	A mountains tile.
OCEAN	An ocean tile.
PLAINS	A plains tile.
N_TILE_TYPES	A simple hack to get the number of elements in TileType.

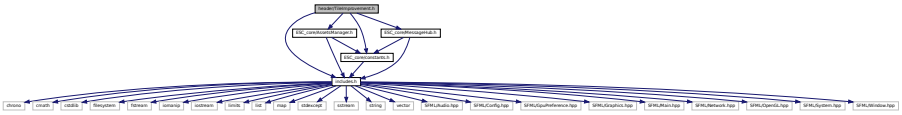
```
31              {
32     NONE_TYPE,
33     FOREST,
34     LAKE,
35     MOUNTAINS,
36     OCEAN,
37     PLAINS,
38     N_TILE_TYPES
39 }; /* TileType */
```

4.11 header/TileImprovement.h File Reference

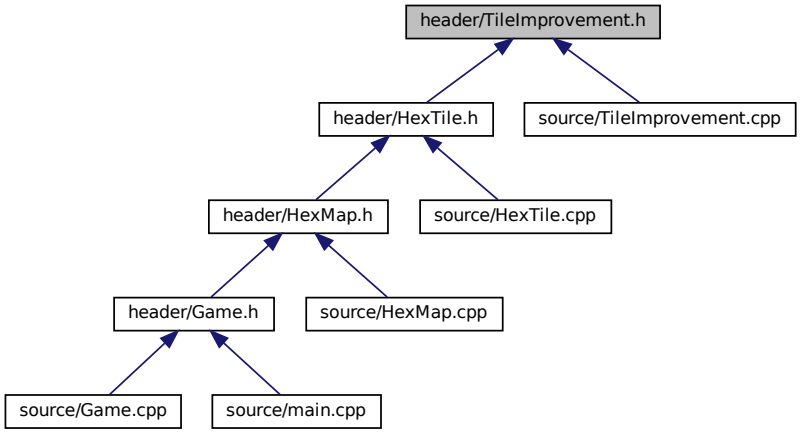
Header file for the TileImprovement class.

```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
#include "ESC_core/MessageHub.h"
```

Include dependency graph for TileImprovement.h:



This graph shows which files directly or indirectly include this file:



Classes

- class TileImprovement

  A base class for the tile improvement hierarchy.

Enumerations

- enum TileImprovementType {
  SETTLEMENT , SOLAR_PV , WIND_TURBINE , TIDAL_TURBINE ,
  WAVE_ENERGY_CONVERTER , ENERGY_STORAGE_SYSTEM , N_TILE_IMPROVEMENT_TYPES }

  An enumeration of the different tile improvement types.

4.11.1 Detailed Description

Header file for the TileImprovement class.

4.11.2 Enumeration Type Documentation

4.11.2.1 TileImprovementType

```
enum TileImprovementType
```

An enumeration of the different tile improvement types.

Enumerator

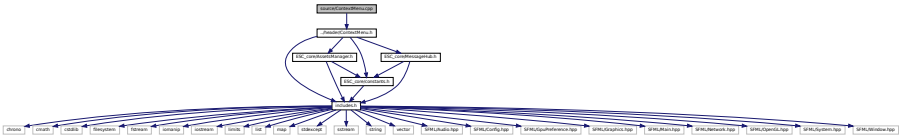
SETTLEMENT	A settlement.
SOLAR_PV	A solar PV array.
WIND_TURBINE	A wind turbine.
TIDAL_TURBINE	A tidal turbine.
WAVE_ENERGY_CONVERTER	A wave energy converter.
ENERGY_STORAGE_SYSTEM	An energy storage system.
N_TILE_IMPROVEMENT_TYPES	A simple hack to get the number of elements in TileImprovementType.

```
34                          {
35     SETTLEMENT,
36     SOLAR_PV,
37     WIND_TURBINE,
38     TIDAL_TURBINE,
39     WAVE_ENERGY_CONVERTER,
40     ENERGY_STORAGE_SYSTEM,
41     N_TILE_IMPROVEMENT_TYPES
42 };  /* TileImprovementType */
```

4.12 source/ContextMenu.cpp File Reference

Implementation file for the ContextMenu class.

```
#include "../header/ContextMenu.h"
```
Include dependency graph for ContextMenu.cpp:



4.12.1 Detailed Description

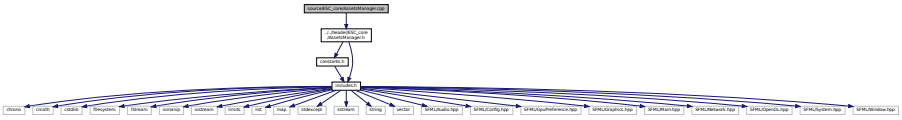
Implementation file for the ContextMenu class.

A class which defines a context menu for the game.

4.13 source/ESC_core/AssetsManager.cpp File Reference

Implementation file for the AssetsManager class.

```
#include "../../header/ESC_core/AssetsManager.h"
```
Include dependency graph for AssetsManager.cpp:



4.13.1 Detailed Description

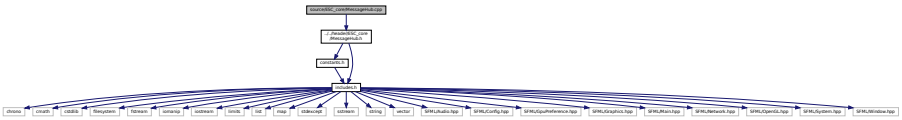
Implementation file for the AssetsManager class.

A class which manages visual and sound assets.

4.14 source/ESC_core/MessageHub.cpp File Reference

Implementation file for the MessageHub class.

```
#include "../../header/ESC_core/MessageHub.h"
```
Include dependency graph for MessageHub.cpp:



4.14.1 Detailed Description

Implementation file for the MessageHub class.

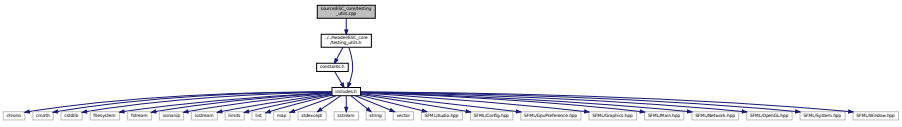
A class which acts as a central hub for inter-object message traffic.

4.15 source/ESC_core/testing_utils.cpp File Reference

Implementation file for various testing utilities.

```
#include "../../header/ESC_core/testing_utils.h"
```

Include dependency graph for testing_utils.cpp:



Functions

- void printGreen (std::string input_str)

  A function that sends green text to std::cout.
- void printGold (std::string input_str)

  A function that sends gold text to std::cout.
- void printRed (std::string input_str)

  A function that sends red text to std::cout.
- void testFloatEquals (double x, double y, std::string file, int line)

  Tests for the equality of two floating point numbers x and y (to within FLOAT_TOLERANCE).
- void testGreaterThan (double x, double y, std::string file, int line)

  Tests if x > y.
- void testGreaterThanOrEqualTo (double x, double y, std::string file, int line)

  Tests if x >= y.
- void testLessThan (double x, double y, std::string file, int line)

  Tests if x < y.
- void testLessThanOrEqualTo (double x, double y, std::string file, int line)

  Tests if x <= y.
- void testTruth (bool statement, std::string file, int line)

  Tests if the given statement is true.
- void expectedErrorNotDetected (std::string file, int line)

  A utility function to print out a meaningful error message whenever an expected error fails to be thrown/caught/detected.

4.15.1 Detailed Description

Implementation file for various testing utilities.

This is a library of utility functions used throughout the various test suites.

4.15.2 Function Documentation

4.15.2.1 expectedErrorNotDetected()

```
void expectedErrorNotDetected (
            std::string file,
            int line )
```

A utility function to print out a meaningful error message whenever an expected error fails to be thrown/caught/detected.

Parameters

file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
430 {
431     std::string error_str = "\n ERROR  failed to throw expected error prior to line ";
432     error_str += std::to_string(line);
433     error_str += " of ";
434     error_str += file;
435 
436     #ifdef _WIN32
437         std::cout « error_str « std::endl;
438     #endif
439 
440     throw std::runtime_error(error_str);
441     return;
442 }   /* expectedErrorNotDetected() */
```

4.15.2.2 printGold()

```
void printGold (
            std::string input_str )
```

A function that sends gold text to std::cout.

Parameters

input_str	The text of the string to be sent to std::cout.

```
82 {
83     std::cout « "\x1B[33m" « input_str « "\033[0m";
84     return;
85 }   /* printGold() */
```

4.15.2.3 printGreen()

```
void printGreen (
            std::string input_str )
```

A function that sends green text to std::cout.

Parameters

input_str	The text of the string to be sent to std::cout.

```
62 {
63     std::cout « "\x1B[32m" « input_str « "\033[0m";
64     return;
65 }   /* printGreen() */
```

4.15.2.4 printRed()

```
void printRed (
              std::string input_str )
```

A function that sends red text to std::cout.

Parameters

input_str	The text of the string to be sent to std::cout.

```
102 {
103     std::cout « "\x1B[31m" « input_str « "\033[0m";
104     return;
105 }   /* printRed() */
```

4.15.2.5 testFloatEquals()

```
void testFloatEquals (
              double x,
              double y,
              std::string file,
              int line )
```

Tests for the equality of two floating point numbers *x* and *y* (to within FLOAT_TOLERANCE).

Parameters

x	The first of two numbers to test.
y	The second of two numbers to test.
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
136 {
137     if (fabs(x - y) <= FLOAT_TOLERANCE) {
138         return;
139     }
140
141     std::string error_str = "ERROR: testFloatEquals():\t in ";
142     error_str += file;
143     error_str += "\tline ";
144     error_str += std::to_string(line);
145     error_str += ":\t\n";
146     error_str += std::to_string(x);
147     error_str += " and ";
148     error_str += std::to_string(y);
149     error_str += " are not equal to within +/- ";
```

```
150     error_str += std::to_string(FLOAT_TOLERANCE);
151     error_str += "\n";
152 
153     #ifdef _WIN32
154         std::cout « error_str « std::endl;
155     #endif
156 
157     throw std::runtime_error(error_str);
158     return;
159 }   /* testFloatEquals() */
```

4.15.2.6 testGreaterThan()

```
void testGreaterThan (
              double x,
              double y,
              std::string file,
              int line )
```

Tests if x > y.

Parameters

x	The first of two numbers to test.
y	The second of two numbers to test.
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
189 {
190     if (x > y) {
191         return;
192     }
193 
194     std::string error_str = "ERROR: testGreaterThan():\t in ";
195     error_str += file;
196     error_str += "\tline ";
197     error_str += std::to_string(line);
198     error_str += ":\t\n";
199     error_str += std::to_string(x);
200     error_str += " is not greater than ";
201     error_str += std::to_string(y);
202     error_str += "\n";
203 
204     #ifdef _WIN32
205         std::cout « error_str « std::endl;
206     #endif
207 
208     throw std::runtime_error(error_str);
209     return;
210 }   /* testGreaterThan() */
```

4.15.2.7 testGreaterThanOrEqualTo()

```
void testGreaterThanOrEqualTo (
              double x,
              double y,
              std::string file,
              int line )
```

Tests if x >= y.

Parameters

x	The first of two numbers to test.
y	The second of two numbers to test.
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
240 {
241     if (x >= y) {
242         return;
243     }
244
245     std::string error_str = "ERROR: testGreaterThanOrEqualTo():\t in ";
246     error_str += file;
247     error_str += "\tline ";
248     error_str += std::to_string(line);
249     error_str += ":\t\n";
250     error_str += std::to_string(x);
251     error_str += " is not greater than or equal to ";
252     error_str += std::to_string(y);
253     error_str += "\n";
254
255     #ifdef _WIN32
256         std::cout « error_str « std::endl;
257     #endif
258
259     throw std::runtime_error(error_str);
260     return;
261 }   /* testGreaterThanOrEqualTo() */
```

4.15.2.8 testLessThan()

```
void testLessThan (
            double x,
            double y,
            std::string file,
            int line )
```

Tests if x $<$ y.

Parameters

x	The first of two numbers to test.
y	The second of two numbers to test.
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
291 {
292     if (x < y) {
293         return;
294     }
295
296     std::string error_str = "ERROR: testLessThan():\t in ";
297     error_str += file;
298     error_str += "\tline ";
299     error_str += std::to_string(line);
300     error_str += ":\t\n";
301     error_str += std::to_string(x);
302     error_str += " is not less than ";
303     error_str += std::to_string(y);
304     error_str += "\n";
305
306     #ifdef _WIN32
307         std::cout « error_str « std::endl;
308     #endif
309
310     throw std::runtime_error(error_str);
```

```
311     return;
312 }   /* testLessThan() */
```

4.15.2.9 testLessThanOrEqualTo()

```
void testLessThanOrEqualTo (
              double x,
              double y,
              std::string file,
              int line )
```

Tests if x <= y.

Parameters

x	The first of two numbers to test.
y	The second of two numbers to test.
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
342 {
343     if (x <= y) {
344         return;
345     }
346 
347     std::string error_str = "ERROR: testLessThanOrEqualTo():\t in ";
348     error_str += file;
349     error_str += "\tline ";
350     error_str += std::to_string(line);
351     error_str += ":\t\n";
352     error_str += std::to_string(x);
353     error_str += " is not less than or equal to ";
354     error_str += std::to_string(y);
355     error_str += "\n";
356 
357     #ifdef _WIN32
358         std::cout « error_str « std::endl;
359     #endif
360 
361     throw std::runtime_error(error_str);
362     return;
363 }   /* testLessThanOrEqualTo() */
```

4.15.2.10 testTruth()

```
void testTruth (
              bool statement,
              std::string file,
              int line )
```

Tests if the given statement is true.

Parameters

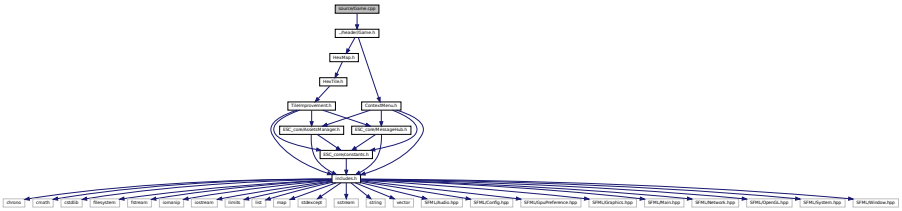
statement	The statement whose truth is to be tested ("1 == 0", for example).
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
390 {
391     if (statement) {
392         return;
393     }
394 
395     std::string error_str = "ERROR: testTruth():\t in ";
396     error_str += file;
397     error_str += "\tline ";
398     error_str += std::to_string(line);
399     error_str += ":\t\n";
400     error_str += "Given statement is not true";
401 
402     #ifdef _WIN32
403         std::cout « error_str « std::endl;
404     #endif
405 
406     throw std::runtime_error(error_str);
407     return;
408 }   /* testTruth() */
```

4.16 source/Game.cpp File Reference

Implementation file for the Game class.

`#include "../header/Game.h"`
Include dependency graph for Game.cpp:



4.16.1 Detailed Description

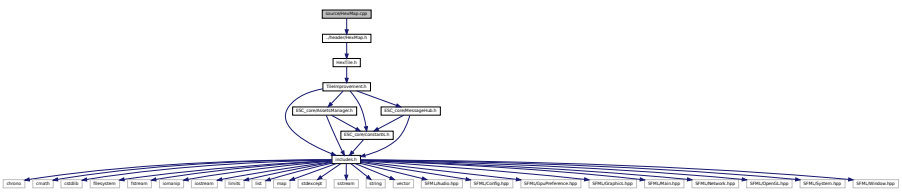
Implementation file for the Game class.

A class which defines a tile of a hex map.

4.17 source/HexMap.cpp File Reference

Implementation file for the HexMap class.

`#include "../header/HexMap.h"`
Include dependency graph for HexMap.cpp:



4.17.1 Detailed Description

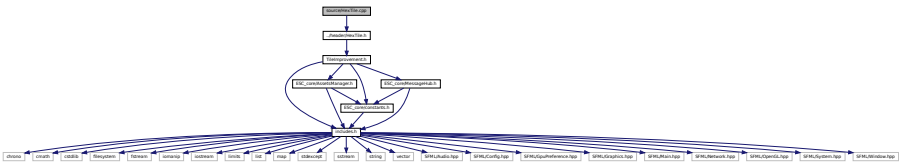
Implementation file for the HexMap class.

A class which defines a hex map of hex tiles.

4.18 source/HexTile.cpp File Reference

Implementation file for the HexTile class.

```
#include "../header/HexTile.h"
```
Include dependency graph for HexTile.cpp:



4.18.1 Detailed Description

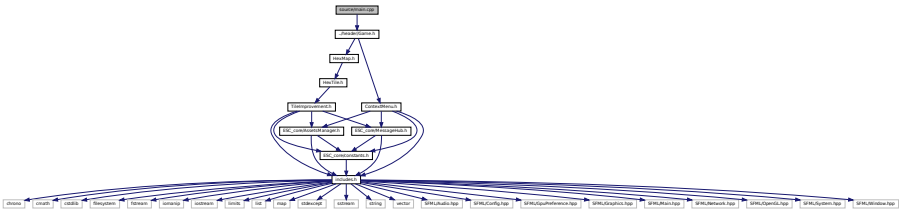
Implementation file for the HexTile class.

A class which defines a tile of a hex map.

4.19 source/main.cpp File Reference

Implementation file for main() for Road To Zero.

```
#include "../header/Game.h"
```
Include dependency graph for main.cpp:



Functions

- void loadAssets (AssetsManager *assets_manager_ptr)

  Helper function to load game assets.
- sf::RenderWindow * constructRenderWindow (void)

  Helper function to construct render window.
- int main (int argc, char **argv)

4.19.1 Detailed Description

Implementation file for main() for Road To Zero.

4.19.2 Function Documentation

4.19.2.1 constructRenderWindow()

```
sf::RenderWindow * constructRenderWindow (
            void  )
```

Helper function to construct render window.

Returns

Pointer to the render window.

```
80 {
81     sf::RenderWindow* render_window_ptr = new sf::RenderWindow(
82         sf::VideoMode(GAME_WIDTH, GAME_HEIGHT),
83         "Road To Zero"
84     );
85 
86     return render_window_ptr;
87 }   /* constructRenderWindow() */
```

4.19.2.2 loadAssets()

```
void loadAssets (
            AssetsManager * assets_manager_ptr )
```

Helper function to load game assets.

Parameters

assets_manager_ptr	Pointer to the assets manager.

```
32 {
33     //  1. load font assets
34     assets_manager_ptr->loadFont("assets/fonts/DroidSansMono.ttf", "DroidSansMono");
35     assets_manager_ptr->loadFont("assets/fonts/Glass_TTY_VT220.ttf", "Glass_TTY_VT220");
36 
37     //  2. load tile sheets
38     assets_manager_ptr->loadTexture(
39         "assets/tile_sheets/pine_tree_64x64_1.png",
40         "pine_tree_64x64_1"
41     );
42 
43     assets_manager_ptr->loadTexture(
44         "assets/tile_sheets/wheat_64x64_1.png",
45         "wheat_64x64_1"
46     );
47 
48     assets_manager_ptr->loadTexture(
49         "assets/tile_sheets/mountain_64x64_1.png",
50         "mountain_64x64_1"
```

```
51     );
52
53     assets_manager_ptr->loadTexture(
54         "assets/tile_sheets/water_waves_64x64_1.png",
55         "water_waves_64x64_1"
56     );
57
58     assets_manager_ptr->loadTexture(
59         "assets/tile_sheets/water_shimmer_64x64_1.png",
60         "water_shimmer_64x64_1"
61     );
62
63     return;
64 }   /* loadAssets() */
```

4.19.2.3 main()

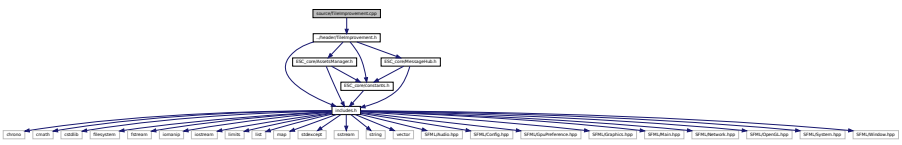
```
int main (
              int argc,
              char ** argv )
96 {
97     //  1. load assets
98     AssetsManager assets_manager;
99     loadAssets(&assets_manager);
100
101     //  2. construct render window
102     sf::RenderWindow* render_window_ptr = constructRenderWindow();
103
104     //  3. start game loop
105     bool quit_game = false;
106
107     while (not quit_game) {
108         Game game(render_window_ptr, &assets_manager);
109         quit_game = game.run();
110     }
111
112     //  4. clean up
113     render_window_ptr->close();
114     delete render_window_ptr;
115
116     return 0;
117 }   /* main() */
```

4.20 source/TileImprovement.cpp File Reference

Implementation file for the TileImprovement class.

```
#include "../header/TileImprovement.h"
```

Include dependency graph for TileImprovement.cpp:



4.20.1 Detailed Description

Implementation file for the TileImprovement class.

A base class for the tile improvement hierarchy.

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