Road To Zero

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Chapter 1

Hierarchical Index

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Chapter 3

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Chapter 4

Class Documentation

4.1 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.

4.1.1 Detailed Description

A class which manages visual and sound assets.

4.1.2 Constructor & Destructor Documentation

4.1.2.1 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() */
```

4.1.2.2 ~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() */
```

4.1.3 Member Function Documentation

4.1.3.1 __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() */
```

4.1.3.2 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() */
```

4.1.3.3 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() */
```

4.1.3.4 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() */
```

4.1.3.5 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() */
```

4.1.3.6 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() */
```

4.1.3.7 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() */
```

4.1.3.8 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 */
```

4.1.3.9 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() */
```

4.1.3.10 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() */
```

4.1.3.11 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() */
```

4.1.3.12 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() */
```

4.1.3.13 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() */
```

4.1.3.14 pauseTrack()

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

Method to pause the current track.

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

4.1.3.15 playTrack()

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

Method to play the current track.

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

4.1.3.16 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() */
```

4.1.3.17 stopTrack()

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

Method to stop the current track.

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

4.1.4 Member Data Documentation

4.1.4.1 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).

4.1.4.2 font_map

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

A map of pointers to loaded fonts.

4.1.4.3 sound_map

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

A map of pointers to loaded sounds.

4.1.4.4 soundbuffer_map

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

A map of pointers to sound buffers.

4.1.4.5 texture_map

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

A map of pointers to loaded textures.

4.1.4.6 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:

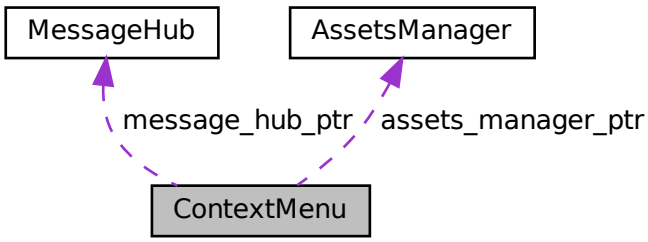
- header/ESC_core/AssetsManager.h
- source/ESC_core/AssetsManager.cpp

4.2 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 console_string_changed

  Boolean which indicates if console string just changed.
- bool game_menu_up

  Indicates whether or not the game menu is up.
- size_t console_substring_idx

  The current final index of the console string draw.
- 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.

4.2.1 Detailed Description

A class which defines a context menu for the game.

4.2.2 Constructor & Destructor Documentation

4.2.2.1 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.

```
815 {
816     //  1. set attributes
817 
818     //  1.1. private
819     this->event_ptr = event_ptr;
820     this->render_window_ptr = render_window_ptr;
821 
822     this->assets_manager_ptr = assets_manager_ptr;
823     this->message_hub_ptr = message_hub_ptr;
824 
825     //  1.2. public
826     this->console_state = ConsoleState :: NONE_STATE;
827     this->__setConsoleState(ConsoleState :: READY);
828 
829     this->console_string_changed = true;
830     this->game_menu_up = false;
831 
832     this->frame = 0;
833 
834     this->position_x = GAME_WIDTH;
835     this->position_y = 0;
836 
837     //  2. set up and position drawable attributes
838     this->__setUpMenuFrame();
839     this->__setUpVisualScreen();
840     this->__setUpVisualScreenFrame();
841     this->__setUpConsoleScreen();
842     this->__setUpConsoleScreenFrame();
843 
844     std::cout « "ContextMenu constructed at " « this « std::endl;
845 
846     return;
847 }   /* ContextMenu() */
```

4.2.2.2 ~ContextMenu()

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

Destructor for the ContextMenu class.

```
997 {
998     std::cout « "ContextMenu at " « this « " destroyed" « std::endl;
999 
1000     return;
1001 }   /* ~ContextMenu() */
```

4.2.3 Member Function Documentation

4.2.3.1 __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() */
```

4.2.3.2 __drawConsoleText()

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

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

```
556 {
557     //  1. set up console text (drawable)
558     sf::Text console_text;
559 
560     if (this->console_string_changed) {
561         this->assets_manager_ptr->getSound("console string print")->play();
562 
563         console_text.setString(this->console_string.substr(0, this->console_substring_idx));
564 
565         this->console_substring_idx++;
566 
567         while (
568             (this->console_string.substr(0, this->console_substring_idx).back() == ' ') or
569             (this->console_string.substr(0, this->console_substring_idx).back() == '\n')
570         ) {
571             this->console_substring_idx++;
572 
573             if (this->console_substring_idx >= this->console_string.size()) {
574                 break;
575             }
576         }
577 
578         if (this->console_substring_idx >= this->console_string.size()) {
579             this->console_string_changed = false;
580         }
581     }
582 
583     else {
584         console_text.setString(this->console_string);
585     }
586 
587     console_text.setFont(*(this->assets_manager_ptr->getFont("Glass_TTY_VT220")));
588     console_text.setCharacterSize(16);
589     console_text.setFillColor(MONOCHROME_TEXT_GREEN);
590 
591     console_text.setPosition(
592         this->position_x - 50 - 300 + 16,
593         this->position_y + GAME_HEIGHT - 50 - 340 + 16
594     );
595 
596 
597     //  2. draw console text
598     this->render_window_ptr->draw(console_text);
599 
600 
601     //  3. assemble and draw blinking console cursor
602     if ((this->frame % FRAMES_PER_SECOND) > FRAMES_PER_SECOND / 2) {
603         sf::RectangleShape console_cursor(sf::Vector2f(10, 16));
604 
605         console_cursor.setFillColor(MONOCHROME_TEXT_GREEN);
606 
607         console_cursor.setPosition(
608             console_text.getPosition().x,
609             console_text.getPosition().y + console_text.getLocalBounds().height + 10
610         );
611 
612         this->render_window_ptr->draw(console_cursor);
613     }
614 
615     //  4. updating frame count if console is in menu state
616     if (this->console_state == ConsoleState :: MENU) {
617         std::string frame_count_string = "FRAME: ";
618         frame_count_string += std::to_string(this->frame);
```

```
619
620         sf::Text frame_count_text(
621             frame_count_string,
622             *(this->assets_manager_ptr->getFont("Glass_TTY_VT220")),
623             16
624         );
625
626         frame_count_text.setFillColor(MONOCHROME_TEXT_GREEN);
627
628         frame_count_text.setPosition(
629             console_text.getPosition().x,
630             console_text.getPosition().y + console_text.getLocalBounds().height - 10
631         );
632
633         this->render_window_ptr->draw(frame_count_text);
634     }
635
636     return;
637 }   /* __drawConsoleText() */
```

4.2.3.3 __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() */
```

4.2.3.4 __handleKeyPressEvents()

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

Helper method to handle key press events.

```
652 {
653     switch (this->event_ptr->key.code) {
654         case (sf::Keyboard::Escape): {
655             if (this->console_state == ConsoleState :: MENU) {
656                 this->__setConsoleState(ConsoleState :: READY);
657             }
658
659             else {
660                 this->__setConsoleState(ConsoleState :: MENU);
661             }
662
663             break;
664         }
665
666
667         case (sf::Keyboard::Q): {
668             if (this->console_state == ConsoleState :: MENU) {
669                 this->__sendQuitGameMessage();
670             }
671         }
672
673
674         case (sf::Keyboard::R): {
675             if (this->console_state == ConsoleState :: MENU) {
676                 this->__sendRestartGameMessage();
677             }
678         }
679
```

```
680
681         default: {
682             // do nothing!
683
684             break;
685         }
686     }
687
688     return;
689 }   /* __handleKeyPressEvents() */
```

4.2.3.5 __handleMouseButtonEvents()

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

Helper method to handle mouse button events.

```
704 {
705     switch (this->event_ptr->mouseButton.button) {
706         case (sf::Mouse::Left): {
707             //...
708
709             break;
710         }
711
712
713         case (sf::Mouse::Right): {
714             //...
715
716             break;
717         }
718
719
720         default: {
721             // do nothing!
722
723             break;
724         }
725     }
726
727     return;
728 }   /* __handleMouseButtonEvents() */
```

4.2.3.6 __sendQuitGameMessage()

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

Helper method to format and send a quit game message.

```
743 {
744     Message quit_game_message;
745
746     quit_game_message.channel = GAME_CHANNEL;
747     quit_game_message.subject = "quit game";
748
749     this->message_hub_ptr->sendMessage(quit_game_message);
750
751     std::cout « "Quit game message sent by " « this « std::endl;
752     return;
753 }   /* __sendQuitGameMessage() */
```

4.2.3.7 __sendRestartGameMessage()

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

Helper method to format and send a restart game message.

```
768 {
769     Message restart_game_message;
770 
771     restart_game_message.channel = GAME_CHANNEL;
772     restart_game_message.subject = "restart game";
773 
774     this->message_hub_ptr->sendMessage(restart_game_message);
775 
776     std::cout « "Restart game message sent by " « this « std::endl;
777     return;
778 }   /* __sendRestartGameMessage() */
```

4.2.3.8 __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() */
```

4.2.3.9 __setConsoleString()

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

Helper method to set console string depending on console state.

```
483 {
484     this->console_string_changed = true;
485     this->console_substring_idx = 0;
486 
487     this->console_string.clear();
488 
489     switch (this->console_state) {
490         case (ConsoleState :: MENU): {
491             //           32 char x 17 line console "--------------------------------\n";
492             this->console_string                = "          **** MENU ****          \n";
493             this->console_string               += "                                  \n";
494             this->console_string               += "[R]:  RESTART                      \n";
495             this->console_string               += "                                  \n";
496             this->console_string               += "[TAB]:  TOGGLE RESOURCE OVERLAY \n";
```

```
497             this->console_string                += "[T]:  TUTORIAL                  \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                += "                               \n";
503             this->console_string                += "                               \n";
504             this->console_string                += "                               \n";
505             this->console_string                += "[Q]:    QUIT                    \n";
506             this->console_string                += "[ESC]:  CLOSE MENU              \n";
507             this->console_string                += "                               \n";
508 
509             break;
510         }
511 
512 
513         case (ConsoleState :: TILE): {
514             // take console string from tile state message
515 
516             break;
517         }
518 
519 
520         default: {
521             //           32 char x 17 line console "--------------------------------\n";
522             this->console_string                 = "  **** RTZ 64 CONTEXT V12 ****  \n";
523             this->console_string                += "                                \n";
524             this->console_string                += "64K RAM SYSTEM  38911 BYTES FREE\n";
525             this->console_string                += "                                \n";
526             this->console_string                += "[TAB]:  TOGGLE RESOURCE OVERLAY \n";
527             this->console_string                += "                                \n";
528             this->console_string                += "[ESC]:         MENU             \n";
529             this->console_string                += "[LEFT CLICK]:  TILE INFO/OPTIONS\n";
530             this->console_string                += "[RIGHT CLICK]: CLEAR SELECTION  \n";
531             this->console_string                += "                               \n";
532             this->console_string                += "[ENTER]:  END TURN              \n";
533             this->console_string                += "                               \n";
534             this->console_string                += "READY.                          ";
535 
536             break;
537         }
538     }
539 
540     return;
541 }   /* __setConsoleString() */
```

4.2.3.10 __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() */
```

4.2.3.11 __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() */
```

4.2.3.12 __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() */
```

4.2.3.13 __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() */
```

4.2.3.14 __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() */
```

4.2.3.15 draw()

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

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

```
967 {
968     //  1. menu frame
969     this->render_window_ptr->draw(this->menu_frame);
970 
971     //  2. visual screen
972     this->render_window_ptr->draw(this->visual_screen);
973     this->__drawVisualScreenFrame();
974 
975     //  3. console screen
976     this->render_window_ptr->draw(this->console_screen);
977     this->__drawConsoleScreenFrame();
978     this->__drawConsoleText();
979 
980     this->frame++;
981     return;
982 }   /* draw() */
```

4.2.3.16 processEvent()

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

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

```
862 {
863     if (this->event_ptr->type == sf::Event::KeyPressed) {
864         this->__handleKeyPressEvents();
865     }
866 
867     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
868         this->__handleMouseButtonEvents();
869     }
870 
871     return;
872 }   /* processEvent() */
```

4.2.3.17 processMessage()

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

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

```
887 {
888     switch (this->console_state) {
889         case (ConsoleState :: TILE): {
890             //  process no tile selected
891             if (not this->message_hub_ptr->isEmpty(NO_TILE_SELECTED_CHANNEL)) {
892                 Message no_tile_selected_message = this->message_hub_ptr->receiveMessage(
893                     NO_TILE_SELECTED_CHANNEL
894                 );
895 
896                 if (no_tile_selected_message.subject == "no tile selected") {
897                     this->__setConsoleState(ConsoleState :: READY);
898 
899                     std::cout « "No tile selected message received by " « this «
900                         std::endl;
901                     this->message_hub_ptr->popMessage(NO_TILE_SELECTED_CHANNEL);
902                 }
903             }
904 
905             //  process tile state
```

```
906             if (not this->message_hub_ptr->isEmpty(TILE_STATE_CHANNEL)) {
907                 Message tile_state_message = this->message_hub_ptr->receiveMessage(
908                     TILE_STATE_CHANNEL
909                 );
910 
911                 if (tile_state_message.subject == "tile state") {
912                     this->console_string = tile_state_message.string_payload["console string"];
913 
914                     this->console_string_changed = true;
915                     this->console_substring_idx = 0;
916 
917                     std::cout « "Tile state message received by " « this « std::endl;
918                     this->message_hub_ptr->popMessage(TILE_STATE_CHANNEL);
919                 }
920             }
921 
922             //  process tile selected (subsequent left clicks causing program to hang)
923             if (not this->message_hub_ptr->isEmpty(TILE_SELECTED_CHANNEL)) {
924                 this->message_hub_ptr->popMessage(TILE_SELECTED_CHANNEL);
925             }
926 
927             break;
928         }
929 
930         default: {
931             //  process tile selected
932             if (not this->message_hub_ptr->isEmpty(TILE_SELECTED_CHANNEL)) {
933                 Message tile_selected_message = this->message_hub_ptr->receiveMessage(
934                     TILE_SELECTED_CHANNEL
935                 );
936 
937                 if (tile_selected_message.subject == "tile selected") {
938                     this->__setConsoleState(ConsoleState :: TILE);
939 
940                     std::cout « "Tile selected message received by " « this «
941                         std::endl;
942                     this->message_hub_ptr->popMessage(TILE_SELECTED_CHANNEL);
943                 }
944             }
945 
946             break;
947         }
948     }
949 
950     return;
951 }   /* processMessage() */
```

4.2.4 Member Data Documentation

4.2.4.1 assets_manager_ptr

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

A pointer to the assets manager.

4.2.4.2 console_screen

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

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

4.2.4.3 console_screen_frame_bottom

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

The bottom framing of the console screen.

4.2.4.4 console_screen_frame_left

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

The left framing of the console screen.

4.2.4.5 console_screen_frame_right

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

The right framing of the console screen.

4.2.4.6 console_screen_frame_top

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

The top framing of the console screen.

4.2.4.7 console_state

```
ConsoleState ContextMenu::console_state
```

The current state of the console screen.

4.2.4.8 console_string

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

The string to be printed to the console screen.

4.2.4.9 console_string_changed

```
bool ContextMenu::console_string_changed
```

Boolean which indicates if console string just changed.

4.2.4.10 console_substring_idx

```
size_t ContextMenu::console_substring_idx
```

The current final index of the console string draw.

4.2.4.11 event_ptr

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

A pointer to the event class.

4.2.4.12 frame

```
int ContextMenu::frame
```

The current frame of this object.

4.2.4.13 game_menu_up

```
bool ContextMenu::game_menu_up
```

Indicates whether or not the game menu is up.

4.2.4.14 menu_frame

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

The frame of the context menu.

4.2.4.15 message_hub_ptr

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

A pointer to the message hub.

4.2.4.16 position_x

```
double ContextMenu::position_x
```

The position of the object.

4.2.4.17 position_y

```
double ContextMenu::position_y
```

The position of the object.

4.2.4.18 render_window_ptr

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

A pointer to the render window.

4.2.4.19 visual_screen

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

The context menu screen for visuals.

4.2.4.20 visual_screen_frame_bottom

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

The bottom framing of the visual screen.

4.2.4.21 visual_screen_frame_left

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

The left framing of the visual screen.

4.2.4.22 visual_screen_frame_right

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

The right framing of the visual screen.

4.2.4.23 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:

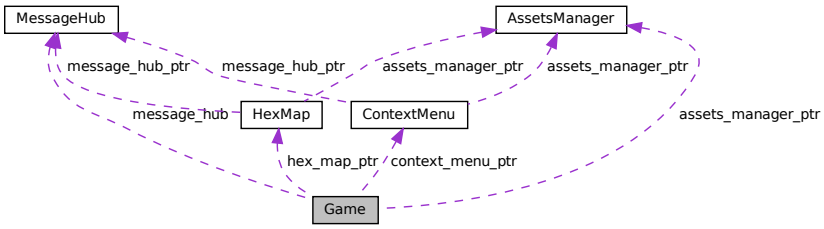
- header/ContextMenu.h
- source/ContextMenu.cpp

4.3 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

- GamePhase game_phase

  The current phase of the game.
- 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.
- int year

  Current game year.
- int month

  Current game month.
- int population

  Current population.
- int credits

  Current balance of credits.
- int demand_MWh

  Current energy demand [MWh].
- int cumulative_emissions_tonnes

  Cumulative emissions [tonnes] (1 tonne = 1000 kg).
- int turn = 0

  The current game turn.
- 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 __sendGameStateMessage (void)

  Helper method to format and send a game state message.
- void __insufficientCreditsAlarm (void)

  Helper method to sound and display and insufficient credits alarm.
- 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.

4.3.1 Detailed Description

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

4.3.2 Constructor & Destructor Documentation

4.3.2.1 Game()

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

Constructor for the Game class.

```
662 {
663     //  1. set attributes
664 
665     //  1.1. private
666     this->render_window_ptr = render_window_ptr;
667 
668     this->assets_manager_ptr = assets_manager_ptr;
669 
670     //  1.2. public
671     this->game_phase = GamePhase :: BUILD_SETTLEMENT;
672 
673     this->quit_game = false;
674     this->game_loop_broken = false;
675     this->show_frame_clock_overlay = false;
676 
677     this->frame = 0;
678     this->time_since_start_s = 0;
679 
680     double seconds_since_epoch = time(NULL);
681     double years_since_epoch = seconds_since_epoch / SECONDS_PER_YEAR;
682 
683     this->year = 1970 + (int)years_since_epoch;
684     this->month = (years_since_epoch - (int)years_since_epoch) * 12 + 1;
685 
686     this->population = 0;
687     this->credits = 500;
688     this->demand_MWh = 0;
689     this->cumulative_emissions_tonnes = 0;
690 
691     this->hex_map_ptr = new HexMap(
692         6,
693         &(this->event),
694         this->render_window_ptr,
695         this->assets_manager_ptr,
696         &(this->message_hub)
697     );
698 
699     this->context_menu_ptr = new ContextMenu(
700         &(this->event),
701         this->render_window_ptr,
702         this->assets_manager_ptr,
703         &(this->message_hub)
704     );
705 
706     //  2. add message channel(s)
707     this->message_hub.addChannel(GAME_CHANNEL);
708     this->message_hub.addChannel(GAME_STATE_CHANNEL);
709 
710     std::cout << "Game constructed at " << this << std::endl;
711 
712     return;
713 }   /* Game() */
```

4.3.2.2 ~Game()

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

Destructor for the Game class.

```
790 {
791     //  1. clean up attributes
792     delete this->hex_map_ptr;
793     delete this->context_menu_ptr;
794 
795     std::cout << "Game at " << this << " destroyed" << std::endl;
796 
797     return;
798 }   /* ~Game() */
```

4.3.3 Member Function Documentation

4.3.3.1 __draw()

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

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

```
629 {
630     this->__drawHUD();
631 
632     if (this->show_frame_clock_overlay) {
633         this->__drawFrameClockOverlay();
634     }
635 
636     return;
637 }   /* draw() */
```

4.3.3.2 __drawFrameClockOverlay()

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

Helper method to draw frame clock overlay.

```
455 {
456     std::string frame_clock_string = "FRAME: ";
457     frame_clock_string += std::to_string(this->frame);
458     frame_clock_string += "\nTIME SINCE START [s]: ";
459     frame_clock_string += std::to_string(this->time_since_start_s);
460 
461     sf::Text frame_clock_text(
462         frame_clock_string,
463         *(this->assets_manager_ptr->getFont("DroidSansMono")),
464         16
465     );
466 
467     sf::RectangleShape frame_clock_backing(
468         sf::Vector2f(
469             1.02 * frame_clock_text.getLocalBounds().width,
470             1.20 * frame_clock_text.getLocalBounds().height
471         )
472     );
473     frame_clock_backing.setFillColor(sf::Color(0, 0, 0, 255));
474 
475     this->render_window_ptr->draw(frame_clock_backing);
476     this->render_window_ptr->draw(frame_clock_text);
477 
478     return;
479 }   /* __drawFrameClockOverlay() */
```

4.3.3.3 __drawHUD()

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

Helper method to heads-up display (HUD).

```
494 {
495     //  1. first line (top)
496     std::string HUD_string = "YEAR: ";
497     HUD_string += std::to_string(this->year);
498 
499     HUD_string += "    MONTH: ";
500     HUD_string += std::to_string(this->month);
501 
502     HUD_string += "    POPULATION: ";
503     HUD_string += std::to_string(this->population);
504 
505     HUD_string += "    CREDITS: ";
506     HUD_string += std::to_string(this->credits);
507     HUD_string += " K";
508 
509     HUD_string += "    CURRENT DEMAND: ";
510     HUD_string += std::to_string(this->demand_MWh);
511     HUD_string += " MWh";
512 
513     sf::Text HUD_text(
514         HUD_string,
515         *(this->assets_manager_ptr->getFont("Glass_TTY_VT220")),
516         16
517     );
518 
519     HUD_text.setPosition(
520         (800 - HUD_text.getLocalBounds().width) / 2,
521         8
522     );
523 
524     HUD_text.setFillColor(MONOCHROME_TEXT_GREEN);
525 
526     this->render_window_ptr->draw(HUD_text);
527 
528 
529     //  2. second line (top)
530     HUD_string = "CUMULATIVE EMISSIONS: ";
531     HUD_string += std::to_string(this->cumulative_emissions_tonnes);
532     HUD_string += " tonnes (CO2e)";
533 
534     HUD_string += "    LIFETIME LIMIT: ";
535     HUD_string += std::to_string(EMISSIONS_LIFETIME_LIMIT_TONNES);
536     HUD_string += " tonnes (CO2e)";
537 
538     HUD_text.setString(HUD_string);
539 
540     HUD_text.setPosition(
541         (800 - HUD_text.getLocalBounds().width) / 2,
542         35
543     );
544 
545     this->render_window_ptr->draw(HUD_text);
546 
547 
548     //  3. third line (bottom)
549     HUD_string = "GAME PHASE: ";
550 
551     switch (this->game_phase) {
552         case (GamePhase :: BUILD_SETTLEMENT): {
553             HUD_string += "BUILD SETTLEMENT";
554 
555             break;
556         }
557 
558 
559         case (GamePhase :: SYSTEM_MANAGEMENT): {
560             HUD_string += "SYSTEM MANAGEMENT";
561 
562             break;
563         }
564 
565 
566         case (GamePhase :: LOSS_EMISSIONS): {
567             HUD_string += "LOSS (EMISSIONS)";
568 
569             break;
570         }
571 
```

```
572
573         case (GamePhase :: LOSS_DEMAND): {
574             HUD_string += "LOSS (DEMAND)";
575
576             break;
577         }
578
579
580         case (GamePhase :: LOSS_CREDITS): {
581             HUD_string += "LOSS (CREDITS)";
582
583             break;
584         }
585
586
587         case (GamePhase :: VICTORY): {
588             HUD_string += "VICTORY";
589
590             break;
591         }
592
593
594         default: {
595             HUD_string += "???";
596
597             break;
598         }
599     }
600
601     HUD_string += "    TURN: ";
602     HUD_string += std::to_string(this->turn);
603
604     HUD_text.setString(HUD_string);
605
606     HUD_text.setPosition(
607         (800 - HUD_text.getLocalBounds().width) / 2,
608         GAME_HEIGHT - 35
609     );
610
611     this->render_window_ptr->draw(HUD_text);
612
613     return;
614 }   /* __drawHUD() */
```

4.3.3.4 __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() */
```

4.3.3.5 __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() */
```

4.3.3.6 __insufficientCreditsAlarm()

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

Helper method to sound and display and insufficient credits alarm.

```
354 {
355     //  1. sound buzzer
356     this->assets_manager_ptr->getSound("insufficient credits")->play();
357 
358     //  2. construct alarm text and backing rectangle
359     sf::Text insufficient_credits_text(
360         "INSUFFICIENT CREDITS",
361         (*(this->assets_manager_ptr->getFont("DroidSansMono"))),
362         32
363     );
364 
365     insufficient_credits_text.setOrigin(
366         insufficient_credits_text.getLocalBounds().width / 2,
367         insufficient_credits_text.getLocalBounds().height / 2
368     );
369 
370     insufficient_credits_text.setPosition(400, GAME_HEIGHT / 2);
371 
372     sf::RectangleShape backing_rectangle(
373         sf::Vector2f(
374             1.1 * insufficient_credits_text.getLocalBounds().width,
375             1.5 * insufficient_credits_text.getLocalBounds().height
376         )
377     );
378 
379     backing_rectangle.setFillColor(RESOURCE_CHIP_GREY);
380 
381     backing_rectangle.setOrigin(
382         backing_rectangle.getLocalBounds().width / 2,
383         backing_rectangle.getLocalBounds().height / 2
384     );
385 
386     backing_rectangle.setPosition(400, (GAME_HEIGHT / 2) + 8);
387 
388     //  3. display loop (blocking ~3 seconds)
389     bool red_flag = true;
390     int alarm_frame = 0;
```

```
391     double time_since_alarm_s = 0;
392
393     sf::Clock alarm_clock;
394
395     while (alarm_frame < 2.5 * FRAMES_PER_SECOND) {
396
397
398         time_since_alarm_s = alarm_clock.getElapsedTime().asSeconds();
399
400         if (time_since_alarm_s >= (alarm_frame + 1) * SECONDS_PER_FRAME) {
401             while (this->render_window_ptr->pollEvent(this->event)) {
402                 // do nothing!
403             }
404
405             this->render_window_ptr->clear();
406
407             this->hex_map_ptr->draw();
408             this->context_menu_ptr->draw();
409             this->__draw();
410
411             if (alarm_frame % (FRAMES_PER_SECOND / 3) == 0) {
412                 if (red_flag) {
413                     red_flag = false;
414                 }
415
416                 else {
417                     red_flag = true;
418                 }
419             }
420
421             if (red_flag) {
422                 insufficient_credits_text.setFillColor(MONOCHROME_TEXT_RED);
423             }
424
425             else {
426                 insufficient_credits_text.setFillColor(sf::Color(255, 255, 255));
427             }
428
429             this->render_window_ptr->draw(backing_rectangle);
430             this->render_window_ptr->draw(insufficient_credits_text);
431
432             this->render_window_ptr->display();
433
434             alarm_frame++;
435             this->frame++;
436         }
437     }
438
439     return;
440 }   /* __insufficientCreditsAlarm( */
```

4.3.3.7 __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() */
```

4.3.3.8 __processMessage()

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

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

```
251 {
252     if (not this->message_hub.isEmpty(GAME_CHANNEL)) {
253         Message game_channel_message = this->message_hub.receiveMessage(GAME_CHANNEL);
254 
255         if (game_channel_message.subject == "quit game") {
256             this->quit_game = true;
257             this->game_loop_broken = true;
258 
259             std::cout « "Quit game message received by " « this « std::endl;
260             this->message_hub.popMessage(GAME_CHANNEL);
261         }
262 
263         if (game_channel_message.subject == "restart game") {
264             this->game_loop_broken = true;
265 
266             std::cout « "Restart game message received by " « this « std::endl;
267             this->message_hub.popMessage(GAME_CHANNEL);
268         }
269 
270         if (game_channel_message.subject == "state request") {
271             std::cout « "Game state request message received by " « this « std::endl;
272 
273             this->__sendGameStateMessage();
274             this->message_hub.popMessage(GAME_CHANNEL);
275         }
276 
277         if (game_channel_message.subject == "credits spent") {
278             this->credits -= game_channel_message.int_payload["credits spent"];
279 
280             std::cout « "Credits spent message (" «
281                 game_channel_message.int_payload["credits spent"] « ") received by "
282                 « this « std::endl;
283 
284             std::cout « "Current credits (Game): " « this->credits « " K" «
285                 std::endl;
286 
287             this->message_hub.popMessage(GAME_CHANNEL);
288         }
289 
290         if (game_channel_message.subject == "insufficient credits") {
291             std::cout « "Insufficient credits message received by " « this «
292                 std::endl;
293 
294             this->__insufficientCreditsAlarm();
295 
296             this->message_hub.popMessage(GAME_CHANNEL);
297         }
298 
299         if (game_channel_message.subject == "update game phase") {
300             std::cout « "Update game phase message received by " « this « std::endl;
301 
302             if (
303                 game_channel_message.string_payload["game phase"] == "system management"
304             ) {
305                 this->game_phase = GamePhase :: SYSTEM_MANAGEMENT;
306                 this->population = STARTING_POPULATION;
307                 this->turn++;
308             }
309 
310             else if (
311                 game_channel_message.string_payload["game phase"] == "loss emissions"
312             ) {
313                 this->game_phase = GamePhase :: LOSS_EMISSIONS;
314             }
315 
316             else if (
317                 game_channel_message.string_payload["game phase"] == "loss demand"
318             ) {
319                 this->game_phase = GamePhase :: LOSS_DEMAND;
320             }
321 
322             else if (
323                 game_channel_message.string_payload["game phase"] == "loss credits"
324             ) {
325                 this->game_phase = GamePhase :: LOSS_CREDITS;
326             }
327 
328             else if (
```

```
329                 game_channel_message.string_payload["game phase"] == "victory"
330             ) {
331                 this->game_phase = GamePhase :: VICTORY;
332             }
333 
334             this->message_hub.popMessage(GAME_CHANNEL);
335         }
336     }
337 
338     return;
339 }   /* __processMessage() */
```

4.3.3.9 __sendGameStateMessage()

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

Helper method to format and send a game state message.

```
168 {
169     Message game_state_message;
170 
171     game_state_message.channel = GAME_STATE_CHANNEL;
172     game_state_message.subject = "game state";
173 
174     game_state_message.int_payload["year"] = this->year;
175     game_state_message.int_payload["month"] = this->month;
176     game_state_message.int_payload["population"] = this->population;
177     game_state_message.int_payload["credits"] = this->credits;
178     game_state_message.int_payload["demand_MWh"] = this->demand_MWh;
179     game_state_message.int_payload["cumulative_emissions_tonnes"] =
180         this->cumulative_emissions_tonnes;
181 
182     switch (this->game_phase) {
183         case (GamePhase :: BUILD_SETTLEMENT): {
184             game_state_message.string_payload["game phase"] = "build settlement";
185 
186             break;
187         }
188 
189 
190         case (GamePhase :: SYSTEM_MANAGEMENT): {
191             game_state_message.string_payload["game phase"] = "system management";
192 
193             break;
194         }
195 
196 
197         case (GamePhase :: LOSS_EMISSIONS): {
198             game_state_message.string_payload["game phase"] = "loss emissions";
199 
200             break;
201         }
202 
203 
204         case (GamePhase :: LOSS_DEMAND): {
205             game_state_message.string_payload["game phase"] = "loss demand";
206 
207             break;
208         }
209 
210 
211         case (GamePhase :: LOSS_CREDITS): {
212             game_state_message.string_payload["game phase"] = "loss credits";
213 
214             break;
215         }
216 
217 
218         case (GamePhase :: VICTORY): {
219             game_state_message.string_payload["game phase"] = "victory";
220 
221             break;
222         }
223 
224 
225         default: {
226             // do nothing!
227 
```

```
228             break;
229         }
230     }
231
232     this->message_hub.sendMessage(game_state_message);
233
234     std::cout « "Game state message sent by " « this « std::endl;
235     return;
236 }   /* __sendGameStateMessage() */
```

4.3.3.10 __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() */
```

4.3.3.11 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).

```
731 {
732     //  1. play brand animation
733     //...
734
735     //  2. show splash screen
736     //...
737
738     //  3. start game loop
739     while (not this->game_loop_broken) {
740         this->time_since_start_s = this->clock.getElapsedTime().asSeconds();
741
742         if (this->time_since_start_s >= (this->frame + 1) * SECONDS_PER_FRAME) {
743             //  6.1. process events
744             while (this->render_window_ptr->pollEvent(this->event)) {
745                 this->hex_map_ptr->processEvent();
746                 this->context_menu_ptr->processEvent();
747                 this->__processEvent();
748             }
749
750
751             //  6.2. process messages
752             while (this->message_hub.hasTraffic()) {
753                 this->hex_map_ptr->processMessage();
754                 this->context_menu_ptr->processMessage();
755                 this->__processMessage();
756             }
757
758
```

```
759             //  6.3. draw frame
760             this->render_window_ptr->clear();
761 
762             this->hex_map_ptr->draw();
763             this->context_menu_ptr->draw();
764             this->__draw();
765 
766             this->render_window_ptr->display();
767 
768 
769             //  6.4. increment frame
770             this->frame++;
771         }
772     }
773 
774     return this->quit_game;
775 }   /* run() */
```

4.3.4 Member Data Documentation

4.3.4.1 assets_manager_ptr

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

A pointer to the assets manager.

4.3.4.2 clock

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

The game clock.

4.3.4.3 context_menu_ptr

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

Pointer to the context menu.

4.3.4.4 credits

```
int Game::credits
```

Current balance of credits.

4.3.4.5 cumulative_emissions_tonnes

```
int Game::cumulative_emissions_tonnes
```

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

4.3.4.6 demand_MWh

```
int Game::demand_MWh
```

Current energy demand [MWh].

4.3.4.7 event

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

The game events class.

4.3.4.8 frame

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

The current frame of the game.

4.3.4.9 game_loop_broken

```
bool Game::game_loop_broken
```

Boolean indicating whether or not the game loop is broken.

4.3.4.10 game_phase

```
GamePhase Game::game_phase
```

The current phase of the game.

4.3.4.11 hex_map_ptr

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

Pointer to the hex map (defines game world).

4.3.4.12 message_hub

```
MessageHub Game::message_hub
```

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

4.3.4.13 month

```
int Game::month
```

Current game month.

4.3.4.14 population

```
int Game::population
```

Current population.

4.3.4.15 quit_game

```
bool Game::quit_game
```

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

4.3.4.16 render_window_ptr

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

A pointer to the render window.

4.3.4.17 show_frame_clock_overlay

```
bool Game::show_frame_clock_overlay
```

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

4.3.4.18 time_since_start_s

```
double Game::time_since_start_s
```

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

4.3.4.19 turn

```
int Game::turn = 0
```

The current game turn.

4.3.4.20 year

```
int Game::year
```

Current game year.

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

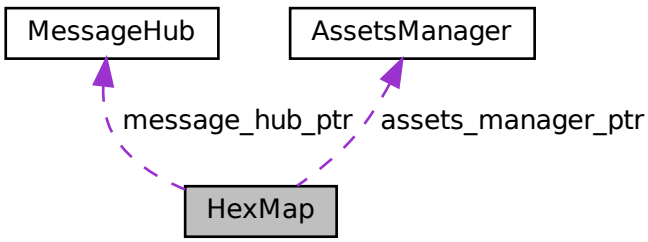
- header/Game.h
- source/Game.cpp

4.4 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 show_resource

  A boolean which indicates whether or not to show resource value.
- 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.
- void __assessNeighbours (HexTile *)

  Helper method to assess all neighbours of the given tile.

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.

4.4.1 Detailed Description

A class which defines a hex map of hex tiles.

4.4.2 Constructor & Destructor Documentation

4.4.2.1 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.

```
1082 {
1083     //  1. set attributes
1084 
1085     //  1.1. private
1086     this->event_ptr = event_ptr;
1087     this->render_window_ptr = render_window_ptr;
1088 
1089     this->assets_manager_ptr = assets_manager_ptr;
1090     this->message_hub_ptr = message_hub_ptr;
1091 
1092     //  1.2. public
1093     this->show_resource = false;
1094     this->tile_selected = false;
1095 
1096     this->frame = 0;
1097 
1098     this->n_layers = n_layers;
1099     if (this->n_layers < 0) {
1100         this->n_layers = 0;
1101     }
1102 
1103     this->position_x = 400;
1104     this->position_y = 400;
1105 
1106     //  2. assemble n layer hex map
1107     this->__assembleHexMap();
1108 
1109     //  3. set up and position drawable attributes
1110     this->__setUpGlassScreen();
1111 
1112     //  4. add message channel(s)
1113     this->message_hub_ptr->addChannel(TILE_SELECTED_CHANNEL);
1114     this->message_hub_ptr->addChannel(NO_TILE_SELECTED_CHANNEL);
1115     this->message_hub_ptr->addChannel(TILE_STATE_CHANNEL);
1116     this->message_hub_ptr->addChannel(HEX_MAP_CHANNEL);
1117 
1118     std::cout << "HexMap constructed at " << this << std::endl;
1119 
```

```
1120     return;
1121 }   /* HexMap(), intended */
```

4.4.2.2 ~HexMap()

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

Destructor for the HexMap class.

```
1413 {
1414     this->clear();
1415
1416     std::cout << "HexMap at " << this << " destroyed" << std::endl;
1417
1418     return;
1419 }   /* ~HexMap() */
```

4.4.3 Member Function Documentation

4.4.3.1 __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() */
```

4.4.3.2 __assessNeighbours()

```
void HexMap::__assessNeighbours (
            HexTile * hex_ptr )  [private]
```

Helper method to assess all neighbours of the given tile.

Parameters

Pointer	to the tile whose neighbours are to be assessed.

```
1033 {
1034     std::vector<HexTile*> neighbours_vec = this->__getNeighboursVector(hex_ptr);
1035 
1036     for (size_t i = 0; i < neighbours_vec.size(); i++) {
1037         neighbours_vec[i]->assess();
1038     }
1039 
1040     return;
1041 }   /* __assessNeighbours() */
```

4.4.3.3 __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() */
```

4.4.3.4 __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() */
```

4.4.3.5 __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() */
```

4.4.3.6 __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() */
```

4.4.3.7 __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() */
```

4.4.3.8 __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() */
```

4.4.3.9 __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() */
```

4.4.3.10 __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() */
```

4.4.3.11 __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() */
```

4.4.3.12 __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() */
```

4.4.3.13 __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() */
```

4.4.3.14 __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() */
```

4.4.3.15 __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() */
```

4.4.3.16 __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     std::cout « "No tile selected message sent by " « this « std::endl;
1015     return;
1016 }   /* __sendNoTileSelectedMessage() */
```

4.4.3.17 __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() */
```

4.4.3.18 __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() */
```

4.4.3.19 assess()

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

Method to assess the resource of the selected tile.

```
1136 {
1137     HexTile* selected_tile_ptr = this->__getSelectedTile();
1138     if (selected_tile_ptr != NULL) {
1139         selected_tile_ptr->assess();
1140     }
1141
1142     return;
1143 }   /* assess() */
```

4.4.3.20 clear()

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

Method to clear the hex map.

```
1375 {
1376     std::map<double, std::map<double, HexTile*>::iterator hex_map_iter_x;
1377     std::map<double, HexTile*>::iterator hex_map_iter_y;
1378     for (
1379         hex_map_iter_x = this->hex_map.begin();
1380         hex_map_iter_x != this->hex_map.end();
1381         hex_map_iter_x++
1382     ) {
1383         for (
1384             hex_map_iter_y = hex_map_iter_x->second.begin();
1385             hex_map_iter_y != hex_map_iter_x->second.end();
1386             hex_map_iter_y++
1387         ) {
1388             delete hex_map_iter_y->second;
1389         }
1390     }
1391     this->hex_map.clear();
1392
1393     this->tile_position_x_vec.clear();
1394     this->tile_position_y_vec.clear();
1395     this->border_tiles_vec.clear();
1396
1397     return;
1398 }   /* clear() */
```

4.4.3.21 draw()

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

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

```
1314 {
1315     //  1. draw background
1316     sf::Color glass_screen_colour = this->glass_screen.getFillColor();
1317     glass_screen_colour.a = 255;
1318     this->glass_screen.setFillColor(glass_screen_colour);
1319
1320     this->render_window_ptr->draw(this->glass_screen);
1321
1322     //  2. draw tiles in drawing order
1323     for (size_t i = 0; i < this->hex_draw_order_vec.size(); i++) {
1324         this->hex_draw_order_vec[i]->draw();
1325     }
1326
1327     //  3. redraw selected tile
```

```
1328     HexTile* selected_tile_ptr = this->__getSelectedTile();
1329     if (selected_tile_ptr != NULL) {
1330         selected_tile_ptr->draw();
1331     }
1332 
1333     //  4. draw resource overlay text indication
1334     if (this->show_resource) {
1335         sf::Text resource_overlay_text(
1336             "**** RENEWABLE RESOURCE OVERLAY ****",
1337             *(this->assets_manager_ptr->getFont("Glass_TTY_VT220")),
1338             16
1339         );
1340 
1341         resource_overlay_text.setPosition(
1342             (800 - resource_overlay_text.getLocalBounds().width) / 2,
1343             GAME_HEIGHT - 70
1344         );
1345 
1346         resource_overlay_text.setFillColor(MONOCHROME_TEXT_GREEN);
1347 
1348         this->render_window_ptr->draw(resource_overlay_text);
1349     }
1350 
1351     //  5. draw glass screen
1352     glass_screen_colour = this->glass_screen.getFillColor();
1353     glass_screen_colour.a = 40;
1354     this->glass_screen.setFillColor(glass_screen_colour);
1355 
1356     this->render_window_ptr->draw(this->glass_screen);
1357 
1358     this->frame++;
1359     return;
1360 }   /* draw() */
```

4.4.3.22 processEvent()

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

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

```
1221 {
1222     //  1. process HexTile events
1223     std::map<double, std::map<double, HexTile*»::iterator hex_map_iter_x;
1224     std::map<double, HexTile*>::iterator hex_map_iter_y;
1225     for (
1226         hex_map_iter_x = this->hex_map.begin();
1227         hex_map_iter_x != this->hex_map.end();
1228         hex_map_iter_x++
1229     ) {
1230         for (
1231             hex_map_iter_y = hex_map_iter_x->second.begin();
1232             hex_map_iter_y != hex_map_iter_x->second.end();
1233             hex_map_iter_y++
1234         ) {
1235             hex_map_iter_y->second->processEvent();
1236         }
1237     }
1238 
1239     //  2. process HexMap events
1240     if (this->event_ptr->type == sf::Event::KeyPressed) {
1241         this->__handleKeyPressEvents();
1242     }
1243 
1244     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
1245         this->__handleMouseButtonEvents();
1246     }
1247 
1248     return;
1249 }   /* processEvent() */
```

4.4.3.23 processMessage()

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

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

```
1264 {
1265     //  1. process HexTile messages
1266     std::map<double, std::map<double, HexTile*>::iterator hex_map_iter_x;
1267     std::map<double, HexTile*>::iterator hex_map_iter_y;
1268     for (
1269         hex_map_iter_x = this->hex_map.begin();
1270         hex_map_iter_x != this->hex_map.end();
1271         hex_map_iter_x++
1272     ) {
1273         for (
1274             hex_map_iter_y = hex_map_iter_x->second.begin();
1275             hex_map_iter_y != hex_map_iter_x->second.end();
1276             hex_map_iter_y++
1277         ) {
1278             hex_map_iter_y->second->processMessage();
1279         }
1280     }
1281
1282     //  2. process HexMap messages
1283     if (not this->message_hub_ptr->isEmpty(HEX_MAP_CHANNEL)) {
1284         Message hex_map_message = this->message_hub_ptr->receiveMessage(
1285             HEX_MAP_CHANNEL
1286         );
1287
1288         if (hex_map_message.subject == "assess neighbours") {
1289             HexTile* hex_ptr = this->__getSelectedTile();
1290             this->__assessNeighbours(hex_ptr);
1291
1292             std::cout « "Assess neighbours message received by " « this « std::endl;
1293             this->message_hub_ptr->popMessage(HEX_MAP_CHANNEL);
1294         }
1295     }
1296
1297     return;
1298 }   /* processMessage() */
```

4.4.3.24 reroll()

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

Method to re-roll the hex map.

```
1158 {
1159     this->clear();
1160     this->__assembleHexMap();
1161
1162     return;
1163 }   /* reroll() */
```

4.4.3.25 toggleResourceOverlay()

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

Method to toggle the hex map resource overlay.

```
1178 {
1179     std::map<double, std::map<double, HexTile*>::iterator hex_map_iter_x;
1180     std::map<double, HexTile*>::iterator hex_map_iter_y;
1181     for (
1182         hex_map_iter_x = this->hex_map.begin();
```

```
1183         hex_map_iter_x != this->hex_map.end();
1184         hex_map_iter_x++
1185     ) {
1186         for (
1187             hex_map_iter_y = hex_map_iter_x->second.begin();
1188             hex_map_iter_y != hex_map_iter_x->second.end();
1189             hex_map_iter_y++
1190         ) {
1191             hex_map_iter_y->second->toggleResourceOverlay();
1192         }
1193     }
1194
1195     if (this->show_resource) {
1196         this->show_resource = false;
1197         this->assets_manager_ptr->getSound("resource overlay toggle off")->play();
1198     }
1199
1200     else {
1201         this->show_resource = true;
1202         this->assets_manager_ptr->getSound("resource overlay toggle on")->play();
1203     }
1204
1205     return;
1206 }   /* toggleResourceOverlay() */
```

4.4.4 Member Data Documentation

4.4.4.1 assets_manager_ptr

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

A pointer to the assets manager.

4.4.4.2 border_tiles_vec

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

A vector of pointers to the border tiles.

4.4.4.3 event_ptr

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

A pointer to the event class.

4.4.4.4 frame

```
int HexMap::frame
```

The current frame of this object.

4.4.4.5 glass_screen

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

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

4.4.4.6 hex_draw_order_vec

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

A vector of hex tiles, in drawing order.

4.4.4.7 hex_map

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

A position-indexed, nested map of hex tiles.

4.4.4.8 message_hub_ptr

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

A pointer to the message hub.

4.4.4.9 n_layers

```
int HexMap::n_layers
```

The number of layers in the hex map.

4.4.4.10 n_tiles

```
int HexMap::n_tiles
```

The number of tiles in the hex map.

4.4.4.11 position_x

```
double HexMap::position_x
```

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

4.4.4.12 position_y

```
double HexMap::position_y
```

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

4.4.4.13 render_window_ptr

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

A pointer to the render window.

4.4.4.14 show_resource

```
bool HexMap::show_resource
```

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

4.4.4.15 tile_position_x_vec

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

A vector of tile x positions.

4.4.4.16 tile_position_y_vec

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

A vector of tile y position.

4.4.4.17 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:

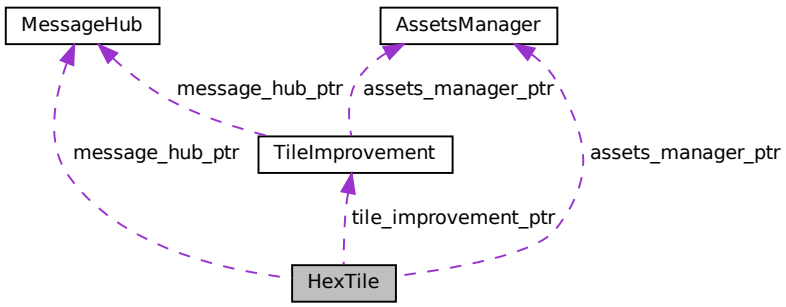
- header/HexMap.h
- source/HexMap.cpp

4.5 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 resource_assessment

  A boolean which triggers a resource assessment notification.
- bool is_selected

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

  A boolean which indicates whether or not to draw a tile explosion.
- bool decoration_cleared

  A boolean which indicates if the tile decoration has been cleared.
- 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.
- bool build_menu_open

  A boolean which indicates if the tile build menu is open.
- size_t explosion_frame

  The current frame of the explosion animation.
- int frame

  The current frame of this object.
- int credits

  The current balance of credits.
- 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.
- std::string game_phase

The current phase of the game.

- 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.
- sf::Sprite magnifying_glass_sprite

  A magnifying glass sprite.
- std::vector< sf::Sprite > explosion_sprite_reel

  A reel of sprites for a tile explosion animation.
- sf::RectangleShape build_menu_backing

  A backing for the tile build menu.
- sf::Text build_menu_backing_text

  A text label for the build menu.
- std::vector< std::vector< sf::Sprite > > build_menu_options_vec

  A vector of sprites for illustrating the tile build options.
- std::vector< sf::Text > build_menu_options_text_vec

  A vector of text for the tile build options.

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.
- void __setUpMagnifyingGlassSprite (void)

  Helper method to set up and position magnifying glass sprite.
- void __setUpTileExplosionReel (void)

  Helper method to set up tile explosion sprite reel.
- void __setUpBuildOption (std::string, std::string)

  Helper method to set up and postion the sprite and text for a build option.
- void __setUpDieselGeneratorBuildOption (void)

  Helper method to set up and position the diesel generator build option.
- void __setUpWindTurbineBuildOption (bool=false, bool=false)

  Helper method to set up and position the wind turbine build option.
- void __setUpSolarPVBuildOption (bool=false)

  Helper method to set up and position the solar PV array build option.

- void __setUpTidalTurbineBuildOption (void)

  Helper method to set up and position the tidal turbine build option.
- void __setUpWaveEnergyConverterBuildOption (void)

  Helper method to set up and position the wave energy converter build option.
- void __setUpEnergyStorageSystemBuildOption (void)

  Helper method to set up and position the wave energy converter build option.
- void __setUpBuildMenu (void)

  Helper method to set up and place build menu assets (drawable).
- void __setIsSelected (bool)

  Helper method to set the is selected attribute (of tile and improvement).
- void __clearDecoration (void)

  Helper method to clear tile decoration.
- 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 __openBuildMenu (void)

  Helper method to open the tile improvement build menu.
- void __closeBuildMenu (void)

  Helper method to close the tile improvement build menu.
- 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)

  Helper method to assemble and return the tile improvement substring.
- std::string __getTileOptionsSubstring (void)

  Helper method to assemble and return tile options substring.
- void __sendTileStateMessage (void)

  Helper method to format and send tile state message.
- void __sendAssessNeighboursMessage (void)

  Helper method to format and send assess neighbours message.
- void __sendGameStateRequest (void)

  Helper method to format and send a game state request (message).
- void __sendUpdateGamePhaseMessage (std::string)

  Helper method to format and send update game phase message.
- void __sendCreditsSpentMessage (int)

  Helper method to format and send a credits spent message.
- void __sendInsufficientCreditsMessage (void)

  Helper method to format and send an insufficient credits 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.

4.5.1 Detailed Description

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

4.5.2 Constructor & Destructor Documentation

4.5.2.1 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.

```
1633 {
1634     //  1. set attributes
1635
1636     //  1.1. private
1637     this->event_ptr = event_ptr;
1638     this->render_window_ptr = render_window_ptr;
1639
1640     this->assets_manager_ptr = assets_manager_ptr;
1641     this->message_hub_ptr = message_hub_ptr;
1642
```

```
1643     //  1.2. public
1644     this->show_node = false;
1645     this->show_resource = false;
1646     this->resource_assessed = false;
1647     this->resource_assessment = false;
1648     this->is_selected = false;
1649     this->draw_explosion = false;
1650 
1651     this->decoration_cleared = false;
1652     this->has_improvement = false;
1653     this->tile_improvement_ptr = NULL;
1654 
1655     this->build_menu_open = false;
1656 
1657     this->explosion_frame = 0;
1658 
1659     this->frame = 0;
1660     this->credits = 0;
1661 
1662     this->position_x = position_x;
1663     this->position_y = position_y;
1664 
1665     this->major_radius = 32;
1666     this->minor_radius = (sqrt(3) / 2) * this->major_radius;
1667 
1668     this->game_phase = "build settlement";
1669 
1670     //  2. set up and position drawable attributes
1671     this->__setUpNodeSprite();
1672     this->__setUpTileSprite();
1673     this->__setUpSelectOutlineSprite();
1674     this->__setUpResourceChipSprite();
1675     this->__setResourceText();
1676     this->__setUpMagnifyingGlassSprite();
1677     this->__setUpTileExplosionReel();
1678 
1679     //  3. set tile type and resource (default to none type and average)
1680     this->setTileType(TileType :: NONE_TYPE);
1681     this->setTileResource(TileResource :: AVERAGE);
1682 
1683     std::cout « "HexTile constructed at " « this « std::endl;
1684 
1685     return;
1686 }    /* HexTile() */
```

4.5.2.2 ~HexTile()

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

Destructor for the HexTile class.

```
2217 {
2218     if (this->tile_improvement_ptr != NULL) {
2219         delete this->tile_improvement_ptr;
2220     }
2221 
2222     std::cout « "HexTile at " « this « " destroyed" « std::endl;
2223 
2224     return;
2225 }    /* ~HexTile() */
```

4.5.3 Member Function Documentation

4.5.3.1 __clearDecoration()

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

Helper method to clear tile decoration.

```
756 {
757     this->decoration_cleared = true;
758     this->draw_explosion = true;
759 
760     switch (this->tile_type) {
761         case (TileType :: FOREST): {
762             this->assets_manager_ptr->getSound("clear non-mountains tile")->play();
763 
764             break;
765         }
766 
767 
768         case (TileType :: MOUNTAINS): {
769             this->assets_manager_ptr->getSound("clear mountains tile")->play();
770 
771             break;
772         }
773 
774 
775         case (TileType :: PLAINS): {
776             this->assets_manager_ptr->getSound("clear non-mountains tile")->play();
777 
778             break;
779         }
780 
781 
782         default: {
783             // do nothing!
784 
785             break;
786         }
787     }
788 
789     return;
790 }   /* __clearDecoration() */
```

4.5.3.2 __closeBuildMenu()

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

Helper method to close the tile improvement build menu.

```
1068 {
1069     if (not this->build_menu_open) {
1070         return;
1071     }
1072 
1073     //...
1074 
1075     this->build_menu_open = false;
1076     this->assets_manager_ptr->getSound("build menu close")->play();
1077 
1078     return;
1079 }   /* __closeBuildMenu() */
```

4.5.3.3 __getTileCoordsSubstring()

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

Helper method to assemble and return tile coordinates substring.

Returns

Tile coordinates substring.

```
1120 {
1121     std::string coords_substring = "TILE COORDS:  (";
1122     coords_substring += std::to_string(int(this->position_x - 400));
1123     coords_substring += ", ";
1124     coords_substring += std::to_string(int(this->position_y - 400));
1125     coords_substring += ")\n";
1126 
1127     return coords_substring;
1128 }   /* __getTileCoordsSubstring() */
```

4.5.3.4 __getTileImprovementSubstring()

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

Helper method to assemble and return the tile improvement substring.

Returns

Tile improvement substring.

```
1279 {
1280     std::string improvement_substring = "TILE IMPROVEMENT:  ";
1281 
1282     if (this->has_improvement) {
1283         improvement_substring += this->tile_improvement_ptr->tile_improvement_string;
1284         improvement_substring += "\n";
1285     }
1286 
1287     else {
1288         improvement_substring += "NONE\n";
1289     }
1290 
1291     return improvement_substring;
1292 }   /* __getTileImprovementSubstring() */
```

4.5.3.5 __getTileOptionsSubstring()

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

Helper method to assemble and return tile options substring.

Returns

Tile options substring.

```
1309 {
1310     //                  32 char x 17 line console "--------------------------------\n";
1311     std::string options_substring               = "     **** TILE OPTIONS ****     \n";
1312     options_substring                          += "                                \n";
1313 
1314     if (this->game_phase == "build settlement") {
1315         if (
1316             (this->tile_type != TileType :: OCEAN) and
1317             (this->tile_type != TileType :: LAKE)
1318         ) {
1319             options_substring += "[B]:  BUILD SETTLEMENT (";
1320             options_substring += std::to_string(BUILD_SETTLEMENT_COST);
1321             options_substring += " K)";
1322         }
```

```
1323     }
1324
1325
1326     else if (this->game_phase == "system management") {
1327         if (this->has_improvement) {
1328             /*
1329             options_substring.clear();
1330             options_substring = this->tile_improvement_ptr->getTileOptionsSubstring();
1331             */
1332         }
1333
1334
1335         else if (not this->resource_assessed) {
1336             options_substring += "[A]:  ASSESS RESOURCE (";
1337             options_substring += std::to_string(RESOURCE_ASSESSMENT_COST);
1338             options_substring += " K)\n";
1339         }
1340
1341
1342         else if (
1343             (not this->decoration_cleared) and
1344             (this->tile_type != TileType :: OCEAN) and
1345             (this->tile_type != TileType :: LAKE)
1346         ) {
1347             options_substring += "[C]:  CLEAR TILE (";
1348
1349             switch (this->tile_type) {
1350                 case (TileType :: FOREST): {
1351                     options_substring += std::to_string(CLEAR_FOREST_COST);
1352
1353                     break;
1354                 }
1355
1356
1357                 case (TileType :: MOUNTAINS): {
1358                     options_substring += std::to_string(CLEAR_MOUNTAINS_COST);
1359
1360                     break;
1361                 }
1362
1363
1364                 case (TileType :: PLAINS): {
1365                     options_substring += std::to_string(CLEAR_PLAINS_COST);
1366
1367                     break;
1368                 }
1369
1370
1371                 default: {
1372                     //do nothing!
1373
1374                     break;
1375                 }
1376             }
1377
1378             options_substring += " K)\n";
1379         }
1380
1381
1382         else if (
1383             (this->decoration_cleared) or
1384             (this->tile_type == TileType :: OCEAN) or
1385             (this->tile_type == TileType :: LAKE)
1386         ) {
1387             options_substring += "[B]: OPEN BUILD MENU\n";
1388         }
1389     }
1390
1391
1392     else if (this->game_phase == "victory") {
1393         options_substring                       += "       **** VICTORY ****        \n";
1394     }
1395
1396
1397     else {
1398         options_substring                       += "        **** LOSS ****          \n";
1399     }
1400
1401     return options_substring;
1402 }   /* __getTileOptionsString() */
```

4.5.3.6 __getTileResourceSubstring()

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

Helper method to assemble and return tile resource substring.

Returns

Tile resource substring.

```
1209 {
1210     std::string resource_substring = "TILE RESOURCE:     ";
1211 
1212     if (this->resource_assessed) {
1213         switch (this->tile_resource) {
1214             case (TileResource :: POOR): {
1215                 resource_substring += "POOR\n";
1216 
1217                 break;
1218             }
1219 
1220 
1221             case (TileResource ::BELOW_AVERAGE): {
1222                 resource_substring += "BELOW AVERAGE\n";
1223 
1224                 break;
1225             }
1226 
1227 
1228             case (TileResource :: AVERAGE): {
1229                 resource_substring += "AVERAGE\n";
1230 
1231                 break;
1232             }
1233 
1234 
1235             case (TileResource :: ABOVE_AVERAGE): {
1236                 resource_substring += "ABOVE AVERAGE\n";
1237 
1238                 break;
1239             }
1240 
1241 
1242             case (TileResource :: GOOD): {
1243                 resource_substring += "GOOD\n";
1244 
1245                 break;
1246             }
1247 
1248 
1249             default: {
1250                 resource_substring += "???\n";
1251 
1252                 break;
1253             }
1254         }
1255     }
1256 
1257     else {
1258         resource_substring += "???\n";
1259     }
1260 
1261     return resource_substring;
1262 }   /* __getTileResourceSubstring() */
```

4.5.3.7 __getTileTypeSubstring()

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

Helper method to assemble and return tile type substring.

Returns

Tile type substring.

```
1145 {
1146     std::string type_substring = "TILE TYPE:         ";
1147 
1148     switch (this->tile_type) {
1149         case (TileType :: FOREST): {
1150             type_substring += "FOREST\n";
1151 
1152             break;
1153         }
1154 
1155 
1156         case (TileType :: LAKE): {
1157             type_substring += "LAKE\n";
1158 
1159             break;
1160         }
1161 
1162 
1163         case (TileType :: MOUNTAINS): {
1164             type_substring += "MOUNTAINS\n";
1165 
1166             break;
1167         }
1168 
1169 
1170         case (TileType :: OCEAN): {
1171             type_substring += "OCEAN\n";
1172 
1173             break;
1174         }
1175 
1176 
1177         case (TileType :: PLAINS): {
1178             type_substring += "PLAINS\n";
1179 
1180             break;
1181         }
1182 
1183 
1184         default: {
1185             type_substring += "???\n";
1186 
1187             break;
1188         }
1189     }
1190 
1191     return type_substring;
1192 }   /* __getTileTypeSubstring() */
```

4.5.3.8 __handleKeyPressEvents()

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

Helper method to handle key press events.

```
839 {
840     if (this->event_ptr->key.code == sf::Keyboard::Escape) {
841         this->__setIsSelected(false);
842     }
843 
844 
845     if (not this->is_selected) {
846         return;
847     }
848 
849 
850     //if (this->build_menu_open) {}
851 
852 
853     if (this->game_phase == "build settlement") {
854         if (
855             (this->tile_type != TileType :: OCEAN) and
856             (this->tile_type != TileType :: LAKE)
857         ) {
```

```
858             if (this->event_ptr->key.code == sf::Keyboard::B) {
859                 this->__clearDecoration();
860 
861                 this->tile_improvement_ptr = new Settlement(
862                     this->position_x,
863                     this->position_y,
864                     this->event_ptr,
865                     this->render_window_ptr,
866                     this->assets_manager_ptr,
867                     this->message_hub_ptr
868                 );
869 
870                 this->has_improvement = true;
871 
872                 this->assess();
873                 this->__sendAssessNeighboursMessage();
874 
875                 this->__sendUpdateGamePhaseMessage("system management");
876                 this->__sendCreditsSpentMessage(BUILD_SETTLEMENT_COST);
877                 this->__sendTileStateMessage();
878                 this->__sendGameStateRequest();
879             }
880         }
881     }
882 
883 
884     else if (this->game_phase == "system management") {
885         if (this->has_improvement) {
886             //...
887         }
888 
889 
890         else if (not this->resource_assessed) {
891             if (this->event_ptr->key.code == sf::Keyboard::A) {
892                 if (this->credits < RESOURCE_ASSESSMENT_COST) {
893                     std::cout << "Cannot assess resource: insufficient credits (need "
894                         << RESOURCE_ASSESSMENT_COST << " K)" << std::endl;
895 
896                     this->__sendInsufficientCreditsMessage();
897                 }
898 
899                 else {
900                     this->assess();
901                     this->__sendCreditsSpentMessage(RESOURCE_ASSESSMENT_COST);
902                     this->__sendTileStateMessage();
903                     this->__sendGameStateRequest();
904                 }
905             }
906         }
907 
908 
909         else if (
910             (not this->decoration_cleared) and
911             (this->tile_type != TileType :: OCEAN) and
912             (this->tile_type != TileType :: LAKE)
913         ) {
914             if (this->event_ptr->key.code == sf::Keyboard::C) {
915                 int clear_cost = 0;
916 
917                 switch (this->tile_type) {
918                     case (TileType :: FOREST): {
919                         clear_cost = CLEAR_FOREST_COST;
920 
921                         break;
922                     }
923 
924 
925                     case (TileType :: MOUNTAINS): {
926                         clear_cost = CLEAR_MOUNTAINS_COST;
927 
928                         break;
929                     }
930 
931 
932                     case (TileType :: PLAINS): {
933                         clear_cost = CLEAR_PLAINS_COST;
934 
935                         break;
936                     }
937 
938 
939                     default: {
940                         // do nothing!
941 
942                         break;
943                     }
944                 }
```

```
945
946                 if (this->credits < clear_cost) {
947                     std::cout « "Cannot clear tile: insufficient credits (need "
948                         « clear_cost « " K)" « std::endl;
949
950                     this->__sendInsufficientCreditsMessage();
951                 }
952
953                 else {
954                     this->__clearDecoration();
955                     this->__sendCreditsSpentMessage(clear_cost);
956                     this->__sendTileStateMessage();
957                     this->__sendGameStateRequest();
958                 }
959             }
960         }
961
962
963         else if (
964             (this->decoration_cleared) or
965             (this->tile_type == TileType :: OCEAN) or
966             (this->tile_type == TileType :: LAKE)
967         ) {
968             if (this->event_ptr->key.code == sf::Keyboard::B) {
969                 this->__openBuildMenu();
970             }
971         }
972     }
973
974     return;
975 }   /* __handleKeyPressEvents() */
```

4.5.3.9 __handleMouseButtonEvents()

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

Helper method to handle mouse button events.

```
990 {
991     switch (this->event_ptr->mouseButton.button) {
992         case (sf::Mouse::Left): {
993             if (this->__isClicked()) {
994                 std::cout « "Tile (" « this->position_x « ", " «
995                     this->position_y « ") was selected" « std::endl;
996
997                 this->__setIsSelected(true);
998
999                 this->__sendTileSelectedMessage();
1000                 this->__sendTileStateMessage();
1001                 this->__sendGameStateRequest();
1002             }
1003
1004             else {
1005                 this->__setIsSelected(false);
1006             }
1007
1008             break;
1009         }
1010
1011
1012         case (sf::Mouse::Right): {
1013             this->__setIsSelected(false);
1014
1015             break;
1016         }
1017
1018
1019         default: {
1020             // do nothing!
1021
1022             break;
1023         }
1024     }
1025
1026     return;
1027 }   /* __handleMouseButtonEvents() */
```

4.5.3.10 __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.

```
807 {
808     sf::Vector2i mouse_position = sf::Mouse::getPosition(*render_window_ptr);
809 
810     double mouse_x = mouse_position.x;
811     double mouse_y = mouse_position.y;
812 
813     double distance = sqrt(
814         pow(this->position_x - mouse_x, 2) +
815         pow(this->position_y - mouse_y, 2)
816     );
817 
818     if (distance < this->minor_radius) {
819         return true;
820     }
821     else {
822         return false;
823     }
824 }   /* __isClicked() */
```

4.5.3.11 __openBuildMenu()

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

Helper method to open the tile improvement build menu.

```
1042 {
1043     if (this->build_menu_open) {
1044         return;
1045     }
1046 
1047     //...
1048 
1049     this->build_menu_open = true;
1050     this->assets_manager_ptr->getSound("build menu open")->play();
1051 
1052     return;
1053 }   /* __openBuildMenu() */
```

4.5.3.12 __sendAssessNeighboursMessage()

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

Helper method to format and send assess neighbours message.

```
1464 {
1465     Message assess_neighbours_message;
1466 
1467     assess_neighbours_message.channel = HEX_MAP_CHANNEL;
1468     assess_neighbours_message.subject = "assess neighbours";
1469 
1470     this->message_hub_ptr->sendMessage(assess_neighbours_message);
1471 
1472     std::cout « "Assess neighbours message sent by " « this « std::endl;
1473 
1474     return;
1475 }   /* __sendAssessNeighboursMessage() */
```

4.5.3.13 __sendCreditsSpentMessage()

```
void HexTile::__sendCreditsSpentMessage (
            int credits_spent )  [private]
```

Helper method to format and send a credits spent message.

Parameters

credits_spent	The number of credits that were spent.

```
1547 {
1548     Message credits_spent_message;
1549
1550     credits_spent_message.channel = GAME_CHANNEL;
1551     credits_spent_message.subject = "credits spent";
1552
1553     credits_spent_message.int_payload["credits spent"] = credits_spent;
1554
1555     this->message_hub_ptr->sendMessage(credits_spent_message);
1556
1557     std::cout « "Credits spent (" « credits_spent « ") message sent by " « this
1558         « std::endl;
1559     return;
1560 }   /* __sendCreditsSpentMessage() */
```

4.5.3.14 __sendGameStateRequest()

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

Helper method to format and send a game state request (message).

```
1490 {
1491     Message game_state_request;
1492
1493     game_state_request.channel = GAME_CHANNEL;
1494     game_state_request.subject = "state request";
1495
1496     this->message_hub_ptr->sendMessage(game_state_request);
1497
1498     std::cout « "Game state request message sent by " « this « std::endl;
1499     return;
1500 }   /* __sendGameStateRequest() */
```

4.5.3.15 __sendInsufficientCreditsMessage()

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

Helper method to format and send an insufficient credits message.

```
1575 {
1576     Message insufficient_credits_message;
1577
1578     insufficient_credits_message.channel = GAME_CHANNEL;
1579     insufficient_credits_message.subject = "insufficient credits";
1580
1581     this->message_hub_ptr->sendMessage(insufficient_credits_message);
1582
1583     std::cout « "Insufficient credits message sent by " « this « std::endl;
1584
1585     return;
1586 }   /* __sendInsufficientCreditsMessage() */
```

4.5.3.16 __sendTileSelectedMessage()

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

Helper method to format and send message on tile selection.

```
1094 {
1095     Message tile_selected_message;
1096
1097     tile_selected_message.channel = TILE_SELECTED_CHANNEL;
1098     tile_selected_message.subject = "tile selected";
1099
1100     this->message_hub_ptr->sendMessage(tile_selected_message);
1101
1102     return;
1103 }   /* __sendTileSelectedMessage() */
```

4.5.3.17 __sendTileStateMessage()

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

Helper method to format and send tile state message.

```
1417 {
1418     Message tile_state_message;
1419
1420     tile_state_message.channel = TILE_STATE_CHANNEL;
1421     tile_state_message.subject = "tile state";
1422
1423
1424     //                  32 char x 17 line console "--------------------------------\n";
1425     std::string console_string                   = "      **** TILE INFO ****       \n";
1426     console_string                              += "                                \n";
1427
1428     console_string                              += this->__getTileCoordsSubstring();
1429     console_string                              += "                                \n";
1430
1431     console_string                              += this->__getTileTypeSubstring();
1432
1433     if (not this->has_improvement) {
1434         console_string                          += this->__getTileResourceSubstring();
1435     }
1436
1437     console_string                              += this->__getTileImprovementSubstring();
1438     console_string                              += "                                \n";
1439
1440     console_string                              += this->__getTileOptionsSubstring();
1441
1442
1443     tile_state_message.string_payload["console string"] = console_string;
1444
1445     this->message_hub_ptr->sendMessage(tile_state_message);
1446
1447     std::cout « "Tile state message sent by " « this « std::endl;
1448     return;
1449 }   /* __sendTileStateMessage() */
```

4.5.3.18 __sendUpdateGamePhaseMessage()

```
void HexTile::__sendUpdateGamePhaseMessage (
            std::string game_phase )  [private]
```

Helper method to format and send update game phase message.

Parameters

game_phase	The updated game phase.

```
1517 {
1518     Message update_game_phase_message;
1519 
1520     update_game_phase_message.channel = GAME_CHANNEL;
1521     update_game_phase_message.subject = "update game phase";
1522 
1523     update_game_phase_message.string_payload["game phase"] = game_phase;
1524 
1525     this->message_hub_ptr->sendMessage(update_game_phase_message);
1526 
1527     std::cout « "Update game phase message sent by " « this « std::endl;
1528 
1529     return;
1530 }   /* __sendUpdateGamePhaseMessage() */
```

4.5.3.19 __setIsSelected()

```
void HexTile::__setIsSelected (
            bool is_selected )  [private]
```

Helper method to set the is selected attribute (of tile and improvement).

Parameters

is_selected	The value to set the is selected attribute to.

```
729 {
730     this->is_selected = is_selected;
731 
732     if (this->tile_improvement_ptr != NULL) {
733         this->tile_improvement_ptr->is_selected = is_selected;
734     }
735 
736     if ((not is_selected) and this->build_menu_open) {
737         this->__closeBuildMenu();
738     }
739 
740     return;
741 }   /* __toggleIsSelected() */
```

4.5.3.20 __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     this->resource_text.setFillColor(sf::Color(0, 0, 0, 255));
163 
164     if (this->resource_assessed) {
165         switch (this->tile_resource) {
166             case (TileResource :: POOR): {
167                 this->resource_text.setString("-2");
168                 this->resource_text.setFillColor(MONOCHROME_TEXT_RED);
169 
170                 break;
171             }
```

```
172
173             case (TileResource :: BELOW_AVERAGE): {
174                 this->resource_text.setString("-1");
175                 this->resource_text.setFillColor(MONOCHROME_TEXT_RED);
176
177                 break;
178             }
179
180             case (TileResource :: AVERAGE): {
181                 this->resource_text.setString("+0");
182
183                 break;
184             }
185
186             case (TileResource :: ABOVE_AVERAGE): {
187                 this->resource_text.setString("+1");
188                 this->resource_text.setFillColor(MONOCHROME_TEXT_GREEN);
189
190                 break;
191             }
192
193             case (TileResource :: GOOD): {
194                 this->resource_text.setString("+2");
195                 this->resource_text.setFillColor(MONOCHROME_TEXT_GREEN);
196
197                 break;
198             }
199
200             default: {
201                 this->resource_text.setString("");
202
203                 break;
204             }
205         }
206     }
207
208     else {
209         this->resource_text.setString("");
210     }
211
212     this->resource_text.setCharacterSize(20);
213
214     this->resource_text.setOrigin(
215         this->resource_text.getLocalBounds().width / 2,
216         this->resource_text.getLocalBounds().height / 2
217     );
218
219     this->resource_text.setPosition(
220         this->position_x,
221         this->position_y - 4
222     );
223
224     this->resource_text.setOutlineThickness(1);
225     this->resource_text.setOutlineColor(sf::Color(0, 0, 0, 255));
226
227     return;
228 }   /* __setResourceText() */
```

4.5.3.21 __setUpBuildMenu()

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

Helper method to set up and place build menu assets (drawable).

```
632 {
633     this->build_menu_options_vec.clear();
634     this->build_menu_options_text_vec.clear();
635
636     //  1. set up and place build menu backing and text
637     this->build_menu_backing.setSize(sf::Vector2f(600, 256));
638     this->build_menu_backing.setOrigin(300, 128);
639     this->build_menu_backing.setPosition(400, 400);
640     this->build_menu_backing.setFillColor(MONOCHROME_SCREEN_BACKGROUND);
641     this->build_menu_backing.setOutlineColor(MENU_FRAME_GREY);
642     this->build_menu_backing.setOutlineThickness(4);
643
644     this->build_menu_backing_text.setString("**** BUILD MENU ****");
645     this->build_menu_backing_text.setFont(
```

```
646         *(this->assets_manager_ptr->getFont("Glass_TTY_VT220"))
647     );
648     this->build_menu_backing_text.setCharacterSize(16);
649     this->build_menu_backing_text.setFillColor(MONOCHROME_TEXT_GREEN);
650     this->build_menu_backing_text.setOrigin(
651         this->build_menu_backing_text.getLocalBounds().width / 2, 0
652     );
653     this->build_menu_backing_text.setPosition(400, 400 - 128 + 4);
654 
655     //  2. set up and place build menu option sprites and text
656     switch (this->tile_type) {
657         case (TileType :: FOREST): {
658             this->__setUpDieselGeneratorBuildOption();
659             this->__setUpSolarPVBuildOption();
660             this->__setUpWindTurbineBuildOption();
661             this->__setUpEnergyStorageSystemBuildOption();
662 
663             break;
664         }
665 
666 
667         case (TileType :: LAKE): {
668             this->__setUpSolarPVBuildOption(true);
669             this->__setUpWindTurbineBuildOption(true);
670 
671             break;
672         }
673 
674 
675         case (TileType :: MOUNTAINS): {
676             this->__setUpDieselGeneratorBuildOption();
677             this->__setUpSolarPVBuildOption();
678             this->__setUpWindTurbineBuildOption();
679             this->__setUpEnergyStorageSystemBuildOption();
680 
681             break;
682         }
683 
684 
685         case (TileType :: OCEAN): {
686             this->__setUpWindTurbineBuildOption(false, true);
687             this->__setUpTidalTurbineBuildOption();
688             this->__setUpWaveEnergyConverterBuildOption();
689 
690             break;
691         }
692 
693 
694         case (TileType :: PLAINS): {
695             this->__setUpDieselGeneratorBuildOption();
696             this->__setUpSolarPVBuildOption();
697             this->__setUpWindTurbineBuildOption();
698             this->__setUpEnergyStorageSystemBuildOption();
699 
700             break;
701         }
702 
703 
704         default: {
705             //...
706 
707             break;
708         }
709     }
710 
711     return;
712 }   /* __setUpBuildMenu() */
```

4.5.3.22 __setUpBuildOption()

```
void HexTile::__setUpBuildOption (
            std::string texture_key,
            std::string option_string )  [private]
```

Helper method to set up and postion the sprite and text for a build option.

Parameters

texture_key	The key for the appropriate illustration asset for the build option.
option_string	A string for the build option.

```
323 {
324     size_t n_options = this->build_menu_options_vec.size();
325 
326     //  1. set up option sprite(s)
327     this->build_menu_options_vec.push_back({});
328 
329     if (not texture_key.empty()) {
330         sf::Sprite texture_sheet(
331             *(this->assets_manager_ptr->getTexture(texture_key))
332         );
333 
334         int sheet_height = texture_sheet.getLocalBounds().height;
335         int n_subrects = sheet_height / 64;
336 
337         for (int i = 0; i < n_subrects; i++) {
338             this->build_menu_options_vec.back().push_back(
339                 sf::Sprite(
340                     *(this->assets_manager_ptr->getTexture(texture_key)),
341                     sf::IntRect(0, i * 64, 64, 64)
342                 )
343             );
344 
345             this->build_menu_options_vec.back().back().setOrigin(
346                 this->build_menu_options_vec.back().back().getLocalBounds().width / 2,
347                 this->build_menu_options_vec.back().back().getLocalBounds().height
348             );
349 
350             this->build_menu_options_vec.back().back().setPosition(
351                 400 - 300 + 75 + n_options * 150,
352                 400 - 32
353             );
354         }
355     }
356 
357     else {
358         this->build_menu_options_vec.back().push_back(sf::Sprite());
359     }
360 
361 
362     //  2. set up option text
363     this->build_menu_options_text_vec.push_back(
364         sf::Text(
365             option_string,
366             *(this->assets_manager_ptr->getFont("Glass_TTY_VT220")),
367             16
368         )
369     );
370 
371     this->build_menu_options_text_vec.back().setOrigin(
372         this->build_menu_options_text_vec.back().getLocalBounds().width / 2,
373         0
374     );
375 
376     this->build_menu_options_text_vec.back().setPosition(
377         400 - 300 + 75 + n_options * 150,
378         400 - 16 - 4
379     );
380 
381     this->build_menu_options_text_vec.back().setFillColor(MONOCHROME_TEXT_GREEN);
382 
383     return;
384 }   /* __setUpBuildOption() */
```

4.5.3.23 __setUpDieselGeneratorBuildOption()

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

Helper method to set up and position the diesel generator build option.

```
399 {
```

```
400     //  1. set up option sprite(s)
401     std::string texture_key = "diesel generator";
402
403     //  2. set up option string (up to 16 chars wide)
404     //                                "----------------\n"
405     std::string diesel_generator_string = "DIESEL GENERATOR\n";
406     diesel_generator_string            += "                \n";
407     diesel_generator_string            += "CAPACITY: 100 kW\n";
408     diesel_generator_string            += "COST:     ";
409     diesel_generator_string            += std::to_string(DIESEL_GENERATOR_BUILD_COST);
410     diesel_generator_string            += " K\n\n\n";
411     diesel_generator_string            += "BUILD:    [D]   \n";
412
413     //  3. call general method
414     this->__setUpBuildOption(texture_key, diesel_generator_string);
415
416     return;
417 }   /* __setUpDieselGeneratorBuildOption() */
```

4.5.3.24 __setUpEnergyStorageSystemBuildOption()

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

Helper method to set up and position the wave energy converter build option.

```
599 {
600     //  1. set up option sprite(s)
601     std::string texture_key = "energy storage system";
602
603     //  2. set up option string (up to 16 chars wide)
604     //                                  "----------------\n"
605     std::string energy_storage_system_string    = " ENERGY STORAGE \n";
606     energy_storage_system_string               += "                \n";
607     energy_storage_system_string               += "CAPCTY:  500 kWh\n";
608     energy_storage_system_string               += "COST:     ";
609     energy_storage_system_string               += std::to_string(ENERGY_STORAGE_SYSTEM_BUILD_COST);
610     energy_storage_system_string               += " K\n\n\n";
611     energy_storage_system_string               += "BUILD:    [E]   \n";
612
613     //  3. call general method
614     this->__setUpBuildOption(texture_key, energy_storage_system_string);
615
616     return;
617 }   /* __setUpEnergyStorageSystemBuildOption() */
```

4.5.3.25 __setUpMagnifyingGlassSprite()

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

Helper method to set up and position magnifying glass sprite.

```
243 {
244     this->magnifying_glass_sprite.setTexture(
245         *(this->assets_manager_ptr->getTexture("magnifying_glass_64x64_1"))
246     );
247
248     this->magnifying_glass_sprite.setOrigin(
249         this->magnifying_glass_sprite.getLocalBounds().width / 2,
250         this->magnifying_glass_sprite.getLocalBounds().height / 2
251     );
252
253     this->magnifying_glass_sprite.setPosition(
254         this->position_x,
255         this->position_y
256     );
257
258     return;
259 }   /* __setUpMagnifyingGlassSprite() */
```

4.5.3.26 __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() */
```

4.5.3.27 __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(RESOURCE_CHIP_GREY);
143 
144     return;
145 }   /* __setUpResourceChip() */
```

4.5.3.28 __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() */
```

4.5.3.29 __setUpSolarPVBuildOption()

```
void HexTile::__setUpSolarPVBuildOption (
            bool is_lake = false )  [private]
```

Helper method to set up and position the solar PV array build option.

Parameters

is_lake	If being built on a lake.

```
487 {
488     //  1. set up option sprite(s)
489     std::string texture_key = "solar PV array";
490 
491     //  2. set up option string (up to 16 chars wide)
492     int build_cost = SOLAR_PV_BUILD_COST;
493     if (is_lake) {
494         build_cost *= SOLAR_PV_WATER_BUILD_MULTIPLIER;
495     }
496 
497     //                                    "----------------\n"
498     std::string solar_PV_string         = " SOLAR PV ARRAY \n";
499     solar_PV_string                    += "                \n";
500     solar_PV_string                    += "CAPACITY: 100 kW\n";
501     solar_PV_string                    += "COST:     ";
502     solar_PV_string                    += std::to_string(build_cost);
503     solar_PV_string                    += " K";
504 
505     if (is_lake) {
506         solar_PV_string += "\n** LAKE BUILD **\n\n";
507     }
508     else {
509         solar_PV_string += "\n\n\n";
510     }
511 
512     solar_PV_string                    += "BUILD:    [S]   \n";
513 
514     //  3. call general method
515     this->__setUpBuildOption(texture_key, solar_PV_string);
516 
517     return;
518 }   /* __setUpSolarPVBuildOption() */
```

4.5.3.30 __setUpTidalTurbineBuildOption()

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

Helper method to set up and position the tidal turbine build option.

```
533 {
534     //  1. set up option sprite(s)
535     std::string texture_key = "tidal turbine";
536 
537     //  2. set up option string (up to 16 chars wide)
538     //                                    "----------------\n"
539     std::string tidal_turbine_string    = " TIDAL TURBINE  \n";
540     tidal_turbine_string               += "                \n";
541     tidal_turbine_string               += "CAPACITY: 100 kW\n";
542     tidal_turbine_string               += "COST:     ";
543     tidal_turbine_string               += std::to_string(TIDAL_TURBINE_BUILD_COST);
544     tidal_turbine_string               += " K\n\n\n";
545     tidal_turbine_string               += "BUILD:    [T]   \n";
546 
547     //  3. call general method
548     this->__setUpBuildOption(texture_key, tidal_turbine_string);
549 
550     return;
551 }   /* __setUpTidalTurbineBuildOption() */
```

4.5.3.31 __setUpTileExplosionReel()

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

Helper method to set up tile explosion sprite reel.

```
274 {
275     for (int i = 0; i < 4; i++) {
276         for (int j = 0; j < 4; j++) {
277             this->explosion_sprite_reel.push_back(
278                 sf::Sprite(
279                     *(this->assets_manager_ptr->getTexture("tile clear explosion")),
280                     sf::IntRect(j * 64, i * 64, 64, 64)
281                 )
282             );
283 
284             this->explosion_sprite_reel.back().setOrigin(
285                 this->explosion_sprite_reel.back().getLocalBounds().width / 2,
286                 this->explosion_sprite_reel.back().getLocalBounds().height / 2
287             );
288 
289             this->explosion_sprite_reel.back().setPosition(
290                 this->position_x,
291                 this->position_y
292             );
293         }
294     }
295 
296     return;
297 }   /* __setUpTileExplosionReel() */
```

4.5.3.32 __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() */
```

4.5.3.33 __setUpWaveEnergyConverterBuildOption()

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

Helper method to set up and position the wave energy converter build option.

```
566 {
567     //  1. set up option sprite(s)
```

```
568     std::string texture_key = "wave energy converter";
569
570     //  2. set up option string (up to 16 chars wide)
571     //                                          "----------------\n"
572     std::string wave_energy_converter_string    = "WAVE ENERGY CVTR\n";
573     wave_energy_converter_string               += "                \n";
574     wave_energy_converter_string               += "CAPACITY: 100 kW\n";
575     wave_energy_converter_string               += "COST:     ";
576     wave_energy_converter_string               += std::to_string(WAVE_ENERGY_CONVERTER_BUILD_COST);
577     wave_energy_converter_string               += " K\n\n\n";
578     wave_energy_converter_string               += "BUILD:    [A]   \n";
579
580     //  3. call general method
581     this->__setUpBuildOption(texture_key, wave_energy_converter_string);
582
583     return;
584 }   /* __setUpWaveEnergyConverterBuildOption() */
```

4.5.3.34 __setUpWindTurbineBuildOption()

```
void HexTile::__setUpWindTurbineBuildOption (
            bool is_lake = false,
            bool is_ocean = false )  [private]
```

Helper method to set up and position the wind turbine build option.

Parameters

is_lake	If being built on a lake tile.
is_ocean	If being built on an ocean tile.

```
436 {
437     //  1. set up option sprite(s)
438     std::string texture_key = "wind turbine";
439
440     //  2. set up option string (up to 16 chars wide)
441     int build_cost = WIND_TURBINE_BUILD_COST;
442     if (is_lake or is_ocean) {
443         build_cost *= WIND_TURBINE_WATER_BUILD_MULTIPLIER;
444     }
445
446     //                                     "----------------\n"
447     std::string wind_turbine_string     = "  WIND TURBINE  \n";
448     wind_turbine_string                += "                \n";
449     wind_turbine_string                += "CAPACITY: 100 kW\n";
450     wind_turbine_string                += "COST:     ";
451     wind_turbine_string                += std::to_string(build_cost);
452     wind_turbine_string                += " K";
453
454     if (is_lake) {
455         wind_turbine_string += "\n** LAKE BUILD **\n\n";
456     }
457     else if (is_ocean) {
458         wind_turbine_string += "\n* OCEAN BUILD * \n\n";
459     }
460     else {
461         wind_turbine_string += "\n\n\n";
462     }
463
464     wind_turbine_string                += "BUILD:    [W]   \n";
465
466     //  3. call general method
467     this->__setUpBuildOption(texture_key, wind_turbine_string);
468
469     return;
470 }   /* __setUpWindTurbineBuildOption() */
```

4.5.3.35 assess()

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

Method to assess the tile's resource.

```
2007 {
2008     this->resource_assessed = true;
2009     this->resource_assessment = true;
2010 
2011     this->assets_manager_ptr->getSound("resource assessment")->play();
2012 
2013     this->__setResourceText();
2014     this->__sendTileStateMessage();
2015 
2016     return;
2017 }   /* assess() */
```

4.5.3.36 decorateTile()

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

Method to decorate tile.

```
1885 {
1886     switch (this->tile_type) {
1887         case (TileType :: FOREST): {
1888             this->tile_decoration_sprite.setTexture(
1889                 *(this->assets_manager_ptr->getTexture("pine_tree_64x64_1"))
1890             );
1891 
1892             break;
1893         }
1894 
1895         case (TileType :: LAKE): {
1896             this->tile_decoration_sprite.setTexture(
1897                 *(this->assets_manager_ptr->getTexture("water_shimmer_64x64_1"))
1898             );
1899 
1900             break;
1901         }
1902 
1903         case (TileType :: MOUNTAINS): {
1904             this->tile_decoration_sprite.setTexture(
1905                 *(this->assets_manager_ptr->getTexture("mountain_64x64_1"))
1906             );
1907 
1908             break;
1909         }
1910 
1911         case (TileType :: OCEAN): {
1912             this->tile_decoration_sprite.setTexture(
1913                 *(this->assets_manager_ptr->getTexture("water_waves_64x64_1"))
1914             );
1915 
1916             break;
1917         }
1918 
1919         case (TileType :: PLAINS): {
1920             this->tile_decoration_sprite.setTexture(
1921                 *(this->assets_manager_ptr->getTexture("wheat_64x64_1"))
1922             );
1923 
1924             break;
1925         }
1926 
1927         default: {
1928             // do nothing!
1929 
1930             break;
1931         }
1932     }
1933 
1934 
1935     if (this->tile_type == TileType :: OCEAN or this->tile_type == TileType :: LAKE) {
```

```
1936         this->tile_decoration_sprite.setOrigin(
1937             this->tile_decoration_sprite.getLocalBounds().width / 2,
1938             this->tile_decoration_sprite.getLocalBounds().height / 2
1939         );
1940 
1941         this->tile_decoration_sprite.setPosition(
1942             this->position_x,
1943             this->position_y
1944         );
1945 
1946         if ((double)rand() / RAND_MAX > 0.5) {
1947             this->tile_decoration_sprite.setScale(sf::Vector2f(-1, 1));
1948         }
1949     }
1950 
1951     else {
1952         this->tile_decoration_sprite.setOrigin(
1953             this->tile_decoration_sprite.getLocalBounds().width / 2,
1954             this->tile_decoration_sprite.getLocalBounds().height
1955         );
1956 
1957         this->tile_decoration_sprite.setPosition(
1958             this->position_x,
1959             this->position_y + 12
1960         );
1961 
1962         if ((double)rand() / RAND_MAX > 0.5) {
1963             this->tile_decoration_sprite.setScale(sf::Vector2f(-1, 1));
1964         }
1965     }
1966 
1967     return;
1968 }   /* decorateTile(void) */
```

4.5.3.37 draw()

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

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

```
2112 {
2113     //  1. draw hex
2114     this->render_window_ptr->draw(this->tile_sprite);
2115 
2116     //  2. draw node
2117     if (this->show_node) {
2118         this->render_window_ptr->draw(this->node_sprite);
2119     }
2120 
2121     //  3. draw tile decoration
2122     if (not this->decoration_cleared) {
2123         this->render_window_ptr->draw(this->tile_decoration_sprite);
2124     }
2125 
2126     //  4. draw tile improvement
2127     if (this->has_improvement) {
2128         if (not this->tile_improvement_ptr->just_built) {
2129             this->tile_improvement_ptr->draw();
2130         }
2131     }
2132 
2133     //  5. draw resource
2134     if (this->show_resource) {
2135         this->render_window_ptr->draw(this->resource_chip_sprite);
2136         this->render_window_ptr->draw(this->resource_text);
2137     }
2138 
2139     //  6. draw selection outline
2140     if (this->is_selected) {
2141         sf::Color outline_colour = this->select_outline_sprite.getOutlineColor();
2142 
2143         outline_colour.a =
2144             255 * pow(cos((M_PI * this->frame) / (1.5 * FRAMES_PER_SECOND)), 2);
2145 
2146         this->select_outline_sprite.setOutlineColor(outline_colour);
2147 
2148         this->render_window_ptr->draw(this->select_outline_sprite);
2149     }
```

```
2150
2151     //  7. draw resource assessment notification
2152     if (this->resource_assessment) {
2153         int alpha = this->magnifying_glass_sprite.getColor().a;
2154
2155         alpha -= 0.05 * FRAMES_PER_SECOND;
2156         if (alpha < 0) {
2157             alpha = 0;
2158             this->resource_assessment = false;
2159         }
2160
2161         this->magnifying_glass_sprite.setColor(
2162             sf::Color(255, 255, 255, alpha)
2163         );
2164
2165         this->render_window_ptr->draw(this->magnifying_glass_sprite);
2166     }
2167
2168     //  8. draw explosion, then settlement placement
2169     if (this->draw_explosion) {
2170         this->render_window_ptr->draw(this->explosion_sprite_reel[this->explosion_frame]);
2171
2172         if (this->frame % (FRAMES_PER_SECOND / 10) == 0) {
2173             this->explosion_frame++;
2174         }
2175
2176         if (this->explosion_frame >= this->explosion_sprite_reel.size()) {
2177             this->draw_explosion = false;
2178         }
2179     }
2180
2181     else if (this->has_improvement) {
2182         if (this->tile_improvement_ptr->just_built) {
2183             this->tile_improvement_ptr->draw();
2184         }
2185     }
2186
2187     //  9. build menu
2188     if (this->build_menu_open) {
2189         this->render_window_ptr->draw(this->build_menu_backing);
2190         this->render_window_ptr->draw(this->build_menu_backing_text);
2191
2192         for (size_t i = 0; i < this->build_menu_options_vec.size(); i++) {
2193             for (size_t j = 0; j < this->build_menu_options_vec[i].size(); j++) {
2194                 this->render_window_ptr->draw(this->build_menu_options_vec[i][j]);
2195             }
2196             this->render_window_ptr->draw(this->build_menu_options_text_vec[i]);
2197         }
2198     }
2199
2200     this->frame++;
2201     return;
2202 }   /* draw() */
```

4.5.3.38 processEvent()

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

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

```
2032 {
2033     //  1. process TileImprovement events
2034     if (this->tile_improvement_ptr != NULL) {
2035         this->tile_improvement_ptr->processEvent();
2036     }
2037
2038     //  2. process HexTile events
2039     if (this->event_ptr->type == sf::Event::KeyPressed) {
2040         this->__handleKeyPressEvents();
2041     }
2042
2043     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
2044         this->__handleMouseButtonEvents();
2045     }
2046
2047     return;
2048 }   /* processEvent() */
```

4.5.3.39 processMessage()

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

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

```
2063 {
2064     //  1. process TileImprovement messages
2065     if (this->tile_improvement_ptr != NULL) {
2066         this->tile_improvement_ptr->processMessage();
2067     }
2068
2069     //  2. process HexTile messages
2070     if (this->is_selected) {
2071         if (not this->message_hub_ptr->isEmpty(GAME_STATE_CHANNEL)) {
2072             Message game_state_message = this->message_hub_ptr->receiveMessage(
2073                 GAME_STATE_CHANNEL
2074             );
2075
2076             if (game_state_message.subject == "game state") {
2077                 this->credits = game_state_message.int_payload["credits"];
2078                 this->game_phase = game_state_message.string_payload["game phase"];
2079
2080                 if (this->tile_improvement_ptr != NULL) {
2081                     this->tile_improvement_ptr->credits = this->credits;
2082                     this->tile_improvement_ptr->game_phase = this->game_phase;
2083                 }
2084
2085                 std::cout « "Game state message received by " « this « std::endl;
2086                 this->__sendTileStateMessage();
2087                 this->message_hub_ptr->popMessage(GAME_STATE_CHANNEL);
2088             }
2089         }
2090
2091         std::cout « "Current credits (HexTile): " « this->credits « " K" «
2092             std::endl;
2093     }
2094
2095     return;
2096 }   /* processMessage() */
```

4.5.3.40 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].

```
1834 {
1835     //  1. check input
1836     if (input_value < 0 or input_value > 1) {
1837         std::string error_str = "ERROR  HexTile::setTileResource()  given input value is ";
1838         error_str += "not in the closed interval [0, 1]";
1839
1840         #ifdef _WIN32
1841             std::cout « error_str « std::endl;
1842         #endif  /* _WIN32 */
1843
1844         throw std::runtime_error(error_str);
1845     }
1846
1847     //  2. convert input value to tile resource
1848     TileResource tile_resource;
1849
1850     if (input_value <= TILE_RESOURCE_CUMULATIVE_PROBABILITIES[0]) {
1851         tile_resource = TileResource :: POOR;
1852     }
```

```
1853     else if (input_value <= TILE_RESOURCE_CUMULATIVE_PROBABILITIES[1]) {
1854         tile_resource = TileResource :: BELOW_AVERAGE;
1855     }
1856     else if (input_value <= TILE_RESOURCE_CUMULATIVE_PROBABILITIES[2]) {
1857         tile_resource = TileResource :: AVERAGE;
1858     }
1859     else if (input_value <= TILE_RESOURCE_CUMULATIVE_PROBABILITIES[3]) {
1860         tile_resource = TileResource :: ABOVE_AVERAGE;
1861     }
1862     else {
1863         tile_resource = TileResource :: GOOD;
1864     }
1865
1866     //  3. call alternate method
1867     this->setTileResource(tile_resource);
1868
1869     return;
1870 }   /* setTileResource(double) */
```

4.5.3.41 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.

```
1812 {
1813     this->tile_resource = tile_resource;
1814     this->__setResourceText();
1815
1816     return;
1817 }   /* setTileResource(TileResource) */
```

4.5.3.42 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].

```
1762 {
1763     //  1. check input
1764     if (input_value < 0 or input_value > 1) {
1765         std::string error_str = "ERROR  HexTile::setTileType()  given input value is ";
1766         error_str += "not in the closed interval [0, 1]";
1767
1768         #ifdef _WIN32
1769             std::cout « error_str « std::endl;
1770         #endif  /* _WIN32 */
1771
1772         throw std::runtime_error(error_str);
1773     }
1774
1775     //  2. convert input value to tile type
```

```
1776     TileType tile_type;
1777
1778     if (input_value <= TILE_TYPE_CUMULATIVE_PROBABILITIES[0]) {
1779         tile_type = TileType :: LAKE;
1780     }
1781     else if (input_value <= TILE_TYPE_CUMULATIVE_PROBABILITIES[1]) {
1782         tile_type = TileType :: PLAINS;
1783     }
1784     else if (input_value <= TILE_TYPE_CUMULATIVE_PROBABILITIES[2]) {
1785         tile_type = TileType :: FOREST;
1786     }
1787     else {
1788         tile_type = TileType :: MOUNTAINS;
1789     }
1790
1791     //  3. call alternate method
1792     this->setTileType(tile_type);
1793
1794     return;
1795 }   /* setTileType(double) */
```

4.5.3.43 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.

```
1701 {
1702     this->tile_type = tile_type;
1703
1704     switch (this->tile_type) {
1705         case (TileType :: FOREST): {
1706             this->tile_sprite.setFillColor(FOREST_GREEN);
1707
1708             break;
1709         }
1710
1711         case (TileType :: LAKE): {
1712             this->tile_sprite.setFillColor(LAKE_BLUE);
1713
1714             break;
1715         }
1716
1717         case (TileType :: MOUNTAINS): {
1718             this->tile_sprite.setFillColor(MOUNTAINS_GREY);
1719
1720             break;
1721         }
1722
1723         case (TileType :: OCEAN): {
1724             this->tile_sprite.setFillColor(OCEAN_BLUE);
1725
1726             break;
1727         }
1728
1729         case (TileType :: PLAINS): {
1730             this->tile_sprite.setFillColor(PLAINS_YELLOW);
1731
1732             break;
1733         }
1734
1735         default: {
1736             // do nothing!
1737
1738             break;
1739         }
1740     }
1741
1742     this->__setUpBuildMenu();
1743
```

```
1744     return;
1745 }   /* setTileType(TileType) */
```

4.5.3.44 toggleResourceOverlay()

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

Method to toggle the tile resource overlay.

```
1983 {
1984     if (this->show_resource) {
1985         this->show_resource = false;
1986     }
1987     else {
1988         this->show_resource = true;
1989     }
1990
1991     return;
1992 }   /* toggleResourceOverlay() */
```

4.5.4 Member Data Documentation

4.5.4.1 assets_manager_ptr

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

A pointer to the assets manager.

4.5.4.2 build_menu_backing

```
sf::RectangleShape HexTile::build_menu_backing
```

A backing for the tile build menu.

4.5.4.3 build_menu_backing_text

```
sf::Text HexTile::build_menu_backing_text
```

A text label for the build menu.

4.5.4.4 build_menu_open

```
bool HexTile::build_menu_open
```

A boolean which indicates if the tile build menu is open.

4.5.4.5 build_menu_options_text_vec

```
std::vector<sf::Text> HexTile::build_menu_options_text_vec
```

A vector of text for the tile build options.

4.5.4.6 build_menu_options_vec

```
std::vector<std::vector<sf::Sprite> > HexTile::build_menu_options_vec
```

A vector of sprites for illustrating the tile build options.

4.5.4.7 credits

```
int HexTile::credits
```

The current balance of credits.

4.5.4.8 decoration_cleared

```
bool HexTile::decoration_cleared
```

A boolean which indicates if the tile decoration has been cleared.

4.5.4.9 draw_explosion

```
bool HexTile::draw_explosion
```

A boolean which indicates whether or not to draw a tile explosion.

4.5.4.10 event_ptr

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

A pointer to the event class.

4.5.4.11 explosion_frame

```
size_t HexTile::explosion_frame
```

The current frame of the explosion animation.

4.5.4.12 explosion_sprite_reel

```
std::vector<sf::Sprite> HexTile::explosion_sprite_reel
```

A reel of sprites for a tile explosion animation.

4.5.4.13 frame

```
int HexTile::frame
```

The current frame of this object.

4.5.4.14 game_phase

```
std::string HexTile::game_phase
```

The current phase of the game.

4.5.4.15 has_improvement

```
bool HexTile::has_improvement
```

A boolean which indicates if tile has improvement or not.

4.5.4.16 is_selected

```
bool HexTile::is_selected
```

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

4.5.4.17 magnifying_glass_sprite

```
sf::Sprite HexTile::magnifying_glass_sprite
```

A magnifying glass sprite.

4.5.4.18 major_radius

```
double HexTile::major_radius
```

The radius of the smallest bounding circle.

4.5.4.19 message_hub_ptr

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

A pointer to the message hub.

4.5.4.20 minor_radius

```
double HexTile::minor_radius
```

The radius of the largest inscribed circle.

4.5.4.21 node_sprite

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

A circle shape to mark the tile node.

4.5.4.22 position_x

```
double HexTile::position_x
```

The x position of the tile.

4.5.4.23 position_y

```
double HexTile::position_y
```

The y position of the tile.

4.5.4.24 render_window_ptr

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

A pointer to the render window.

4.5.4.25 resource_assessed

```
bool HexTile::resource_assessed
```

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

4.5.4.26 resource_assessment

```
bool HexTile::resource_assessment
```

A boolean which triggers a resource assessment notification.

4.5.4.27 resource_chip_sprite

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

A circle shape which represents a resource chip.

4.5.4.28 resource_text

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

A text representation of the resource.

4.5.4.29 select_outline_sprite

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

A convex shape which outlines the tile when selected.

4.5.4.30 show_node

```
bool HexTile::show_node
```

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

4.5.4.31 show_resource

```
bool HexTile::show_resource
```

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

4.5.4.32 tile_decoration_sprite

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

A tile decoration sprite.

4.5.4.33 tile_improvement_ptr

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

A pointer to the improvement for this tile.

4.5.4.34 tile_resource

```
TileResource HexTile::tile_resource
```

4.5.4.35 tile_sprite

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

A convex shape which represents the tile.

4.5.4.36 tile_type

```
TileType HexTile::tile_type
```

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

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

4.6 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::map< std::string, bool > bool_payload = {}
  A boolean payload.
- std::map< std::string, int > int_payload = {}
  A vector payload.
- std::map< std::string, double > double_payload = {}
  A vector payload.
- std::map< std::string, std::string > string_payload = {}
  A string payload.

4.6.1 Detailed Description

A structure which defines a standard message format.

4.6.2 Member Data Documentation

4.6.2.1 bool_payload

```
std::map<std::string, bool> Message::bool_payload = {}
```

A boolean payload.

4.6.2.2 channel

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

A string identifying the appropriate channel for this message.

4.6.2.3 double_payload

```
std::map<std::string, double> Message::double_payload = {}
```

A vector payload.

4.6.2.4 int_payload

```
std::map<std::string, int> Message::int_payload = {}
```

A vector payload.

4.6.2.5 string_payload

```
std::map<std::string, std::string> Message::string_payload = {}
```

A string payload.

4.6.2.6 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

4.7 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. Channels are implemented in a first in, first out manner (i.e. message queue).
- bool isEmpty (std::string)

  Method to check if channel is empty.
- Message receiveMessage (std::string)

  Method to receive the first message in the channel. Channels are implemented in a first in, first out manner (i.e. message queue).
- void popMessage (std::string)

  Method to pop first message off of the given channel. Channels are implemented in a first in, first out manner (i.e. message queue).
- 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.

4.7.1 Detailed Description

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

4.7.2 Constructor & Destructor Documentation

4.7.2.1 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() */
```

4.7.2.2 ~MessageHub()

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

Destructor for the MessageHub class.

```
393 {
394     this->clear();
395
396     std::cout « "MessageHub at " « this « " destroyed" « std::endl;
397
398     return;
399 }   /* ~MessageHub() */
```

4.7.3 Member Function Documentation

4.7.3.1 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     std::cout « "Channel " « channel « " added to message hub" « std::endl;
115 
116     return;
117 }   /* addChannel() */
```

4.7.3.2 clear()

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

Method to clear the MessageHub.

```
373 {
374 
375     this->clearMessages();
376     this->message_map.clear();
377 
378     return;
379 }   /* clear() */
```

4.7.3.3 clearMessages()

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

Method to clear messages from the MessageHub.

```
347 {
348     std::map<std::string, std::list<Message»::iterator map_iter;
349     for (
350         map_iter = this->message_map.begin();
351         map_iter != this->message_map.end();
352         map_iter++
353     ) {
354         map_iter->second.clear();
355     }
356 
357     return;
358 }   /* clearMessages() */
```

4.7.3.4 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() */
```

4.7.3.5 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.

```
212 {
213     //  1. check if channel is in map (if not, throw error)
214     if (this->message_map.count(channel) <= 0) {
215         std::string error_str = "ERROR  MessageHub::isEmpty()  channel ";
216         error_str += channel;
217         error_str += " is not in message map";
218
219         #ifdef _WIN32
220             std::cout << error_str << std::endl;
221         #endif  /* _WIN32 */
222
223         throw std::runtime_error(error_str);
224     }
225
226     if (this->message_map[channel].empty()) {
227         return true;
228     }
229     else {
230         return false;
231     }
232 }   /* isEmpty() */
```

4.7.3.6 popMessage()

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

Method to pop first message off of the given channel. Channels are implemented in a first in, first out manner (i.e. message queue).

Parameters

channel	The key for the message channel being popped.

```
301 {
302     //  1. check if channel is in map (if not, throw error)
303     if (this->message_map.count(channel) <= 0) {
304         std::string error_str = "ERROR  MessageHub::receiveMessage()  channel ";
305         error_str += channel;
306         error_str += " is not in message map";
307 
308         #ifdef _WIN32
309             std::cout << error_str << std::endl;
310         #endif  /* _WIN32 */
311 
312         throw std::runtime_error(error_str);
313     }
314 
315     //  2. check if channel is empty (if so, throw error)
316     if (this->message_map[channel].empty()) {
317         std::string error_str = "ERROR  MessageHub::receiveMessage()  channel ";
318         error_str += channel;
319         error_str += " is empty";
320 
321         #ifdef _WIN32
322             std::cout << error_str << std::endl;
323         #endif  /* _WIN32 */
324 
325         throw std::runtime_error(error_str);
326     }
327 
328     //  3. pop message
329     this->message_map[channel].pop_front();
330 
331     return;
332 }   /* popMessage() */
```

4.7.3.7 receiveMessage()

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

Method to receive the first message in the channel. Channels are implemented in a first in, first out manner (i.e. message queue).

Parameters

channel	The key for the message channel being received from.

Returns

The first message in the given channel.

```
252 {
253     //  1. check if channel is in map (if not, throw error)
254     if (this->message_map.count(channel) <= 0) {
255         std::string error_str = "ERROR  MessageHub::receiveMessage()  channel ";
256         error_str += channel;
257         error_str += " is not in message map";
258 
259         #ifdef _WIN32
260             std::cout << error_str << std::endl;
261         #endif  /* _WIN32 */
262 
```

```
263         throw std::runtime_error(error_str);
264     }
265
266     //  2. check if channel is empty (if so, throw error)
267     if (this->message_map[channel].empty()) {
268         std::string error_str = "ERROR  MessageHub::receiveMessage()  channel ";
269         error_str += channel;
270         error_str += " is empty";
271
272         #ifdef _WIN32
273             std::cout << error_str << std::endl;
274         #endif  /* _WIN32 */
275
276         throw std::runtime_error(error_str);
277     }
278
279     //  3. receive message
280     Message message = this->message_map[channel].front();
281
282     return message;
283 }   /* receiveMessage() */
```

4.7.3.8 removeChannel()

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

Method to remove channel from message map.

Parameters

channel	The key for the message channel being removed.

```
134 {
135     //  1. check if channel is in map (if not, throw error)
136     if (this->message_map.count(channel) <= 0) {
137         std::string error_str = "ERROR  MessageHub::removeChannel()  channel ";
138         error_str += channel;
139         error_str += " is not in message map";
140
141         #ifdef _WIN32
142             std::cout << error_str << std::endl;
143         #endif  /* _WIN32 */
144
145         throw std::runtime_error(error_str);
146     }
147
148     //  2. remove channel from map
149     this->message_map[channel].clear();
150     this->message_map.erase(channel);
151
152     std::cout << "Channel " << channel << " removed from message hub" << std::endl;
153
154     return;
155 }   /* removeChannel() */
```

4.7.3.9 sendMessage()

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

Method to send a message to the message map. Channels are implemented in a first in, first out manner (i.e. message queue).

Parameters

message	The message to be sent.

```
173 {
174     //  1. check if channel is in map (if not, throw error)
175     std::string channel = message.channel;
176 
177     if (this->message_map.count(channel) <= 0) {
178         std::string error_str = "ERROR  MessageHub::sendMessage()  channel ";
179         error_str += channel;
180         error_str += " is not in message map";
181 
182         #ifdef _WIN32
183             std::cout « error_str « std::endl;
184         #endif  /* _WIN32 */
185 
186         throw std::runtime_error(error_str);
187     }
188 
189     //  2. send message to message map
190     this->message_map[channel].push_back(message);
191 
192     return;
193 }   /* sendMessage() */
```

4.7.4 Member Data Documentation

4.7.4.1 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:

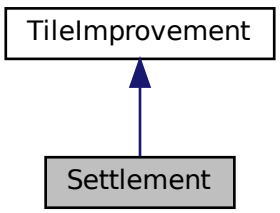
- header/ESC_core/MessageHub.h
- source/ESC_core/MessageHub.cpp

4.8 Settlement Class Reference

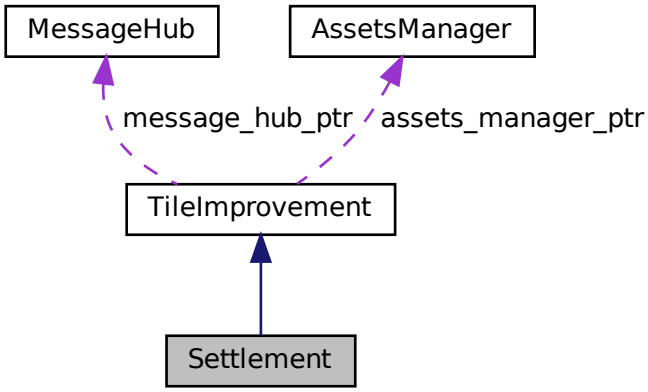
A settlement class (child class of TileImprovement).

`#include <Settlement.h>`

Inheritance diagram for Settlement:



Collaboration diagram for Settlement:



Public Member Functions

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

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

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

  Method to process Settlement. 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.
- virtual ∼Settlement (void)

  Destructor for the Settlement class.

Public Attributes

- bool skip_smoke_processing

  A boolean which indicates whether or not to skip smoke processing.
- double smoke_da

  The per frame delta in smoke particle alpha value.
- double smoke_dx

  The per frame delta in smoke particle x position.
- double smoke_dy

  The per frame delta in smoke particle y position.
- double smoke_prob

  The probability of spawning a new smoke prob in any given frame.
- std::list< sf::Sprite > smoke_sprite_list

  A list of smoke sprite (for chimney animation).

Private Member Functions

- void __setUpTileImprovementSpriteStatic (void)

  Helper method to set up tile improvement sprite (static).
- void __handleKeyPressEvents (void)

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

  Helper method to handle mouse button events.

Additional Inherited Members

4.8.1 Detailed Description

A settlement class (child class of TileImprovement).

4.8.2 Constructor & Destructor Documentation

4.8.2.1 Settlement()

```
Settlement::Settlement (
            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 Settlement 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.

```
167   :
168 TileImprovement(
169     position_x,
170     position_y,
171     event_ptr,
172     render_window_ptr,
173     assets_manager_ptr,
174     message_hub_ptr
175 )
```

```
176 {
177     //  1. set attributes
178 
179     //  1.1. private
180     //...
181 
182     //  1.2. public
183     this->tile_improvement_type = TileImprovementType :: SETTLEMENT;
184 
185     this->skip_smoke_processing = true;
186 
187     this->smoke_da = 1e-8 * SECONDS_PER_FRAME;
188     this->smoke_dx = 5 * SECONDS_PER_FRAME;
189     this->smoke_dy = -10 * SECONDS_PER_FRAME;
190     this->smoke_prob = 8 * SECONDS_PER_FRAME;
191 
192     this->smoke_sprite_list = {};
193 
194     this->tile_improvement_string = "SETTLEMENT";
195 
196     this->__setUpTileImprovementSpriteStatic();
197 
198     std::cout « "Settlement constructed at " « this « std::endl;
199 
200     return;
201 }   /* Settlement() */
```

4.8.2.2 ~Settlement()

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

Destructor for the Settlement class.

```
356 {
357     std::cout « "Settlement at " « this « " destroyed" « std::endl;
358 
359     return;
360 }   /* ~Settlement() */
```

4.8.3 Member Function Documentation

4.8.3.1 __handleKeyPressEvents()

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

Helper method to handle key press events.

Reimplemented from TileImprovement.

```
69 {
70     switch (this->event_ptr->key.code) {
71         //...
72 
73 
74         default: {
75             // do nothing!
76 
77             break;
78         }
79     }
80 
81     return;
82 }   /* __handleKeyPressEvents() */
```

4.8.3.2 __handleMouseButtonEvents()

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

Helper method to handle mouse button events.

Reimplemented from TileImprovement.

```
97 {
98     switch (this->event_ptr->mouseButton.button) {
99         case (sf::Mouse::Left): {
100             //...
101 
102             break;
103         }
104 
105 
106         case (sf::Mouse::Right): {
107             //...
108 
109             break;
110         }
111 
112 
113         default: {
114             // do nothing!
115 
116             break;
117         }
118     }
119 
120     return;
121 }   /* __handleMouseButtonEvents() */
```

4.8.3.3 __setUpTileImprovementSpriteStatic()

```
void Settlement::__setUpTileImprovementSpriteStatic (
            void  )  [private]
```

Helper method to set up tile improvement sprite (static).

```
34 {
35     this->tile_improvement_sprite_static.setTexture(
36         *(this->assets_manager_ptr->getTexture("brick_house_64x64_1"))
37     );
38 
39     this->tile_improvement_sprite_static.setOrigin(
40         this->tile_improvement_sprite_static.getLocalBounds().width / 2,
41         this->tile_improvement_sprite_static.getLocalBounds().height
42     );
43 
44     this->tile_improvement_sprite_static.setPosition(
45         this->position_x,
46         this->position_y - 32
47     );
48 
49     this->tile_improvement_sprite_static.setColor(
50         sf::Color(255, 255, 255, 0)
51     );
52 
53     return;
54 }   /* __setUpTileImprovementSpriteStatic() */
```

4.8.3.4 draw()

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

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

Reimplemented from TileImprovement.

```
261 {
262     //  1. if just built, call base method and return
263     if (this->just_built) {
264         TileImprovement :: draw();
265 
266         return;
267     }
268 
269     //  2. draw static sprite and chimney smoke effects
270     this->render_window_ptr->draw(this->tile_improvement_sprite_static);
271 
272     std::list<sf::Sprite>::iterator iter = this->smoke_sprite_list.begin();
273 
274     double alpha = 255;
275 
276     while (iter != this->smoke_sprite_list.end()) {
277         this->render_window_ptr->draw(*iter);
278 
279         if (not this->skip_smoke_processing) {
280             alpha = (*iter).getColor().a;
281 
282             alpha -= this->smoke_da;
283 
284             if (alpha <= 0) {
285                 iter = this->smoke_sprite_list.erase(iter);
286                 continue;
287             }
288 
289             (*iter).setColor(sf::Color(255, 255, 255, alpha));
290 
291             (*iter).move(
292                 this->smoke_dx + 2 * (((double)rand() / RAND_MAX) - 1) / FRAMES_PER_SECOND,
293                 this->smoke_dy
294             );
295 
296             (*iter).rotate(0.5 * ((double)rand() / RAND_MAX));
297         }
298 
299         iter++;
300     }
301 
302 
303     if (not this->skip_smoke_processing) {
304         if ((double)rand() / RAND_MAX < smoke_prob) {
305             this->smoke_sprite_list.push_back(
306                 sf::Sprite(
307                     *(this->assets_manager_ptr->getTexture("steam / smoke")),
308                     sf::IntRect(0, 8, 8, 8)
309                 )
310             );
311 
312             this->smoke_sprite_list.back().setOrigin(
313                 this->smoke_sprite_list.back().getLocalBounds().width / 2,
314                 this->smoke_sprite_list.back().getLocalBounds().height / 2
315             );
316 
317             this->smoke_sprite_list.back().setPosition(
318                 this->position_x + 9,
319                 this->position_y - 33
320             );
321         }
322     }
323 
324 
325     if (this->is_selected) {
326         if (this->skip_smoke_processing) {
327             this->skip_smoke_processing = false;
328         }
329 
330         else {
331             this->skip_smoke_processing = true;
332         }
333     }
334 
335     else {
```

```
336         this->skip_smoke_processing = false;
337     }
338
339     this->frame++;
340     return;
341 }   /* draw() */
```

4.8.3.5 processEvent()

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

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

Reimplemented from TileImprovement.

```
216 {
217     if (this->event_ptr->type == sf::Event::KeyPressed) {
218         this->__handleKeyPressEvents();
219     }
220
221     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
222         this->__handleMouseButtonEvents();
223     }
224
225     return;
226 }   /* processEvent() */
```

4.8.3.6 processMessage()

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

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

Reimplemented from TileImprovement.

```
241 {
242     //...
243
244     return;
245 }   /* processMessage() */
```

4.8.4 Member Data Documentation

4.8.4.1 skip_smoke_processing

```
bool Settlement::skip_smoke_processing
```

A boolean which indicates whether or not to skip smoke processing.

4.8.4.2 smoke_da

```
double Settlement::smoke_da
```

The per frame delta in smoke particle alpha value.

4.8.4.3 smoke_dx

```
double Settlement::smoke_dx
```

The per frame delta in smoke particle x position.

4.8.4.4 smoke_dy

```
double Settlement::smoke_dy
```

The per frame delta in smoke particle y position.

4.8.4.5 smoke_prob

```
double Settlement::smoke_prob
```

The probability of spawning a new smoke prob in any given frame.

4.8.4.6 smoke_sprite_list

```
std::list<sf::Sprite> Settlement::smoke_sprite_list
```

A list of smoke sprite (for chimney animation).

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

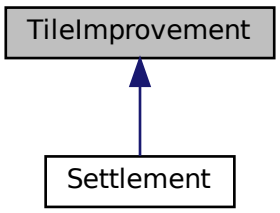
- header/Settlement.h
- source/Settlement.cpp

4.9 TileImprovement Class Reference

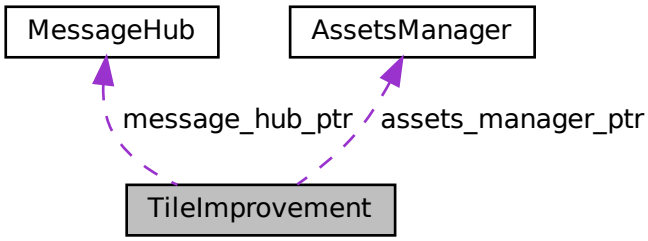
A base class for the tile improvement hierarchy.

`#include <TileImprovement.h>`

Inheritance diagram for TileImprovement:



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

- TileImprovementType tile_improvement_type

  The type of the tile improvement.
- bool is_selected

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

  A boolean which indicates that the improvement was just built.
- int frame

  The current frame of this object.
- int credits

  The current balance of credits.
- double position_x

  The x position of the tile improvement.
- double position_y

  The y position of the tile improvement.
- std::string game_phase

  The current phase of the game.
- std::string tile_improvement_string

  A string representation of the tile improvement type.
- sf::Sprite tile_improvement_sprite_static

  A static sprite, for decorating the tile.
- std::vector< sf::Sprite > tile_improvement_sprite_animated

  An animated sprite, for the ContextMenu visual screen.

Protected Member Functions

- virtual void __handleKeyPressEvents (void)

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

  Helper method to handle mouse button events.

Protected 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.

4.9.1 Detailed Description

A base class for the tile improvement hierarchy.

4.9.2 Constructor & Destructor Documentation

4.9.2.1 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. protected
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->is_selected = true;
145     this->just_built = true;
146 
147     this->frame = 0;
148     this->credits = 0;
149 
150     this->position_x = position_x;
151     this->position_y = position_y;
152 
153     this->game_phase = "build settlement";
154 
155     std::cout « "TileImprovement constructed at " « this « std::endl;
156 
157     return;
158 }   /* TileImprovement() */
```

4.9.2.2 ~TileImprovement()

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

Destructor for the TileImprovement class.

```
265 {
266     std::cout « "TileImprovement at " « this « " destroyed" « std::endl;
267 
268     return;
269 }   /* ~TileImprovement() */
```

4.9.3 Member Function Documentation

4.9.3.1 __handleKeyPressEvents()

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

Helper method to handle key press events.

Reimplemented in Settlement.

```
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() */
```

4.9.3.2 __handleMouseButtonEvents()

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

Helper method to handle mouse button events.

Reimplemented in Settlement.

```
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() */
```

4.9.3.3 draw()

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

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

Reimplemented in Settlement.

```
218 {
219     int alpha = this->tile_improvement_sprite_static.getColor().a;
220 
221     alpha += 0.04 * FRAMES_PER_SECOND;
222 
223     this->tile_improvement_sprite_static.setColor(
224         sf::Color(255, 255, 255, alpha)
225     );
226 
227     this->tile_improvement_sprite_static.move(0, 25 * SECONDS_PER_FRAME);
228 
229     if (
230         (alpha >= 255) or
231         (this->tile_improvement_sprite_static.getPosition().y >= this->position_y + 12)
232     ) {
233         this->tile_improvement_sprite_static.setColor(
234             sf::Color(255, 255, 255, 255)
235         );
236 
237         this->tile_improvement_sprite_static.setPosition(
238             this->position_x,
239             this->position_y + 12
240         );
241 
242         this->just_built = false;
243         this->assets_manager_ptr->getSound("place improvement")->play();
244     }
245 
246     this->render_window_ptr->draw(this->tile_improvement_sprite_static);
247 
248     this->frame++;
249     return;
250 }   /* draw() */
```

4.9.3.4 processEvent()

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

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

Reimplemented in Settlement.

```
173 {
174     if (this->event_ptr->type == sf::Event::KeyPressed) {
175         this->__handleKeyPressEvents();
176     }
177 
178     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
179         this->__handleMouseButtonEvents();
180     }
181 
182     return;
183 }   /* processEvent() */
```

4.9.3.5 processMessage()

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

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

Reimplemented in Settlement.

```
198 {
199     //...
200
201     return;
202 }   /* processMessage() */
```

4.9.4 Member Data Documentation

4.9.4.1 assets_manager_ptr

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

A pointer to the assets manager.

4.9.4.2 credits

```
int TileImprovement::credits
```

The current balance of credits.

4.9.4.3 event_ptr

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

A pointer to the event class.

4.9.4.4 frame

```
int TileImprovement::frame
```

The current frame of this object.

4.9.4.5 game_phase

```
std::string TileImprovement::game_phase
```

The current phase of the game.

4.9.4.6 is_selected

```
bool TileImprovement::is_selected
```

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

4.9.4.7 just_built

```
bool TileImprovement::just_built
```

A boolean which indicates that the improvement was just built.

4.9.4.8 message_hub_ptr

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

A pointer to the message hub.

4.9.4.9 position_x

```
double TileImprovement::position_x
```

The x position of the tile improvement.

4.9.4.10 position_y

```
double TileImprovement::position_y
```

The y position of the tile improvement.

4.9.4.11 render_window_ptr

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

A pointer to the render window.

4.9.4.12 tile_improvement_sprite_animated

```
std::vector<sf::Sprite> TileImprovement::tile_improvement_sprite_animated
```

An animated sprite, for the ContextMenu visual screen.

4.9.4.13 tile_improvement_sprite_static

```
sf::Sprite TileImprovement::tile_improvement_sprite_static
```

A static sprite, for decorating the tile.

4.9.4.14 tile_improvement_string

```
std::string TileImprovement::tile_improvement_string
```

A string representation of the tile improvement type.

4.9.4.15 tile_improvement_type

```
TileImprovementType TileImprovement::tile_improvement_type
```

The type of the tile improvement.

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

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

Chapter 5

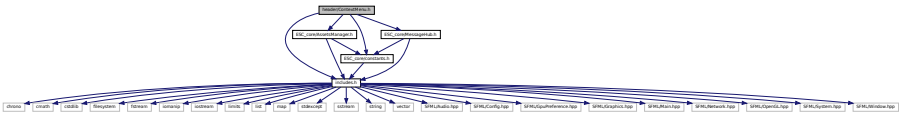
File Documentation

5.1 header/ContextMenu.h File Reference

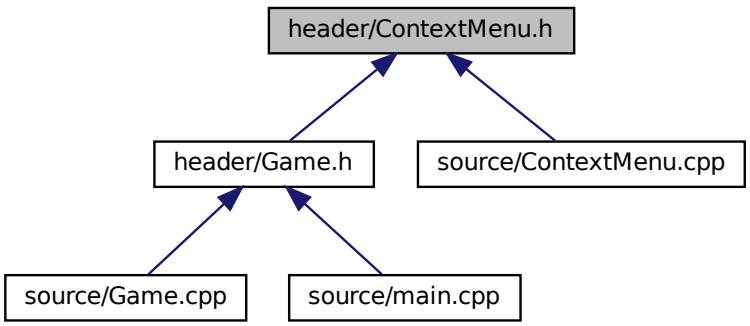
Header file for the ContextMenu class.

```
#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.

5.1.1 Detailed Description

Header file for the ContextMenu class.

5.1.2 Enumeration Type Documentation

5.1.2.1 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.

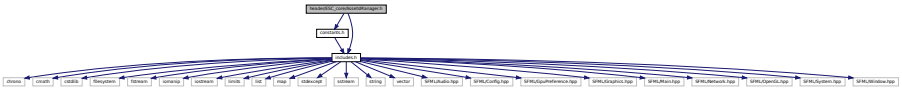
```
34                  {
35     NONE_STATE,
36     READY,
37     MENU,
38     TILE,
39     N_CONSOLE_STATES
40 };
```

5.2 header/ESC_core/AssetsManager.h File Reference

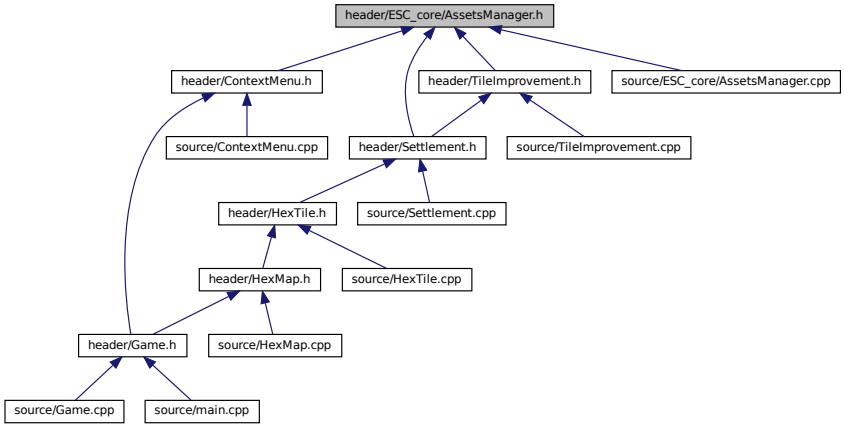
Header file for the AssetsManager class.

```
#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.

5.2.1 Detailed Description

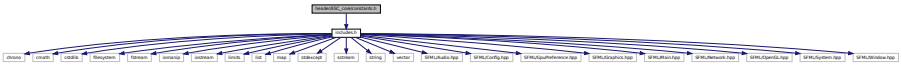
Header file for the AssetsManager class.

5.3 header/ESC_core/constants.h File Reference

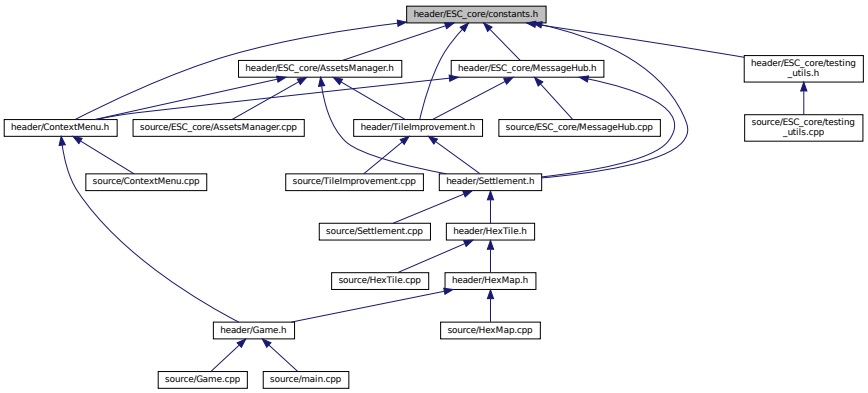
Header file for various constants.

```
#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 RESOURCE_CHIP_GREY (175, 175, 175, 250)

  The base colour of the resource chip (backing).
- 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 std::string HEX_MAP_CHANNEL = "HEX MAP CHANNEL"

  A message channel for hex map messages.
- const int CLEAR_FOREST_COST = 40

  The cost of clearing a forest tile.
- const int CLEAR_MOUNTAINS_COST = 250

  The cost of clearing a mountains tile.
- const int CLEAR_PLAINS_COST = 20

  The cost of clearing a plains tile.
- const int DIESEL_GENERATOR_BUILD_COST = 100

  The cost of building (or ugrading) a diesel generator.
- const int WIND_TURBINE_BUILD_COST = 400

  The cost of building (or upgrading) a wind turbine.
- const double WIND_TURBINE_WATER_BUILD_MULTIPLIER = 1.25

  The additional cost of building on water.
- const int SOLAR_PV_BUILD_COST = 300

  The cost of building (or upgrading) a solar PV array.
- const double SOLAR_PV_WATER_BUILD_MULTIPLIER = 1.5

  The additional cost of building on water.
- const int TIDAL_TURBINE_BUILD_COST = 600

  The cost of building (or upgrading) a tidal turbine.
- const int WAVE_ENERGY_CONVERTER_BUILD_COST = 800

  The cost of building (or upgrading) a wave energy converter.
- const int ENERGY_STORAGE_SYSTEM_BUILD_COST = 400

  The cost of building (or upgrading) an energy storage system.
- const 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 int RESOURCE_ASSESSMENT_COST = 20

  The cost of doing a resource assessment.
- const int BUILD_SETTLEMENT_COST = 250

  The cost of building a settlement.
- const int STARTING_POPULATION = 100

  The starting population of a settlement.
- 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.

- const std::string GAME_STATE_CHANNEL = "GAME STATE CHANNEL"

  A message channel for game state messages.

5.3.1 Detailed Description

Header file for various constants.

5.3.2 Function Documentation

5.3.2.1 FOREST_GREEN()

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

The base colour of a forest tile.

5.3.2.2 LAKE_BLUE()

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

The base colour of a lake (water) tile.

5.3.2.3 MENU_FRAME_GREY()

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

The base colour of the context menu frame.

5.3.2.4 MONOCHROME_SCREEN_BACKGROUND()

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

The base colour of old monochrome screens.

5.3.2.5 MONOCHROME_TEXT_AMBER()

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

The base colour of old monochrome text (amber).

5.3.2.6 MONOCHROME_TEXT_GREEN()

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

The base colour of old monochrome text (green).

5.3.2.7 MONOCHROME_TEXT_RED()

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

The base colour of old monochrome text (red).

5.3.2.8 MOUNTAINS_GREY()

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

The base colour of a mountains tile.

5.3.2.9 OCEAN_BLUE()

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

The base colour of an ocean (water) tile.

5.3.2.10 PLAINS_YELLOW()

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

The base colour of a plains tile.

5.3.2.11 RESOURCE_CHIP_GREY()

```
const sf::Color RESOURCE_CHIP_GREY (
            175 ,
            175 ,
            175 ,
            250  )
```

The base colour of the resource chip (backing).

5.3.2.12 VISUAL_SCREEN_FRAME_GREY()

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

The base colour of the framing of the visual screen.

5.3.3 Variable Documentation

5.3.3.1 BUILD_SETTLEMENT_COST

```
const int BUILD_SETTLEMENT_COST = 250
```

The cost of building a settlement.

5.3.3.2 CLEAR_FOREST_COST

```
const int CLEAR_FOREST_COST = 40
```

The cost of clearing a forest tile.

5.3.3.3 CLEAR_MOUNTAINS_COST

```
const int CLEAR_MOUNTAINS_COST = 250
```

The cost of clearing a mountains tile.

5.3.3.4 CLEAR_PLAINS_COST

```
const int CLEAR_PLAINS_COST = 20
```

The cost of clearing a plains tile.

5.3.3.5 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.

5.3.3.6 DIESEL_GENERATOR_BUILD_COST

```
const int DIESEL_GENERATOR_BUILD_COST = 100
```

The cost of building (or ugrading) a diesel generator.

5.3.3.7 EMISSIONS_LIFETIME_LIMIT_TONNES

```
const int EMISSIONS_LIFETIME_LIMIT_TONNES = 1500
```

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

5.3.3.8 ENERGY_STORAGE_SYSTEM_BUILD_COST

```
const int ENERGY_STORAGE_SYSTEM_BUILD_COST = 400
```

The cost of building (or upgrading) an energy storage system.

5.3.3.9 FLOAT_TOLERANCE

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

Tolerance for floating point equality tests.

5.3.3.10 FRAMES_PER_SECOND

```
const int FRAMES_PER_SECOND = 60
```

Target frames per second.

5.3.3.11 GAME_CHANNEL

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

A message channel for game messages.

5.3.3.12 GAME_HEIGHT

```
const int GAME_HEIGHT = 800
```

Height of the game space.

5.3.3.13 GAME_STATE_CHANNEL

```
const std::string GAME_STATE_CHANNEL = "GAME STATE CHANNEL"
```

A message channel for game state messages.

5.3.3.14 GAME_WIDTH

```
const int GAME_WIDTH = 1200
```

Width of the game space.

5.3.3.15 HEX_MAP_CHANNEL

```
const std::string HEX_MAP_CHANNEL = "HEX MAP CHANNEL"
```

A message channel for hex map messages.

5.3.3.16 NO_TILE_SELECTED_CHANNEL

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

A message channel for no tile selected messages.

5.3.3.17 RESOURCE_ASSESSMENT_COST

```
const int RESOURCE_ASSESSMENT_COST = 20
```

The cost of doing a resource assessment.

5.3.3.18 SECONDS_PER_FRAME

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

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

5.3.3.19 SECONDS_PER_MONTH

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

5.3.3.20 SECONDS_PER_YEAR

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

5.3.3.21 SOLAR_PV_BUILD_COST

```
const int SOLAR_PV_BUILD_COST = 300
```

The cost of building (or upgrading) a solar PV array.

5.3.3.22 SOLAR_PV_WATER_BUILD_MULTIPLIER

```
const double SOLAR_PV_WATER_BUILD_MULTIPLIER = 1.5
```

The additional cost of building on water.

5.3.3.23 STARTING_POPULATION

```
const int STARTING_POPULATION = 100
```

The starting population of a settlement.

5.3.3.24 TIDAL_TURBINE_BUILD_COST

```
const int TIDAL_TURBINE_BUILD_COST = 600
```

The cost of building (or upgrading) a tidal turbine.

5.3.3.25 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).

5.3.3.26 TILE_SELECTED_CHANNEL

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

A message channel for tile selection messages.

5.3.3.27 TILE_STATE_CHANNEL

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

A message channel for tile state messages.

5.3.3.28 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).

5.3.3.29 WAVE_ENERGY_CONVERTER_BUILD_COST

```
const int WAVE_ENERGY_CONVERTER_BUILD_COST = 800
```

The cost of building (or upgrading) a wave energy converter.

5.3.3.30 WIND_TURBINE_BUILD_COST

```
const int WIND_TURBINE_BUILD_COST = 400
```

The cost of building (or upgrading) a wind turbine.

5.3.3.31 WIND_TURBINE_WATER_BUILD_MULTIPLIER

```
const double WIND_TURBINE_WATER_BUILD_MULTIPLIER = 1.25
```

The additional cost of building on water.

5.4 header/ESC_core/doxygen_cite.h File Reference

Header file which simply cites the doxygen tool.

5.4.1 Detailed Description

Header file which simply cites the doxygen tool.

Ref: van Heesch. [2023]

5.5 header/ESC_core/includes.h File Reference

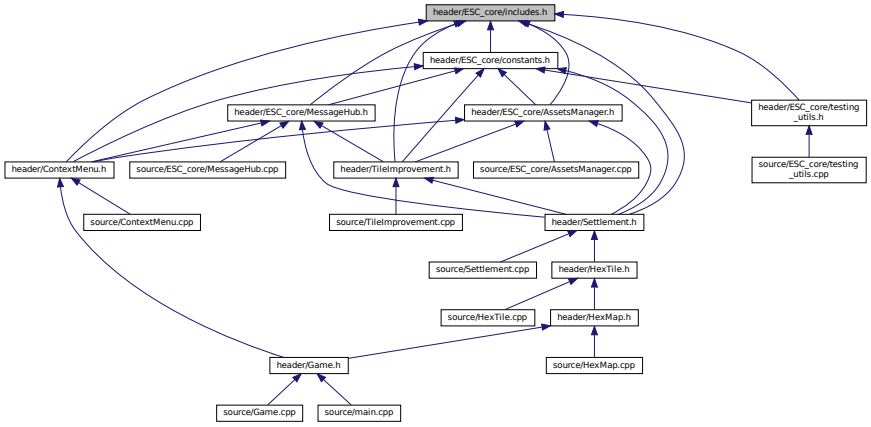
Header file for various includes.

```
#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:



5.5.1 Detailed Description

Header file for various includes.

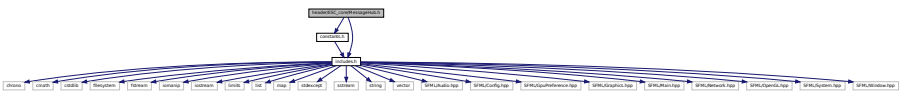
Ref: Gomila [2023]

5.6 header/ESC_core/MessageHub.h File Reference

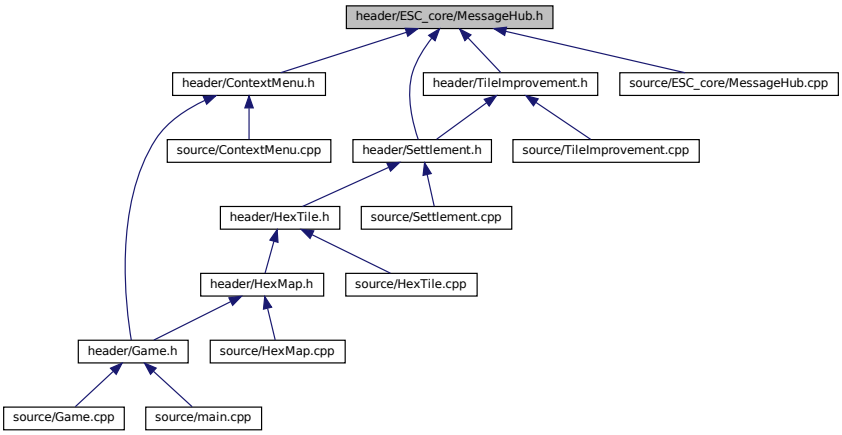
Header file for the MessageHub class.

```
#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.

5.6.1 Detailed Description

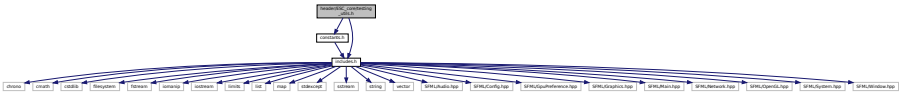
Header file for the MessageHub class.

5.7 header/ESC_core/testing_utils.h File Reference

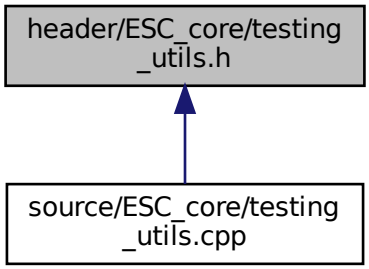
Header file for various testing utilities.

```
#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.

5.7.1 Detailed Description

Header file for various testing utilities.

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

5.7.2 Function Documentation

5.7.2.1 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() */
```

5.7.2.2 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() */
```

5.7.2.3 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() */
```

5.7.2.4 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() */
```

5.7.2.5 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() */
```

5.7.2.6 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() */
```

5.7.2.7 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.

Parameters

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() */
```

5.7.2.8 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() */
```

5.7.2.9 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() */
```

5.7.2.10 testTruth()

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

Tests if the given statement is true.

Parameters

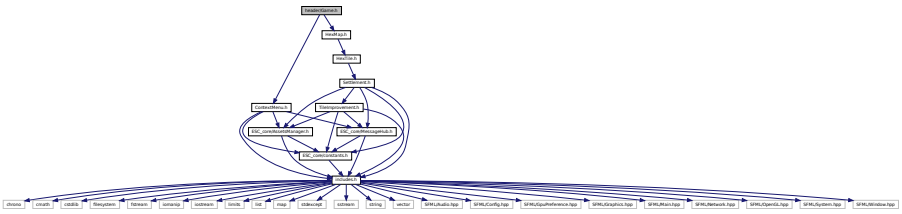
statement	The statement whose truth is to be tested ("1 == 0", for example).
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
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() */
```

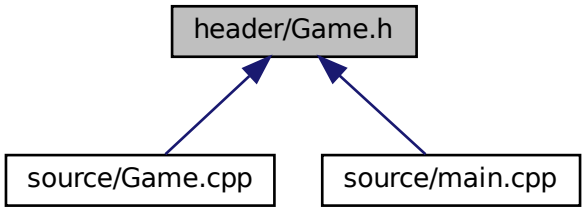
5.8 header/Game.h File Reference

```
#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.

Enumerations

- enum GamePhase {
  BUILD_SETTLEMENT , SYSTEM_MANAGEMENT , LOSS_EMISSIONS , LOSS_DEMAND ,
  LOSS_CREDITS , VICTORY , N_GAME_PHASES }

  An enumeration of the various game phases.

5.8.1 Enumeration Type Documentation

5.8.1.1 GamePhase

```
enum GamePhase
```

An enumeration of the various game phases.

Enumerator

BUILD_SETTLEMENT	The settlement building phase.
SYSTEM_MANAGEMENT	The system management phase (main phase of play).
LOSS_EMISSIONS	A loss due to excessive emissions.
LOSS_DEMAND	A loss due to failing to meet the demand.
LOSS_CREDITS	A loss due to running out of credits.
VICTORY	A victory (12 consecutive months of zero emissions).
N_GAME_PHASES	A simple hack to get the number of elements in GamePhase.

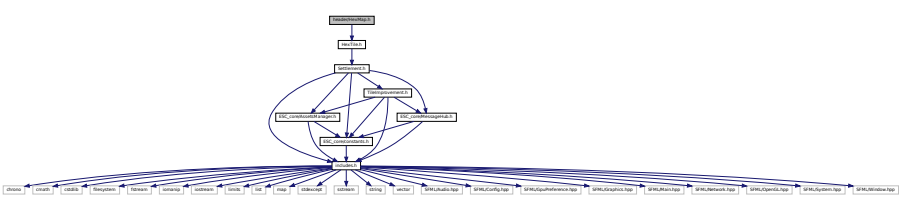
```
32                {
33     BUILD_SETTLEMENT,
34     SYSTEM_MANAGEMENT,
35     LOSS_EMISSIONS,
36     LOSS_DEMAND,
37     LOSS_CREDITS,
38     VICTORY,
39     N_GAME_PHASES
40 };  /* GamePhase */
```

5.9 header/HexMap.h File Reference

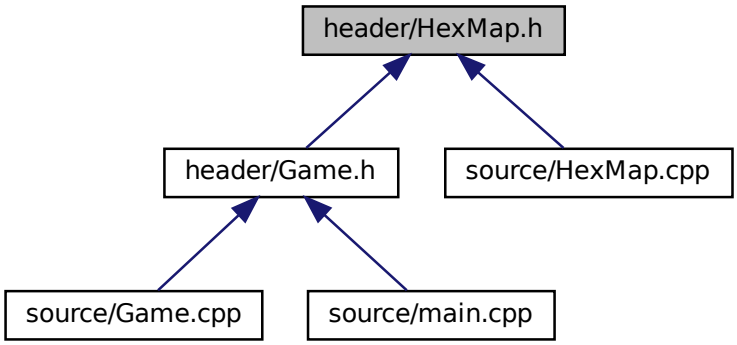
Header file for the HexMap class.

```
#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.

5.9.1 Detailed Description

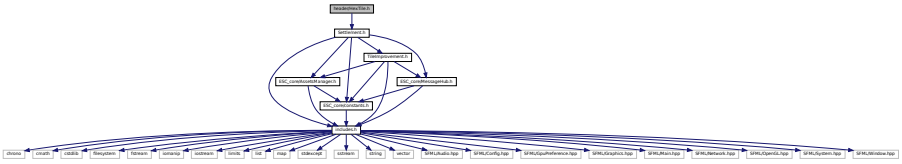
Header file for the HexMap class.

5.10 header/HexTile.h File Reference

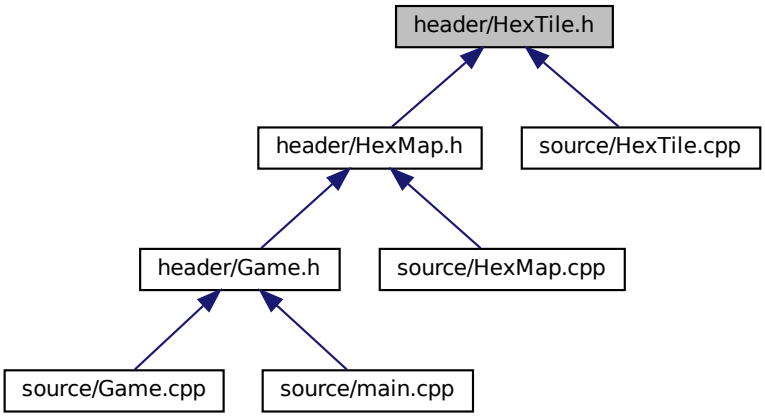
Header file for the Game class.

```
#include "Settlement.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.

5.10.1 Detailed Description

Header file for the Game class.

Header file for the HexTile class.

5.10.2 Enumeration Type Documentation

5.10.2.1 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 */
```

5.10.2.2 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 */
```

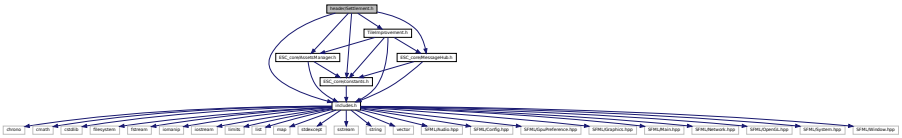
5.11 header/Settlement.h File Reference

Header file for the Settlement class.

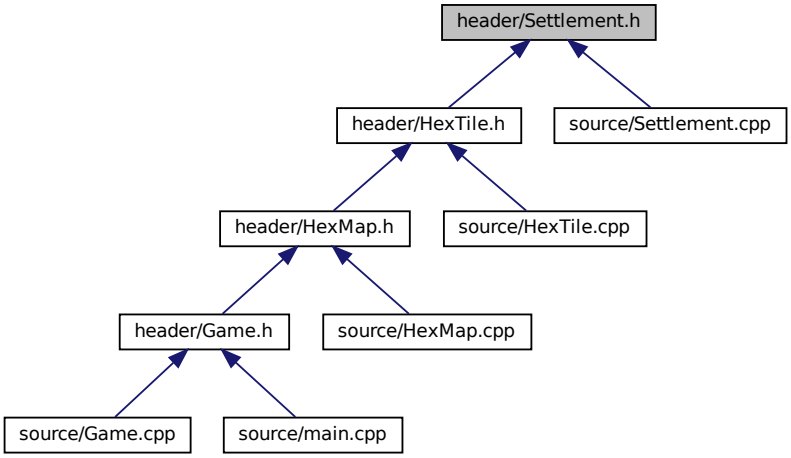
```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
#include "ESC_core/MessageHub.h"
```

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

Include dependency graph for Settlement.h:



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



Classes

- class Settlement

  A settlement class (child class of TileImprovement).

5.11.1 Detailed Description

Header file for the Settlement class.

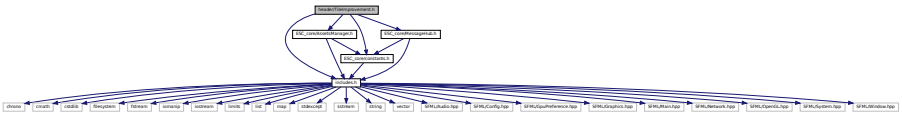
5.12 header/TileImprovement.h File Reference

Header file for the TileImprovement class.

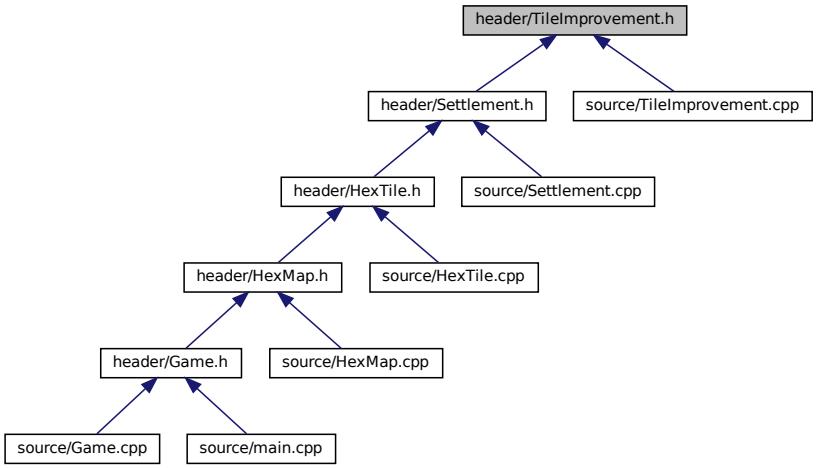
```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
```

```
#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.

5.12.1 Detailed Description

Header file for the TileImprovement class.

5.12.2 Enumeration Type Documentation

5.12.2.1 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.

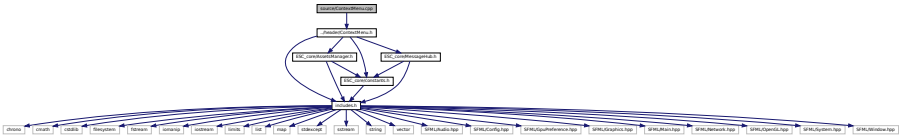
```
34                          {
35     SETTLEMENT,
36     SOLAR_PV,
37     WIND_TURBINE,
38     TIDAL_TURBINE,
39     WAVE_ENERGY_CONVERTER,
40     ENERGY_STORAGE_SYSTEM,
41     N_TILE_IMPROVEMENT_TYPES
42 };  /* TileImprovementType */
```

5.13 source/ContextMenu.cpp File Reference

Implementation file for the ContextMenu class.

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

Include dependency graph for ContextMenu.cpp:



5.13.1 Detailed Description

Implementation file for the ContextMenu class.

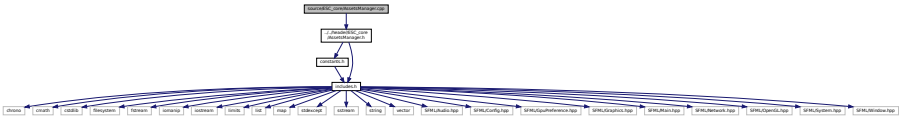
A class which defines a context menu for the game.

5.14 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:



5.14.1 Detailed Description

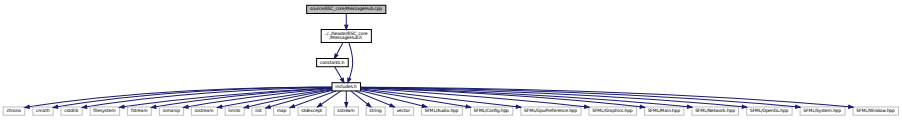
Implementation file for the AssetsManager class.

A class which manages visual and sound assets.

5.15 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:



5.15.1 Detailed Description

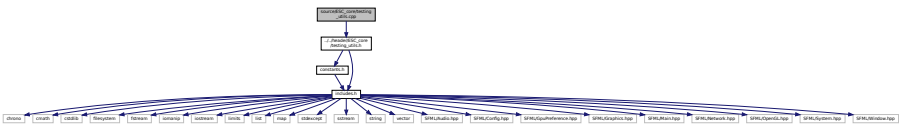
Implementation file for the MessageHub class.

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

5.16 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.

5.16.1 Detailed Description

Implementation file for various testing utilities.

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

5.16.2 Function Documentation

5.16.2.1 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() */
```

5.16.2.2 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() */
```

5.16.2.3 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() */
```

5.16.2.4 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() */
```

5.16.2.5 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() */
```

5.16.2.6 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() */
```

5.16.2.7 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() */
```

5.16.2.8 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() */
```

5.16.2.9 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() */
```

5.16.2.10 testTruth()

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

Tests if the given statement is true.

Parameters

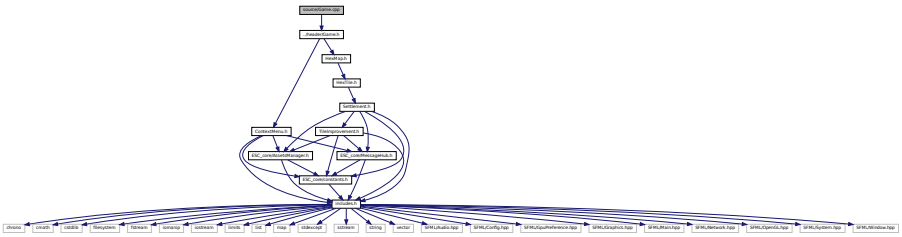
statement	The statement whose truth is to be tested ("1 == 0", for example).
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
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() */
```

5.17 source/Game.cpp File Reference

Implementation file for the Game class.

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



5.17.1 Detailed Description

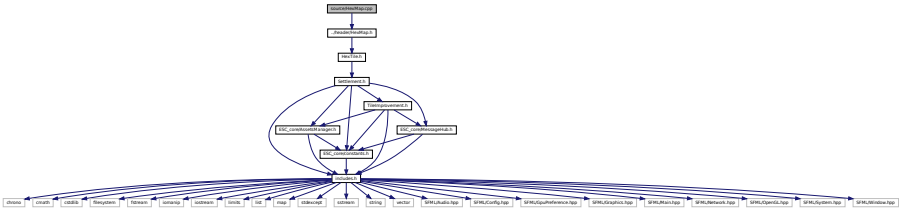
Implementation file for the Game class.

A class which defines a tile of a hex map.

5.18 source/HexMap.cpp File Reference

Implementation file for the HexMap class.

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



5.18.1 Detailed Description

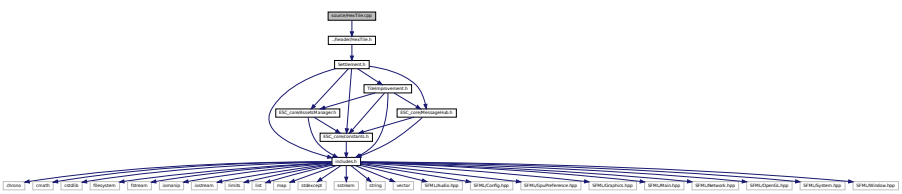
Implementation file for the HexMap class.

A class which defines a hex map of hex tiles.

5.19 source/HexTile.cpp File Reference

Implementation file for the HexTile class.

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



5.19.1 Detailed Description

Implementation file for the HexTile class.

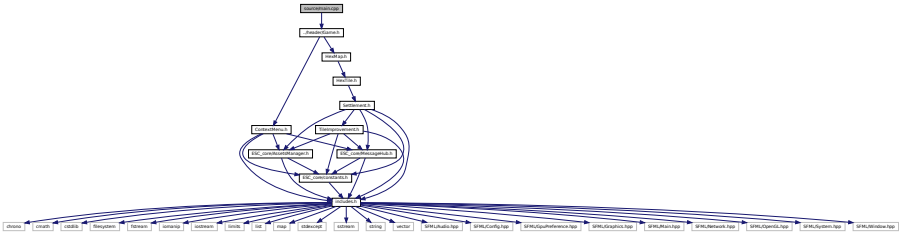
A class which defines a tile of a hex map.

5.20 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)

5.20.1 Detailed Description

Implementation file for main() for Road To Zero.

5.20.2 Function Documentation

5.20.2.1 constructRenderWindow()

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

Helper function to construct render window.

Returns

Pointer to the render window.

```
183 {
184     sf::RenderWindow* render_window_ptr = new sf::RenderWindow(
185         sf::VideoMode(GAME_WIDTH, GAME_HEIGHT),
186         "Road To Zero"
187     );
188 
189     return render_window_ptr;
190 }   /* constructRenderWindow() */
```

5.20.2.2 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
38     //  2. load tile sheets
39     assets_manager_ptr->loadTexture(
40         "assets/tile_sheets/pine_tree_64x64_1.png",
41         "pine_tree_64x64_1"
42     );
43
44     assets_manager_ptr->loadTexture(
45         "assets/tile_sheets/wheat_64x64_1.png",
46         "wheat_64x64_1"
47     );
48
49     assets_manager_ptr->loadTexture(
50         "assets/tile_sheets/mountain_64x64_1.png",
51         "mountain_64x64_1"
52     );
53
54     assets_manager_ptr->loadTexture(
55         "assets/tile_sheets/water_waves_64x64_1.png",
56         "water_waves_64x64_1"
57     );
58
59     assets_manager_ptr->loadTexture(
60         "assets/tile_sheets/water_shimmer_64x64_1.png",
61         "water_shimmer_64x64_1"
62     );
63
64     assets_manager_ptr->loadTexture(
65         "assets/tile_sheets/brick_house_64x64_1.png",
66         "brick_house_64x64_1"
67     );
68
69     assets_manager_ptr->loadTexture(
70         "assets/tile_sheets/magnifying_glass_64x64_1.png",
71         "magnifying_glass_64x64_1"
72     );
73
74     assets_manager_ptr->loadTexture(
75         "assets/tile_sheets/exp2_0.png",
76         "tile clear explosion"
77     );
78
79     assets_manager_ptr->loadTexture(
80         "assets/tile_sheets/emissions_8x8_2.png",
81         "steam / smoke"
82     );
83
84     assets_manager_ptr->loadTexture(
85         "assets/tile_sheets/diesel_generator_64x64_2.png",
86         "diesel generator"
87     );
88
89     assets_manager_ptr->loadTexture(
90         "assets/tile_sheets/solar_PV_64x64_1.png",
91         "solar PV array"
92     );
93
94     assets_manager_ptr->loadTexture(
95         "assets/tile_sheets/wind_turbine_64x64_2.png",
96         "wind turbine"
97     );
98
99      assets_manager_ptr->loadTexture(
100         "assets/tile_sheets/energy_storage_system_64x64_1.png",
101         "energy storage system"
```

```
102     );
103
104     assets_manager_ptr->loadTexture(
105         "assets/tile_sheets/tidal_turbine_64x64_2.png",
106         "tidal turbine"
107     );
108
109     assets_manager_ptr->loadTexture(
110         "assets/tile_sheets/wave_energy_converter_64x64_2.png",
111         "wave energy converter"
112     );
113
114
115     //  3. load sounds
116     assets_manager_ptr->loadSound(
117         "assets/audio/samples/mixkit-apartment-buzzer-bell-press-932.ogg",
118         "insufficient credits"
119     );
120
121     assets_manager_ptr->loadSound(
122         "assets/audio/samples/mixkit-sci-fi-click-900.ogg",
123         "resource assessment"
124     );
125
126     assets_manager_ptr->loadSound(
127         "assets/audio/samples/mixkit-interface-click-1126.ogg",
128         "console string print"
129     );
130
131     assets_manager_ptr->loadSound(
132         "assets/audio/samples/mixkit-video-game-retro-click-237.ogg",
133         "resource overlay toggle on"
134     );
135
136     assets_manager_ptr->loadSound(
137         "assets/audio/samples/mixkit-video-game-retro-click-237_REVERSED.ogg",
138         "resource overlay toggle off"
139     );
140
141     assets_manager_ptr->loadSound(
142         "assets/audio/samples/mixkit-explosion-with-rocks-debris-1703.ogg",
143         "clear mountains tile"
144     );
145
146     assets_manager_ptr->loadSound(
147         "assets/audio/samples/mixkit-arcade-game-explosion-2759.ogg",
148         "clear non-mountains tile"
149     );
150
151     assets_manager_ptr->loadSound(
152         "assets/audio/samples/mixkit-electronic-retro-block-hit-2185.ogg",
153         "place improvement"
154     );
155
156     assets_manager_ptr->loadSound(
157         "assets/audio/samples/mixkit-video-game-lock-2851_REVERSED.ogg",
158         "build menu open"
159     );
160
161         assets_manager_ptr->loadSound(
162         "assets/audio/samples/mixkit-video-game-lock-2851.ogg",
163         "build menu close"
164     );
165
166     return;
167 }   /* loadAssets() */
```

5.20.2.3 main()

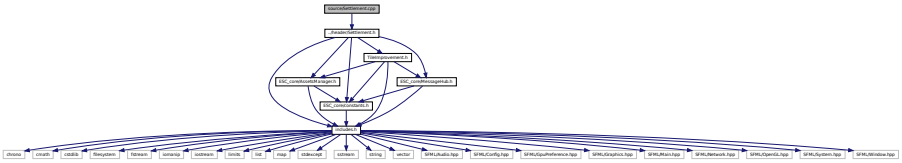
```
int main (
              int argc,
              char ** argv )
199 {
200     //  1. load assets
201     AssetsManager assets_manager;
202     loadAssets(&assets_manager);
203
204     //  2. construct render window
205     sf::RenderWindow* render_window_ptr = constructRenderWindow();
```

```
206
207     //  3. start game loop
208     bool quit_game = false;
209
210     while (not quit_game) {
211         Game game(render_window_ptr, &assets_manager);
212         quit_game = game.run();
213     }
214
215     //  4. clean up
216     render_window_ptr->close();
217     delete render_window_ptr;
218
219     return 0;
220 }   /* main() */
```

5.21 source/Settlement.cpp File Reference

Implementation file for the Settlement class.

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



5.21.1 Detailed Description

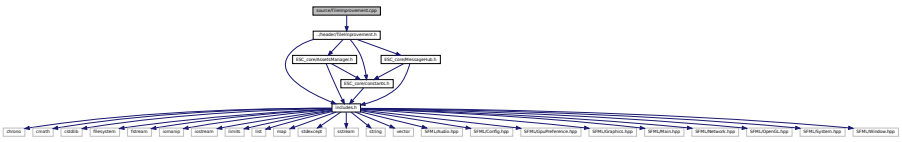
Implementation file for the Settlement class.

A base class for the tile improvement hierarchy.

5.22 source/TileImprovement.cpp File Reference

Implementation file for the TileImprovement class.

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



5.22.1 Detailed Description

Implementation file for the TileImprovement class.

A base class for the tile improvement hierarchy.

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