МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ

ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ БЮДЖЕТНОЕ ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ
ВЫСШЕГО ОБРАЗОВАНИЯ

«БЕЛГОРОДСКИЙ ГОСУДАРСТВЕННЫЙ ТЕХНОЛОГИЧЕСКИЙ УНИВЕРСИТЕТ им. В. Г. ШУХОВА»
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ИНСТИТУТ ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ И УПРАВЛЯЮЩИХ СИСТЕМ

КУРСОВОЙ ПРОЕКТ

по дисциплине: Объектно-ориентированное программирование
тема: «Программа моделирования игры Морской Бой»

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Оценка ____

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Оглавление

Название, цель, постановка задачи

Название: Программа моделирования игры Морской Бой

Цель: Написать программу для моделирования игры Морской Бой

Постановка задачи: Программа для игры в морской бой. Программа должна обеспечивать возможность игры человека с компьютером. На экране отображаются два игровых поля: поле для расстановки кораблей человеком и поле для отметки наносимых ударов по кораблям противника.

Должна быть предусмотрена возможность использования кораблей различного типа: одно-, двух-, трех- и четырехпалубных. Пользователь в режиме расстановки кораблей должен иметь возможность размещения кораблей на игровом поле, перемещения, поворота кораблей.

В режиме игры пользователь в наглядном виде должен информироваться о том, достиг ли цели его выстрел и выстрел противника.

1 Описание функциональных требований к разрабатываемой системе

Функциональные требования:

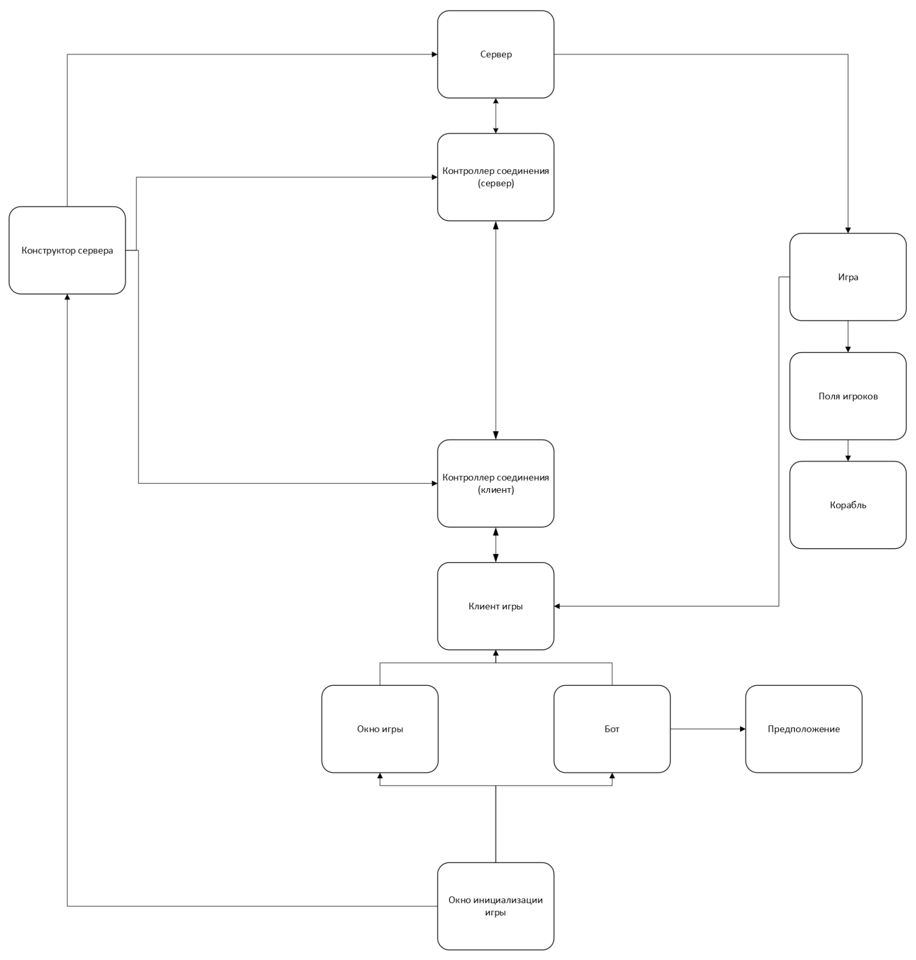
- Программа должна обеспечивать возможность игры человека с компьютером
- На экране должно отображаться два поля: собственное поле и поле для отметки ударов по противнику
- Должна быть предусмотрена возможность расставить (переместить, повернуть) корабли с различным кол-вом палуб
- В режиме игры игрок должен быть проинформирован о ходе игры

Планируется использовать следующие паттерны:

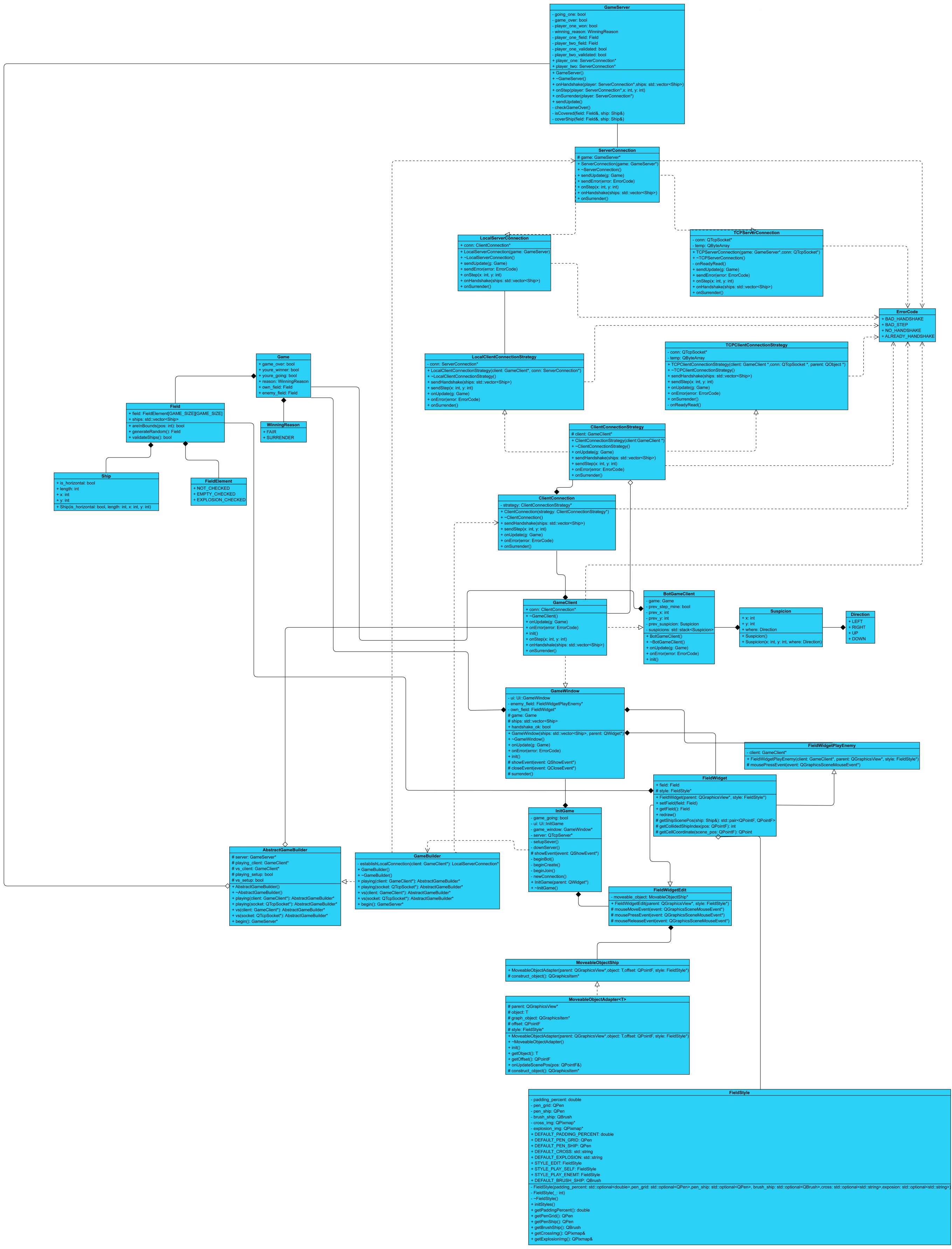
- Фабрика: для генерации игрового сервера, установки соединения сервер-игрок и игрок-сервер
- Стратегия: для создания различного поведения клиентского контроллера соединения в зависимости от вида соединения: программного или TCP-протокол
- Адаптер: для получения возможности отрисовывать на QGraphicsScene объекты, которые можно захватить и передвинуть при помощи мышки

2 Объектная декомпозиция (диаграмма объектов, классов)

2.1 Диаграмма объектов



2.2 UML-диаграмма


GameServer
- going_one: bool
- game_over: bool
- player_one_won: bool
- winning_reason: WinningReason
- player_one_field: Field
- player_two_field: Field
- player_one_validated: bool
- player_two_validated: bool
+ player_one: ServerConnection*
+ player_two: ServerConnection*
+ GameServer()
+ ~GameServer()
+ onHandshake(player: ServerConnection*,ships: std::vector<Ship>)
+ onStep(player: ServerConnection*,x: int, y: int)
+ onSurrender(player: ServerConnection*)
+ sendUpdate()
- checkGameOver()
- isCovered(field: Field&, ship: Ship&)
- coverShip(field: Field&, ship: Ship&)
ServerConnection
# game: GameServer*
+ ServerConnection(game: GameServer*)
+ ~ServerConnection()
+ sendUpdate(g: Game)
+ sendError(error: ErrorCode)
+ onStep(x: int, y: int)
+ onHandshake(ships: std::vector<Ship>)
+ onSurrender()
LocalServerConnection
+ conn: ClientConnection*
+ LocalServerConnection(game: GameServer)
+ ~LocalServerConnection()
+ sendUpdate(g: Game)
+ sendError(error: ErrorCode)
+ onStep(x: int, y: int)
+ onHandshake(ships: std::vector<Ship>)
+ onSurrender()
TCPServerConnection
- conn: QTcpSocket*
- temp: QByteArray
+ TCPServerConnection(game: GameServer*,conn: QTcpSocket*)
+ ~TCPServerConnection()
- onReadyRead()
+ sendUpdate(g: Game)
+ sendError(error: ErrorCode)
+ onStep(x: int, y: int)
+ onHandshake(ships: std::vector<Ship>)
+ onSurrender()
ErrorCode
+ BAD_HANDSHAKE
+ BAD_STEP
+ NO_HANDSHAKE
+ ALREADY_HANDSHAKE
Game
+ game_over: bool
+ youre_winner: bool
+ youre_going: bool
+ reason: WinningReason
+ own_field: Field
+ enemy_field: Field
Field
+ field: FieldElement[GAME_SIZE][GAME_SIZE]
+ ships: std::vector<Ship>
+ areInBounds(pos: int): bool
+ generateRandom(): Field
+ validateShips(): bool
WinningReason
+ FAIR
+ SURRENDER
Ship
+ is_horizontal: bool
+ length: int
+ x: int
+ y: int
+ Ship(is_horizontal: bool, length: int, x: int, y: int)
FieldElement
+ NOT_CHECKED
+ EMPTY_CHECKED
+ EXPLOSION_CHECKED
LocalClientConnectionStrategy
- conn: ServerConnection*
+ LocalClientConnectionStrategy(client: GameClient*, conn: ServerConnection*)
+ ~LocalClientConnectionStrategy()
+ sendHandshake(ships: std::vector<Ship>)
+ sendStep(x: int, y: int)
+ onUpdate(g: Game)
+ onError(error: ErrorCode)
+ onSurrender()
TCPClientConnectionStrategy
- conn: QTcpSocket*
- temp: QByteArray
+ TCPClientConnectionStrategy(client: GameClient *,conn: QTcpSocket *, parent: QObject *)
+ ~TCPClientConnectionStrategy()
+ sendHandshake(ships: std::vector<Ship>)
+ sendStep(x: int, y: int)
+ onUpdate(g: Game)
+ onError(error: ErrorCode)
+ onSurrender()
- onReadyRead()
ClientConnectionStrategy
# client: GameClient*
+ ClientConnectionStrategy(client:GameClient *)
+ ~ClientConnectionStrategy()
+ onUpdate(g: Game)
+ sendHandshake(ships: std::vector<Ship>)
+ sendStep(x: int, y: int)
+ onError(error: ErrorCode)
+ onSurrender()
ClientConnection
- strategy: ClientConnectionStrategy*
+ ClientConnection(strategy: ClientConnectionStrategy*)
+ ~ClientConnection()
+ sendHandshake(ships: std::vector<Ship>)
+ sendStep(x: int, y: int)
+ onUpdate(g: Game)
+ onError(error: ErrorCode)
+ onSurrender()
GameClient
+ conn: ClientConnection*
+ ~GameClient()
+ onUpdate(g: Game)
+ onError(error: ErrorCode)
+ init()
+ onStep(x: int, y: int)
+ onHandshale(ships: std::vector<Ship>)
+ onSurrender()
BotGameClient
- game: Game
- prev_step_mine: bool
- prev_x: int
- prev_y: int
- prev_suspicion: Suspicion
- suspicions: std::stack<Suspicion>
+ BotGameClient()
+ ~BotGameClient()
+ onUpdate(g: Game)
+ onError(error: ErrorCode)
+ init()
Suspicion
+ x: int
+ y: int
+ where: Direction
+ Suspicion()
+ Suspicion(x: int, y: int, where: Direction)
Direction
+ LEFT
+ RIGHT
+ UP
+ DOWN
GameWindow
- ui: Ui::GameWindow
- enemy_field: FieldWidgetPlayEnemy*
- own_field: FieldWidget*
# game: Game
# ships: std::vector<Ship>
+ handshake_ok: bool
+ GameWindow(ships: std::vector<Ship>, parent: QWidget*)
+ ~GameWindow()
+ onUpdate(g: Game)
+ onError(error: ErrorCode)
+ init()
# showEvent(event: QShowEvent*)
# closeEvent(event: QCloseEvent*)
# surrender()
FieldWidgetPlayEnemy
- client: GameClient*
+ FieldWidgetPlayEnemy(client: GameClient*, parent: QGraphicsView*, style: FieldStyle*)
# mousePressEvent(event: QGraphicsSceneMouseEvent*)
FieldWidget
+ field: Field
# style: FieldStyle*
+ FieldWidget(parent: QGraphicsView*, style: FieldStyle*)
+ setField(field: Field)
+ getField(): Field
+ redraw()
# getShipScenePos(ship: Ship&): std::pair<QPointF, QPointF>
# getCollidedShipIndex(pos: QPointF): int
# getCellCoordinate(scene_pos: QPointF): QPoint
InitGame
- game_going: bool
- ui: Ui::InitGame
- game_window: GameWindow*
- server: QTcpServer*
- setupSever()
- downServer()
# showEvent(event: QShowEvent*)
- beginBot()
- beginCreate()
- beginJoin()
- newConnection()
+ InitGame(parent: QWidget*)
+ ~InitGame()
AbstractGameBuilder
# server: GameServer*
# playing_client: GameClient*
# vs_client: GameClient*
# playing_setup: bool
# vs_setup: bool
+ AbstractGameBuilder()
+ ~AbstractGameBuilder()
+ playing(client: GameClient*): AbstractGameBuilder*
+ playing(socket: QTcpSocket*): AbstractGameBuilder*
+ vs(client: GameClient*): AbstractGameBuilder*
+ vs(socket: QTcpSocket*): AbstractGameBuilder*
+ begin(): GameServer*
GameBuilder
- establishLocalConnection(client: GameClient*): LocalServerConnection*
+ GameBuilder()
+ ~GameBuilder()
+ playing(client: GameClient*): AbstractGameBuilder*
+ playing(socket: QTcpSocket*): AbstractGameBuilder*
+ vs(client: GameClient*): AbstractGameBuilder*
+ vs(socket: QTcpSocket*): AbstractGameBuilder*
+ begin(): GameServer*
FieldWidgetEdit
- moveable_object: MovableObjectShip*
+ FieldWidgetEdit(parent: QGraphicsView*, style: FieldStyle*)
# mouseMoveEvent(event: QGraphicsSceneMouseEvent*)
# mousePressEvent(event: QGraphicsSceneMouseEvent*)
# mouseReleaseEvent(event: QGraphicsSceneMouseEvent*)
MoveableObjectShip
+ MoveableObjectAdapter(parent: QGraphicsView*,object: T,offset: QPointF, style: FieldStyle*)
# construct_object(): QGraphicsItem*
MoveableObjectAdapter<T>
# parent: QGraphicsView*
# object: T
# graph_object: QGraphicsItem*
# offset: QPointF
# style: FieldStyle*
+ MoveableObjectAdapter(parent: QGraphicsView*,object: T,offset: QPointF, style: FieldStyle*)
+ ~MoveableObjectAdapter()
+ init()
+ getObject(): T
+ getOffset(): QPointF
+ onUpdateScenePos(pos: QPointF&)
# construct_object(): QGraphicsItem*
FieldStyle
- padding_percent: double
- pen_grid: QPen
- pen_ship: QPen
- brush_ship: QBrush
- cross_img: QPixmap*
- explosion_img: QPixmap*
+ DEFAULT_PADDING_PERCENT: double
+ DEFAULT_PEN_GRID: QPen
+ DEFAULT_PEN_SHIP: QPen
+ DEFAULT_CROSS: std::string
+ DEFAULT_EXPLOSION: std::string
+ STYLE_EDIT: FieldStyle
+ STYLE_PLAY_SELF: FieldStyle
+ STYLE_PLAY_ENEMT: FieldStyle
+ DEFAULT_BRUSH_SHIP: QBrush
- FieldStyle(padding_percent: std::optional<double>,pen_grid: std::optional<QPen>,pen_ship: std::optional<QPen>, brush_ship: std::optional<QBrush>,cross: std::optional<std::string>,exposion: std::optional<std::string>)
- FieldStyle(_: int)
- ~FieldStyle()
+ initStyles()
+ getPaddingPercent(): double
+ getPenGrid(): QPen
+ getPenShip(): QPen
+ getBrushShip(): QBrush
+ getCrossImg(): QPixmap&
+ getExplosionImg(): QPixmap&

3 Листинг программы

cbattle.pro

```
QT       += core gui network

greaterThan(QT_MAJOR_VERSION, 4): QT += widgets

CONFIG += c++17

# You can make your code fail to compile if it uses deprecated APIs.
# In order to do so, uncomment the following line.
#DEFINES += QT_DISABLE_DEPRECATED_BEFORE=0x060000    # disables all the APIs deprecated before Qt 6.0.0

SOURCES += \
    src/game/abstractgamebuilder.cpp \
    src/game/client/botclient.cpp \
    src/game/client/client.cpp \
    src/game/client/connection.cpp \
    src/game/client/connectionstrategy.cpp \
    src/game/client/localconnectionstrategy.cpp \
    src/game/client/tcpconnectionstrategy.cpp \
    src/game/server/conneciton.cpp \
    src/game/server/localconnection.cpp \
    src/game/server/server.cpp \
    src/game/gamebuilder.cpp \
    src/game/server/tcpconnection.cpp \
    src/models/field.cpp \
    src/models/game.cpp \
    src/models/ship.cpp \
    src/utils/moveableobjectship.cpp \
    src/widgets/fieldstyle.cpp \
    src/widgets/fieldwidget.cpp \
    src/widgets/fieldwidgetedit.cpp \
    src/widgets/fieldwidgetplayenemy.cpp \
    src/widgets/gamewindow.cpp \
    src/widgets/initgame.cpp \
    src/main.cpp

HEADERS += \
    include/game/abstractgamebuilder.h \
    include/game/client/botclient.h \
    include/game/client/client.h \
    include/game/client/connection.h \
    include/game/client/connectionstrategy.h \
    include/game/client/localconnectionstrategy.h \
    include/game/client/tcpconnectionstrategy.h \
    include/game/server/connection.h \
    include/game/server/localconnection.h \
    include/game/server/server.h \
    include/game/gamebuilder.h \
    include/game/server/tcpconnection.h \
    include/models/field.h \
    include/models/game.h \
    include/models/ship.h \
    include/utils/moveableobjectadapter.hpp \
    include/utils/moveableobjectship.h \
    include/widgets/fieldstyle.h \
    include/widgets/fieldwidget.h \
    include/widgets/fieldwidgetedit.h \
    include/widgets/fieldwidgetplayenemy.h \
    include/widgets/gamewindow.h \
    include/widgets/initgame.h

FORMS += \
    src/ui/game.ui \
    src/ui/initgame.ui \

INCLUDEPATH += include

RC_ICONS += src/assets/icon.ico

# Default rules for deployment.
qnx: target.path = /tmp/$${TARGET}/bin
else: unix:!android: target.path = /opt/$${TARGET}/bin
!isEmpty(target.path): INSTALLS += target

RESOURCES += \
    resources.qrc

DISTFILES += \
    model.qmodel
```

include \game \abstractgamebuilder.h

```
#pragma once

#include <QTcpSocket>

#include <game/client/client.h>
#include <game/server/localconnection.h>

class AbstractGameBuilder {
protected:
    GameServer *server = nullptr;
    GameClient *playing_client = nullptr;
    GameClient *vs_client = nullptr;
    bool playing_setup = false;
    bool vs_setup = false;
public:
    AbstractGameBuilder();
    virtual ~AbstractGameBuilder();
    virtual AbstractGameBuilder* playing(GameClient *client) = 0;
    virtual AbstractGameBuilder* playing(QTcpSocket *socket) = 0;
    virtual AbstractGameBuilder* vs(GameClient *client) = 0;
    virtual AbstractGameBuilder* vs(QTcpSocket *socket) = 0;
    virtual GameServer* begin() = 0;
};
```

include \game \client \botclient.h

```
#pragma once

#include <game/client/client.h>
#include <models/game.h>
#include <stack>

enum Direction { LEFT, RIGHT, UP, DOWN, UNKNOWN };

class Suspicion {
public:
  int x = 0;
  int y = 0;
  Direction where = UNKNOWN;

  Suspicion();
  Suspicion(int x, int y, Direction where);
};

class BotGameClient : public GameClient {
public:
  BotGameClient();
  virtual ~BotGameClient();

  void onUpdate(Game g);
  void onError(ErrorCode error);
  void init();

private:
  Game game;
  bool prev_step_mine = false;
  int prev_x = 0, prev_y = 0;
  Suspicion prev_suspicion = Suspicion();
  std::stack<Suspicion> suspicions;
};
```

include \game \client \client.h

```
#pragma once

#include <game/client/connection.h>
#include <game/server/server.h>
#include <models/game.h>

class GameClient {
public:
  ClientConnection *conn;

  virtual ~GameClient();

  virtual void onUpdate(Game g) = 0;
  virtual void onError(ErrorCode error) = 0;
  virtual void init() = 0;
  virtual void onStep(int x, int y);
  virtual void onHandshake(std::vector<Ship> ships);
  virtual void onSurrender();
};
```

include \game \client \connection.h

```
#pragma once

#include <game/client/connectionstrategy.h>
#include <game/server/server.h>
#include <models/field.h>
#include <models/game.h>

class ClientConnection {
  ClientConnectionStrategy *strategy;
public:
  ClientConnection(ClientConnectionStrategy *strategy);
  ~ClientConnection();

  void sendHandshake(std::vector<Ship> ships);
  void sendStep(int x, int y);
  void onUpdate(Game g);
  void onError(ErrorCode error);
  void onSurrender();
};
```

include \game \client \connectionstrategy.h

```
#pragma once

#include <game/server/server.h>
#include <models/field.h>
#include <models/game.h>

class GameClient;

class ClientConnectionStrategy {
protected:
  GameClient *client;
public:
  ClientConnectionStrategy(GameClient *client);
  virtual ~ClientConnectionStrategy();

  virtual void sendHandshake(std::vector<Ship> ships) = 0;
  virtual void sendStep(int x, int y) = 0;
  virtual void onUpdate(Game g) = 0;
  virtual void onError(ErrorCode error) = 0;
  virtual void onSurrender() = 0;
};
```

include \game \client \localconnectionstrategy.h

```
#pragma once

#include <models/field.h>
#include <models/game.h>

#include <game/client/connectionstrategy.h>

class ServerConnection;

class LocalClientConnectionStrategy : public ClientConnectionStrategy {
  ServerConnection *conn;
public:
  LocalClientConnectionStrategy(GameClient *client, ServerConnection *conn);
  ~LocalClientConnectionStrategy();
  void sendHandshake(std::vector<Ship> ships);
  void sendStep(int x, int y);
  void onUpdate(Game g);
  void onError(ErrorCode error);
  void onSurrender();
};
```

include \game \client \tcpconnectionstrategy.h

```
#pragma once

#include <QTcpSocket>

#include <game/client/connectionstrategy.h>
#include <models/field.h>
#include <models/game.h>

class TCPClientConnectionStrategy : public QObject,
                                    public ClientConnectionStrategy {
  Q_OBJECT

  QTcpSocket *conn;
  QByteArray temp;
  void onReadyRead();
public:
  TCPClientConnectionStrategy(GameClient *client, QTcpSocket *conn,
                              QObject *parent);
  ~TCPClientConnectionStrategy();
  void sendHandshake(std::vector<Ship> ships);
  void sendStep(int x, int y);
  void onUpdate(Game g);
  void onError(ErrorCode error);
  void onSurrender();
};
```

include \game \gamebuilder.h

```
#pragma once

#include <QTcpServer>

#include <game/client/client.h>
#include <game/server/localconnection.h>
#include <game/server/server.h>
#include <game/abstractgamebuilder.h>

class GameBuilder : public AbstractGameBuilder {
  LocalServerConnection *establishLocalConnection(GameClient *client);

public:
  GameBuilder();
  ~GameBuilder();
  AbstractGameBuilder* playing(GameClient *client);
  AbstractGameBuilder* playing(QTcpSocket *socket);
  AbstractGameBuilder* vs(GameClient *client);
  AbstractGameBuilder* vs(QTcpSocket *socket);
  GameServer* begin();
};
```

include \game \server \connection.h

```
#pragma once

#include <game/server/server.h>
#include <models/game.h>

class ServerConnection {
protected:
  GameServer *game;
public:
  ServerConnection(GameServer *game);
  virtual ~ServerConnection();

  virtual void sendUpdate(Game g) = 0;
  virtual void sendError(ErrorCode error) = 0;
  virtual void onStep(int x, int y) = 0;
  virtual void onHandshake(std::vector<Ship> ships) = 0;
  virtual void onSurrender() = 0;
};
```

include \game \server \localconnection.h

```
#pragma once

#include <game/client/connection.h>
#include <game/server/connection.h>
#include <game/server/localconnection.h>
#include <game/server/server.h>

class LocalServerConnection : public ServerConnection {
public:
  ClientConnection *conn;

  LocalServerConnection(GameServer *game);
  virtual ~LocalServerConnection();

  void sendUpdate(Game g);
  void sendError(ErrorCode error);
  void onStep(int x, int y);
  void onHandshake(std::vector<Ship> ships);
  void onSurrender();
};
```

include \game \server \server.h

```
#pragma once

#include <models/field.h>

class ServerConnection;

enum ErrorCode {
  BAD_HANDSHAKE = 0,
  BAD_STEP = 1,
  NO_HANDSHAKE = 2,
  ALREADY_HANDSHAKE = 3
};

enum WinningReason { FAIR = 0, SURRENDER = 1 };

class GameServer {
  bool going_one = true;
  bool game_over = false;
  bool player_one_won = false;
  WinningReason winning_reason = FAIR;
  Field player_one_field;
  bool player_one_validated = false;
  Field player_two_field;
  bool player_two_validated = false;
  static bool isCovered(Field &field, Ship &ship);
  static void coverShip(Field &field, Ship &ship);
  void checkGameOver();

public:
  GameServer();
  ~GameServer();

  ServerConnection *player_one;
  ServerConnection *player_two;

  void onHandshake(ServerConnection *player, std::vector<Ship> ships);
  void onStep(ServerConnection *player, int x, int y);
  void onSurrender(ServerConnection *player);
  void sendUpdate();
};
```

include \game \server \tcpconnection.h

```
#pragma once

#include <QObject>
#include <QTcpSocket>

#include <game/server/connection.h>
#include <game/server/server.h>

class TCPServerConnection : public QObject, public ServerConnection {
  Q_OBJECT

  QTcpSocket *conn;
  QByteArray temp;
  void onReadyRead();
public:
  TCPServerConnection(GameServer *game, QTcpSocket *conn);
  virtual ~TCPServerConnection();

  void sendUpdate(Game g);
  void sendError(ErrorCode error);
  void onStep(int x, int y);
  void onHandshake(std::vector<Ship> ships);
  void onSurrender();
};
```

include \models \field.h

```
#pragma once

#include <vector>

#include <models/ship.h>

#define GAME_SIZE 10
#define ONE_SHIP 4
#define TWO_SHIP 3
#define THREE_SHIP 2
#define FOUR_SHIP 1

enum FieldElement { NOT_CHECKED = 0, EMPTY_CHECKED = 1, EXPOLSION_CHECKED = 2 };

class Field {
public:
  FieldElement field[GAME_SIZE][GAME_SIZE] = {};
  std::vector<Ship> ships;
  static bool areInBounds(int pos);
  static Field generateRandom();
  bool validateShips();
};
```

include \models \game.h

```
#pragma once

#include <game/server/server.h>
#include <models/field.h>

class Game {
public:
  bool game_over = false;
  bool youre_winner;
  bool youre_going;
  WinningReason reason = FAIR;
  Field own_field;
  Field enemy_field;
};
```

include \models \ship.h

```
#pragma once

class Ship {
public:
  bool is_horizontal = true;
  int length = 1;
  int x = 0;
  int y = 0;

  Ship(bool is_horizontal, int length, int x, int y);
};
```

include \utils \moveableobjectadapter.hpp

```
#pragma once

#include <QGraphicsItem>
#include <QGraphicsView>
```

```
#include <widgets/fieldstyle.h>

template <typename T> class MoveableObjectAdapter {
protected:
  QGraphicsView *parent;
  T object;
  QGraphicsItem *graph_object;
  QPointF offset;
  FieldStyle *style;

  virtual QGraphicsItem *construct_object() = 0;

public:
  void onUpdateScenePos(QPointF &pos) {
    graph_object->setPos(
        QPointF(pos.x() + this->offset.x(), pos.y() + this->offset.y()));
  }

  MoveableObjectAdapter(QGraphicsView *parent, T object, QPointF offset,
                        FieldStyle *style)
      : parent(parent), object(object), offset(offset), style(style) {}

  virtual ~MoveableObjectAdapter() {
    this->parent->scene()->removeItem(graph_object);
    delete graph_object;
  }

  void init() {
    this->graph_object = construct_object();

    this->parent->scene()->addItem(graph_object);
  }

  T getObject() { return object; }

  QPointF getOffset() { return offset; }
};
```

include \utils \moveableobjectship.h

```
#pragma once

#include <QGraphicsItem>
#include <QGraphicsScene>

#include <models/ship.h>
#include <utils/moveableobjectadapter.hpp>
```

```
class MoveableObjectShip : public MoveableObjectAdapter<Ship> {
protected:
  QGraphicsItem *construct_object();

public:
  MoveableObjectShip(QGraphicsView *parent, Ship object, QPointF offset,
                     FieldStyle *style);
};
```

include \widgets \fieldstyle.h

```
#pragma once

#include <QBrush>
#include <QPen>

class FieldStyle {
  double padding_percent;
  QPen pen_grid;
  QPen pen_ship;
  QBrush brush_ship;
  QPixmap *cross_img;
  QPixmap *explosion_img;

  FieldStyle(std::optional<double> padding_percent = std::nullopt,
             std::optional<QPen> pen_grid = std::nullopt,
             std::optional<QPen> pen_ship = std::nullopt,
             std::optional<QBrush> brush_ship = std::nullopt,
             std::optional<std::string> cross = std::nullopt,
             std::optional<std::string> exposion = std::nullopt);

  FieldStyle(int _);

  ~FieldStyle();

public:
  static double DEFAULT_PADDING_PERCENT;
  static QPen DEFAULT_PEN_GRID;
  static QPen DEFAULT_PEN_SHIP;
  static QBrush DEFAULT_BRUSH_SHIP;
  static std::string DEFAULT_CROSS;
  static std::string DEFAULT_EXPLOSION;

  static FieldStyle STYLE_EDIT;
  static FieldStyle STYLE_PLAY_SELF;
  static FieldStyle STYLE_PLAY_ENEMY;

  static void initStyles();
  double getPaddingPercent();
  QPen getPenGrid();
  QPen getPenShip();
  QBrush getBrushShip();
  QPixmap &getCrossImg();
  QPixmap &getExplosionImg();
};
```

include \widgets \fieldwidget.h

```
#pragma once

#include <QColor>
#include <QGraphicsItem>
#include <QGraphicsScene>
#include <QGraphicsSceneMouseEvent>
#include <QGraphicsView>
#include <QPen>

#include <models/field.h>
#include <models/ship.h>
#include <widgets/fieldstyle.h>

class FieldWidget : public QGraphicsScene {
  Q_OBJECT
public:
  Field field;
  FieldWidget(QGraphicsView *parent = nullptr,
              FieldStyle *style = &FieldStyle::STYLE_PLAY_SELF);

  void setField(Field field);
  Field getField();
  void redraw();
protected:
  FieldStyle *style;
  std::pair<QPointF, QPointF> getShipScenePos(Ship &ship);
  int getCollidedShipIndex(QPointF pos);
  QPoint getCellCoordinate(QPointF scene_pos);
};
```

include \widgets \fieldwidgetedit.h

```
#pragma once

#include <utils/moveableobjectship.h>
#include <widgets/fieldwidget.h>

class FieldWidgetEdit : public FieldWidget {
  Q_OBJECT

  MoveableObjectShip *moveable_object = nullptr;

public:
  FieldWidgetEdit(QGraphicsView *parent = nullptr,
                  FieldStyle *style = &FieldStyle::STYLE_EDIT);

protected:
  void mouseMoveEvent(QGraphicsSceneMouseEvent *event);
  void mousePressEvent(QGraphicsSceneMouseEvent *event);
  void mouseReleaseEvent(QGraphicsSceneMouseEvent *event);
};
```

include \widgets \fieldwidgetplayenemy.h

```
#pragma once

#include <game/client/client.h>
#include <widgets/fieldwidget.h>

class FieldWidgetPlayEnemy : public FieldWidget {
  Q_OBJECT
  GameClient *client;

public:
  FieldWidgetPlayEnemy(GameClient *client, QGraphicsView *parent = nullptr,
                       FieldStyle *style = &FieldStyle::STYLE_PLAY_ENEMY);

protected:
  void mousePressEvent(QGraphicsSceneMouseEvent *event);
};
```

include \widgets \gamewindow.h

```
#pragma once

#include <QDialog>
#include <QTcpServer>
```

```cpp
#include <game/client/client.h>
#include <widgets/fieldwidgetplayenemy.h>

namespace Ui {
class GameWindow;
}

class GameWindow : public QDialog, public GameClient {
  Q_OBJECT

  Ui::GameWindow *ui;
  FieldWidgetPlayEnemy *enemy_field = nullptr;
  FieldWidget *own_field = nullptr;
public:
  bool handshake_ok = true;

  explicit GameWindow(std::vector<Ship> ships, QWidget *parent = nullptr);
  ~GameWindow();
  void onUpdate(Game g);
  void onError(ErrorCode error);
  void init();

protected:
  Game game;
  std::vector<Ship> ships;
  void showEvent(QShowEvent *event);
  void closeEvent(QCloseEvent *event);
  void surrender();
};
```

include \widgets \initgame.h

```cpp
#pragma once

#include <QMainWindow>

#include <models/field.h>
#include <models/ship.h>
#include <widgets/fieldwidgetedit.h>
#include <widgets/gamewindow.h>

namespace Ui {
class InitGame;
}

class InitGame : public QMainWindow {
  Q_OBJECT
  bool game_going = false;
  Ui::InitGame *ui;
  GameWindow *game_window;
  QTcpServer *server = nullptr;
  void setupServer();
  void downServer();
  void beginBot();
  void beginCreate();
  void beginJoin();
  void newConnection();

public:
  explicit InitGame(QWidget *parent = nullptr);
  ~InitGame();

protected:
  void showEvent(QShowEvent *event);
};
```

src \game \abstractgamebuilder.cpp

```
#include <game/abstractgamebuilder.h>

AbstractGameBuilder::AbstractGameBuilder() {}

AbstractGameBuilder::~AbstractGameBuilder() {}
```

src \game \client \botclient.cpp

```
#include <game/client/botclient.h>

#include <QDebug>
#include <random>

Suspicion::Suspicion() {}
Suspicion::Suspicion(int x, int y, Direction where)
    : x(x), y(y), where(where) {}

BotGameClient::BotGameClient() : GameClient() {}

BotGameClient::~BotGameClient() {
}

void BotGameClient::onUpdate(Game g) {
```

```
this->game = g;
if (g.game_over)
  return;
if (!g.youre_going) {
  prev_step_mine = false;
  return;
}

if (prev_step_mine && prev_suspicion.where != UNKNOWN) {
  Suspicion sus;
  sus.where = prev_suspicion.where;
  sus.x = prev_suspicion.x + (sus.where == LEFT    ? -1
                            : sus.where == RIGHT ? 1
                                                 : 0);
  sus.y = prev_suspicion.y + (sus.where == UP     ? -1
                            : sus.where == DOWN ? 1
                                                : 0);

  this->suspicions.push(sus);
} else if (prev_step_mine) {
  std::vector<Suspicion> suses = {Suspicion(prev_x - 1, prev_y, LEFT),
                                  Suspicion(prev_x + 1, prev_y, RIGHT),
                                  Suspicion(prev_x, prev_y - 1, UP),
                                  Suspicion(prev_x, prev_y + 1, DOWN)};
  std::random_shuffle(suses.begin(), suses.end());
  for (auto &sus : suses) {
    this->suspicions.push(sus);
  }
}

if (!this->suspicions.empty()) {
  auto sus = suspicions.top();
  suspicions.pop();
  prev_suspicion = sus;
  prev_x = sus.x;
  prev_y = sus.y;

  prev_step_mine = true;
  this->onStep(sus.x, sus.y);

  return;
}

while (true) {
  static auto dev = std::random_device();
  static auto gen = std::mt19937{dev()};
  static auto dist = std::uniform_int_distribution(0, GAME_SIZE - 1);

  int y = dist(gen), x = dist(gen);
  if (g.enemy_field.field[y][x] == FieldElement::NOT_CHECKED) {
      prev_step_mine = true;
      prev_x = x;
      prev_y = y;
      prev_suspicion = Suspicion();

      this->onStep(x, y);

      return;
    }
  }
}

void BotGameClient::onError(ErrorCode error) {
  switch (error) {
  case BAD_HANDSHAKE:
    break;
  case BAD_STEP:
    prev_step_mine = false;
    onUpdate(this->game);
    break;
  case NO_HANDSHAKE:
    init();
    break;
  case ALREADY_HANDSHAKE:
    break;
  }
}

void BotGameClient::init() {
  auto data = Field::generateRandom();
  this->onHandshake(data.ships);
}
```

src \game \client \client.cpp

```
#include <game/client/client.h>
#include <game/client/connection.h>

GameClient::~GameClient() {
    delete this->conn;
}

void GameClient::onStep(int x, int y) { return conn->sendStep(x, y); }

void GameClient::onHandshake(std::vector<Ship> ships) {
  return conn->sendHandshake(ships);
}
```

```cpp
void GameClient::onSurrender() { return conn->onSurrender(); }
```

src \game \client \connection.cpp

```cpp
#include <game/client/connection.h>

ClientConnection::ClientConnection(ClientConnectionStrategy *strategy)
    : strategy(strategy) {}

ClientConnection::~ClientConnection() { delete strategy; }

void ClientConnection::sendHandshake(std::vector<Ship> ships) {
  return strategy->sendHandshake(ships);
}

void ClientConnection::sendStep(int x, int y) {
  return strategy->sendStep(x, y);
}

void ClientConnection::onUpdate(Game g) { return strategy->onUpdate(g); }

void ClientConnection::onError(ErrorCode error) {
  return strategy->onError(error);
}

void ClientConnection::onSurrender() { return strategy->onSurrender(); }
```

src \game \client \connectionstrategy.cpp

```cpp
#include <game/client/connectionstrategy.h>

ClientConnectionStrategy::ClientConnectionStrategy(GameClient *client)
    : client(client) {}

ClientConnectionStrategy::~ClientConnectionStrategy() {}
```

src \game \client \localconnectionstrategy.cpp

```cpp
#include <game/client/client.h>
#include <game/client/localconnectionstrategy.h>
#include <game/server/connection.h>

LocalClientConnectionStrategy::LocalClientConnectionStrategy(
    GameClient *client, ServerConnection *conn)
    : ClientConnectionStrategy(client), conn(conn) {}

LocalClientConnectionStrategy::~LocalClientConnectionStrategy() {}

void LocalClientConnectionStrategy::sendHandshake(std::vector<Ship> ships) {
  conn->onHandshake(ships);
}

void LocalClientConnectionStrategy::sendStep(int x, int y) {
  conn->onStep(x, y);
}

void LocalClientConnectionStrategy::onUpdate(Game g) {
  this->client->onUpdate(g);
}

void LocalClientConnectionStrategy::onError(ErrorCode error) {
  this->client->onError(error);
}

void LocalClientConnectionStrategy::onSurrender() { conn->onSurrender(); }
```

src \game \client \tcpconnectionstrategy.cpp

```
#include <game/client/client.h>
#include <game/client/tcpconnectionstrategy.h>
#include <game/server/connection.h>

#include <sstream>

TCPClientConnectionStrategy::TCPClientConnectionStrategy(GameClient *client,
                                                         QTcpSocket *conn,
                                                         QObject *parent)
    : QObject(parent), ClientConnectionStrategy(client), conn(conn) {
  connect(conn, &QTcpSocket::readyRead, this,
          &TCPClientConnectionStrategy::onReadyRead);
}

TCPClientConnectionStrategy::~TCPClientConnectionStrategy() {
  conn->flush();
  conn->close();
  delete conn;
}

void TCPClientConnectionStrategy::onReadyRead() {
  QTcpSocket *clientSocket = qobject_cast<QTcpSocket *>(sender());
  if (!clientSocket)
    return;

  QByteArray data = clientSocket->readAll();
  for (auto &b : data) {
    if (b != '\n') {
      temp.append(b);
      continue;
    }

    if (temp.toStdString().rfind("error: ", 0) == 0) {
      std::stringstream input(temp.toStdString().substr(7));
      int code;
      input >> code;
      onError(static_cast<ErrorCode>(code));
    } else if (temp.toStdString().rfind("update: ", 0) == 0) {
      std::stringstream input(temp.toStdString().substr(8));
      Game g;
      int dat;
      input >> dat;
      g.game_over = dat == 1;
      input >> dat;
      g.youre_winner = dat == 1;
      input >> dat;
      g.youre_going = dat == 1;
      input >> dat;
      g.reason = static_cast<WinningReason>(dat);

      for (int i = 0; i < GAME_SIZE; i++) {
        for (int j = 0; j < GAME_SIZE; j++) {
          input >> dat;
          g.own_field.field[i][j] = static_cast<FieldElement>(dat);
        }
      }
      int sh_amount;
      input >> sh_amount;
      for (int i = 0; i < sh_amount; i++) {
        input >> dat;
        bool is_horizontal = dat == 1;
        int length;
        input >> length;
        int x;
        input >> x;
        int y;
        input >> y;
        g.own_field.ships.push_back(Ship(is_horizontal, length, x, y));
      }

      for (int i = 0; i < GAME_SIZE; i++) {
        for (int j = 0; j < GAME_SIZE; j++) {
          input >> dat;
```

```
          g.enemy_field.field[i][j] = static_cast<FieldElement>(dat);
        }
      }
      input >> sh_amount;
      for (int i = 0; i < sh_amount; i++) {
        input >> dat;
        bool is_horizontal = dat == 1;
        int length;
        input >> length;
        int x;
        input >> x;
        int y;
        input >> y;
        g.enemy_field.ships.push_back(Ship(is_horizontal, length, x, y));
      }

      onUpdate(g);
    }

    temp.clear();
  }

  // Parse data from server here:
}

void TCPClientConnectionStrategy::sendHandshake(std::vector<Ship> ships) {
  std::stringstream output;
  output << "handshake: " << ships.size() << " ";
  for (auto &ship : ships) {
    output << (ship.is_horizontal ? 1 : 0) << " " << ship.length << " "
           << ship.x << " " << ship.y << " ";
  }
  output << "\n";

  conn->write(output.str().c_str());
  conn->flush();
}

void TCPClientConnectionStrategy::sendStep(int x, int y) {
  std::stringstream output;
  output << "step: " << x << " " << y << "\n";
  conn->write(output.str().c_str());
  conn->flush();
}

void TCPClientConnectionStrategy::onSurrender() {
  std::stringstream output;
  output << "surrender: \n";
  conn->write(output.str().c_str());
  conn->flush();
```

```
}

void TCPClientConnectionStrategy::onUpdate(Game g) {
  this->client->onUpdate(g);
}

void TCPClientConnectionStrategy::onError(ErrorCode error) {
  this->client->onError(error);
}
```

src \game \gamebuilder.cpp

```
#include <game/gamebuilder.h>

#include <QTcpSocket>
#include <game/client/connection.h>
#include <game/client/localconnectionstrategy.h>
#include <game/server/server.h>
#include <game/server/tcpconnection.h>

LocalServerConnection *
GameBuilder::establishLocalConnection(GameClient *client) {
  auto server_conn = new LocalServerConnection(server);

  auto host_client_connection = new ClientConnection(
      new LocalClientConnectionStrategy(client, server_conn));
  client->conn = host_client_connection;
  server_conn->conn = host_client_connection;

  return server_conn;
}

GameBuilder::GameBuilder() : AbstractGameBuilder() { this->server = new GameServer(); };

GameBuilder::~GameBuilder() {}

AbstractGameBuilder* GameBuilder::playing(GameClient *client) {
  server->player_one = establishLocalConnection(client);
  playing_client = client;
  playing_setup = true;

  return this;
}

AbstractGameBuilder* GameBuilder::playing(QTcpSocket *socket) {
  server->player_one = new TCPServerConnection(this->server, socket);
  playing_setup = true;
  return this;
}

AbstractGameBuilder* GameBuilder::vs(GameClient *client) {
  server->player_two = establishLocalConnection(client);
  vs_client = client;
  vs_setup = true;

  return this;
}

AbstractGameBuilder* GameBuilder::vs(QTcpSocket *socket) {
  server->player_two = new TCPServerConnection(this->server, socket);
  vs_setup = true;

  return this;
}

GameServer* GameBuilder::begin() {
  if (!playing_setup) throw std::runtime_error("Player is not set up, call playing... method in
  ↪  builder");
  if (!vs_setup) throw std::runtime_error("Player is not set up, call vs... method in builder");
  if (playing_client)
    playing_client->init();
  if (vs_client)
    vs_client->init();

  return this->server;
}
```

src \game \server \conneciton.cpp

```
#include <game/server/connection.h>

ServerConnection::ServerConnection(GameServer *game) : game(game){};
ServerConnection::~ServerConnection() {}
```

src \game \server \localconnection.cpp

```
#include <game/server/localconnection.h>

LocalServerConnection::LocalServerConnection(GameServer *game)
    : ServerConnection(game) {}
LocalServerConnection::~LocalServerConnection() {}
```

```
void LocalServerConnection::sendUpdate(Game g) { this->conn->onUpdate(g); }

void LocalServerConnection::sendError(ErrorCode error) {
  this->conn->onError(error);
}

void LocalServerConnection::onStep(int x, int y) {
  this->game->onStep(this, x, y);
}

void LocalServerConnection::onHandshake(std::vector<Ship> ships) {
  this->game->onHandshake(this, ships);
}

void LocalServerConnection::onSurrender() { this->game->onSurrender(this); }
```

src \game \server \server.cpp

```
#include <algorithm>
#include <game/server/connection.h>
#include <game/server/server.h>

#include <random>

#include <models/game.h>

GameServer::GameServer() {
  static auto dev = std::random_device();
  static auto gen = std::mt19937{dev()};
  static auto dist = std::uniform_int_distribution(0, 1);
  this->going_one = dist(gen) == 0;
}

GameServer::~GameServer() {
  delete this->player_one;
  delete this->player_two;
}

void GameServer::onHandshake(ServerConnection *player,
                             std::vector<Ship> ships) {
  bool was = this->player_one_validated && this->player_two_validated;
  if (was)
    return player->sendError(ALREADY_HANDSHAKE);

  if (this->player_one == player) {
    if (this->player_one_validated)
      return player->sendError(ALREADY_HANDSHAKE);
    this->player_one_field.ships = ships;
    if (this->player_one_field.validateShips())
      this->player_one_validated = true;
    else
      return player->sendError(BAD_HANDSHAKE);
  }

  if (this->player_two == player) {
    if (this->player_two_validated)
      return player->sendError(ALREADY_HANDSHAKE);

    this->player_two_field.ships = ships;
    if (this->player_two_field.validateShips())
      this->player_two_validated = true;
    else
      return player->sendError(BAD_HANDSHAKE);
  }

  if (!was && this->player_one_validated && this->player_two_validated) {
    sendUpdate();
  }
}

void GameServer::onStep(ServerConnection *player, int xx, int yy) {
  if (game_over)
    return;
  if (player == player_one && !this->player_one_validated)
    return player->sendError(ErrorCode::NO_HANDSHAKE);
  if (player == player_two && !this->player_two_validated)
    return player->sendError(ErrorCode::NO_HANDSHAKE);

  if (!Field::areInBounds(xx) || !Field::areInBounds(yy))
    return player->sendError(ErrorCode::BAD_STEP);
  Field *selected_field = &player_one_field;
  bool selected = false;

  if (player == player_one && going_one) {
    selected_field = &player_two_field;
    selected = true;
  } else if (player == player_two && !going_one) {
    selected = true;
  }

  if (!selected)
    return player->sendError(ErrorCode::BAD_STEP);

  if (selected_field->field[yy][xx] != FieldElement::NOT_CHECKED)
    return player->sendError(ErrorCode::BAD_STEP);

  for (auto &ship : selected_field->ships) {
    if (ship.is_horizontal) {
      for (int x = ship.x; x < ship.x + ship.length; x++) {
        if (ship.y != yy || x != xx)
          continue;

        selected_field->field[yy][xx] = FieldElement::EXPOLSION_CHECKED;
        if (isCovered(*selected_field, ship))
          coverShip(*selected_field, ship);

        checkGameOver();
        sendUpdate();
        return;
      }
    } else {
      for (int y = ship.y; y < ship.y + ship.length; y++) {
        if (y != yy || ship.x != xx)
          continue;

        selected_field->field[yy][xx] = FieldElement::EXPOLSION_CHECKED;
        if (isCovered(*selected_field, ship))
          coverShip(*selected_field, ship);

        checkGameOver();
        sendUpdate();
        return;
      }
    }
  }

  selected_field->field[yy][xx] = FieldElement::EMPTY_CHECKED;
  going_one = !going_one;
  sendUpdate();
}

void GameServer::onSurrender(ServerConnection *player) {
  if (game_over)
    return;
  if (player == player_one && !this->player_one_validated)
    return player->sendError(ErrorCode::NO_HANDSHAKE);
  if (player == player_two && !this->player_two_validated)
    return player->sendError(ErrorCode::NO_HANDSHAKE);

  if (player == player_one) {
    this->game_over = true;
    this->winning_reason = SURRENDER;
    this->player_one_won = false;

    sendUpdate();
  } else if (player == player_two) {
    this->game_over = true;
    this->winning_reason = SURRENDER;
    this->player_one_won = true;

    sendUpdate();
  }
}

void GameServer::checkGameOver() {
  if (game_over || !this->player_one_validated || !this->player_two_validated)
    return;

  bool all_player_one = true;
  for (auto &ship : this->player_one_field.ships) {
    if (!isCovered(this->player_one_field, ship)) {
      all_player_one = false;
      break;
    }
  }

  if (all_player_one) {
    this->game_over = true;
    this->player_one_won = false;
    this->winning_reason = FAIR;

    return;
  }

  bool all_player_two = true;
  for (auto &ship : this->player_two_field.ships) {
    if (!isCovered(this->player_two_field, ship)) {
      all_player_two = false;
      break;
    }
  }

  if (all_player_two) {
    this->game_over = true;
    this->player_one_won = true;
    this->winning_reason = FAIR;
  }
}

void GameServer::sendUpdate() {
  Game p1_game;
  p1_game.reason = this->winning_reason;
  p1_game.youre_going = going_one;
  p1_game.own_field = player_one_field;
  p1_game.enemy_field = player_two_field;
  p1_game.enemy_field.ships.clear();
  std::copy_if(player_two_field.ships.begin(), player_two_field.ships.end(),
             std::back_inserter(p1_game.enemy_field.ships),
             [&](Ship sh) { return isCovered(player_two_field, sh); });
  p1_game.game_over = this->game_over;
  p1_game.youre_winner = this->player_one_won;

  player_one->sendUpdate(p1_game);

  Game p2_game;
  p2_game.reason = this->winning_reason;
  p2_game.youre_going = !going_one;
  p2_game.own_field = player_two_field;
  p2_game.enemy_field = player_one_field;
  p2_game.enemy_field.ships.clear();
  std::copy_if(player_one_field.ships.begin(), player_one_field.ships.end(),
             std::back_inserter(p2_game.enemy_field.ships),
             [&](Ship sh) { return isCovered(player_one_field, sh); });
  p2_game.game_over = this->game_over;
  p2_game.youre_winner = !this->player_one_won;

  player_two->sendUpdate(p2_game);
}

bool GameServer::isCovered(Field &field, Ship &ship) {
  if (ship.is_horizontal) {
    for (int x = ship.x; x < ship.x + ship.length; x++)
      if (field.field[ship.y][x] != FieldElement::EXPOLSION_CHECKED)
        return false;
  } else {
    for (int y = ship.y; y < ship.y + ship.length; y++)
      if (field.field[y][ship.x] != FieldElement::EXPOLSION_CHECKED)
        return false;
  }

  return true;
}

void GameServer::coverShip(Field &field, Ship &ship) {
  if (ship.is_horizontal) {
    for (int x = ship.x; x < ship.x + ship.length; x++) {
      if (Field::areInBounds(ship.y - 1) && Field::areInBounds(x))
        field.field[ship.y - 1][x] = FieldElement::EMPTY_CHECKED;
      if (Field::areInBounds(ship.y + 1) && Field::areInBounds(x))
        field.field[ship.y + 1][x] = FieldElement::EMPTY_CHECKED;
      if (Field::areInBounds(ship.y - 1) && Field::areInBounds(x - 1))
        field.field[ship.y - 1][x - 1] = FieldElement::EMPTY_CHECKED;
      if (Field::areInBounds(ship.y - 1) && Field::areInBounds(x + 1))
        field.field[ship.y - 1][x + 1] = FieldElement::EMPTY_CHECKED;
      if (Field::areInBounds(ship.y + 1) && Field::areInBounds(x + 1))
        field.field[ship.y + 1][x + 1] = FieldElement::EMPTY_CHECKED;
      if (Field::areInBounds(ship.y + 1) && Field::areInBounds(x - 1))
```

```
        field.field[ship.y + 1][x - 1] = FieldElement::EMPTY_CHECKED;
    }

    if (Field::areInBounds(ship.y) && Field::areInBounds(ship.x - 1))
      field.field[ship.y][ship.x - 1] = FieldElement::EMPTY_CHECKED;
    if (Field::areInBounds(ship.y) && Field::areInBounds(ship.x + ship.length))
      field.field[ship.y][ship.x + ship.length] = FieldElement::EMPTY_CHECKED;
  } else {
    for (int y = ship.y; y < ship.y + ship.length; y++) {
      if (Field::areInBounds(y) && Field::areInBounds(ship.x + 1))
        field.field[y][ship.x + 1] = FieldElement::EMPTY_CHECKED;
      if (Field::areInBounds(y) && Field::areInBounds(ship.x - 1))
        field.field[y][ship.x - 1] = FieldElement::EMPTY_CHECKED;
      if (Field::areInBounds(y - 1) && Field::areInBounds(ship.x - 1))
        field.field[y - 1][ship.x - 1] = FieldElement::EMPTY_CHECKED;
      if (Field::areInBounds(y - 1) && Field::areInBounds(ship.x + 1))
        field.field[y - 1][ship.x + 1] = FieldElement::EMPTY_CHECKED;
      if (Field::areInBounds(y + 1) && Field::areInBounds(ship.x + 1))
        field.field[y + 1][ship.x + 1] = FieldElement::EMPTY_CHECKED;
      if (Field::areInBounds(y + 1) && Field::areInBounds(ship.x - 1))
        field.field[y + 1][ship.x - 1] = FieldElement::EMPTY_CHECKED;
    }

    if (Field::areInBounds(ship.y - 1) && Field::areInBounds(ship.x))
      field.field[ship.y - 1][ship.x] = FieldElement::EMPTY_CHECKED;
    if (Field::areInBounds(ship.y + ship.length) && Field::areInBounds(ship.x))
      field.field[ship.y + ship.length][ship.x] = FieldElement::EMPTY_CHECKED;
  }
}
```

src \game \server \tcpconnection.cpp

```
#include <game/server/tcpconnection.h>

#include <sstream>

TCPServerConnection::TCPServerConnection(GameServer *game, QTcpSocket *conn)
    : QObject(nullptr), ServerConnection(game), conn(conn) {
  this->conn = conn;
  connect(conn, &QTcpSocket::readyRead, this,
          &TCPServerConnection::onReadyRead);
  connect(conn, &QTcpSocket::disconnected, this,
          &TCPServerConnection::onSurrender);
}

TCPServerConnection::~TCPServerConnection() {
  conn->flush();
  conn->close();
  delete conn;
}

void TCPServerConnection::onReadyRead() {
  QTcpSocket *clientSocket = qobject_cast<QTcpSocket *>(sender());
  if (!clientSocket)
    return;

  QByteArray data = clientSocket->readAll();
  for (auto &b : data) {
    if (b != '\n') {
      temp.append(b);
      continue;
    }

    if (temp.toStdString().rfind("handshake: ", 0) == 0) {
      std::stringstream input(temp.toStdString().substr(11));
      int sh_amount;
      input >> sh_amount;
      std::vector<Ship> ships;
      for (int i = 0; i < sh_amount; i++) {
        int dat;
        input >> dat;
        bool is_horizontal = dat == 1;
        int length;
        input >> length;
        int x;
        input >> x;
        int y;
        input >> y;
        ships.push_back(Ship(is_horizontal, length, x, y));
      }

      onHandshake(ships);
    } else if (temp.toStdString().rfind("step: ", 0) == 0) {
      std::stringstream input(temp.toStdString().substr(6));
      int x, y;
      input >> x >> y;

      onStep(x, y);
    } else if (temp.toStdString().rfind("surrender: ", 0) == 0) {
      onSurrender();
    }

    temp.clear();
  }
}

void TCPServerConnection::sendUpdate(Game g) {
  std::stringstream output;
  output << "update: " << (g.game_over ? 1 : 0) << " "
         << (g.youre_winner ? 1 : 0) << " " << (g.youre_going ? 1 : 0) << " "
         << static_cast<int>(g.reason) << " ";

  for (int i = 0; i < GAME_SIZE; i++) {
    for (int j = 0; j < GAME_SIZE; j++) {
      output << static_cast<int>(g.own_field.field[i][j]) << " ";
    }
  }
  output << g.own_field.ships.size() << " ";
  for (auto &ship : g.own_field.ships) {
    output << (ship.is_horizontal ? 1 : 0) << " " << ship.length << " "
           << ship.x << " " << ship.y << " ";
  }

  for (int i = 0; i < GAME_SIZE; i++) {
    for (int j = 0; j < GAME_SIZE; j++) {
      output << static_cast<int>(g.enemy_field.field[i][j]) << " ";
    }
  }
  output << g.enemy_field.ships.size() << " ";
  for (auto &ship : g.enemy_field.ships) {
    output << (ship.is_horizontal ? 1 : 0) << " " << ship.length << " "
           << ship.x << " " << ship.y << " ";
  }

  output << "\n";

  conn->write(output.str().c_str());
  conn->flush();
}

void TCPServerConnection::sendError(ErrorCode error) {
  std::stringstream output;
  output << "error: " << static_cast<int>(error) << "\n";

  conn->write(output.str().c_str());
  conn->flush();
}

void TCPServerConnection::onStep(int x, int y) {
  this->game->onStep(this, x, y);
}

void TCPServerConnection::onHandshake(std::vector<Ship> ships) {
  this->game->onHandshake(this, ships);
}

void TCPServerConnection::onSurrender() { this->game->onSurrender(this); }
```

src \main.cpp

```
#include <QApplication>

#include <QTcpSocket>
#include <widgets/initgame.h>

int main(int argc, char *argv[]) {
  QApplication a(argc, argv);

  FieldStyle::initStyles();
  InitGame init_game;
  init_game.show();

  return a.exec();
}
```

src \models \field.cpp

```
#include <models/field.h>

#include <random>

#include <models/ship.h>

Field Field::generateRandom() {
  std::random_device dev;
  std::mt19937 rng(dev());
  std::uniform_int_distribution<std::mt19937::result_type> dist_game_size(
      0, GAME_SIZE - 1);
  std::uniform_int_distribution<std::mt19937::result_type> dist_bool(0, 1);
  Field result;

  while (1) {
    bool should_keep_going = true;
    result.ships.clear();
    for (int i = 0; i < ONE_SHIP && should_keep_going; i++) {
      result.ships.push_back(Ship(dist_bool(rng) == 1 ? true : false, 1,
                                  dist_game_size(rng), dist_game_size(rng)));

      if (!result.validateShips())
        should_keep_going = false;
      ;
    }
    for (int i = 0; i < TWO_SHIP && should_keep_going; i++) {
      result.ships.push_back(Ship(dist_bool(rng) == 1 ? true : false, 2,
                                  dist_game_size(rng), dist_game_size(rng)));

      if (!result.validateShips())
        should_keep_going = false;
    }

    for (int i = 0; i < THREE_SHIP && should_keep_going; i++) {
      result.ships.push_back(Ship(dist_bool(rng) == 1 ? true : false, 3,
                                  dist_game_size(rng), dist_game_size(rng)));

      if (!result.validateShips())
        should_keep_going = false;
    }

    for (int i = 0; i < FOUR_SHIP && should_keep_going; i++) {
      result.ships.push_back(Ship(dist_bool(rng) == 1 ? true : false, 4,
                                  dist_game_size(rng), dist_game_size(rng)));

      if (!result.validateShips())
        should_keep_going = false;
    }

    if (should_keep_going)
      break;
  }

  return result;
}

bool Field::validateShips() {
  std::vector<std::vector<int>> test_field(GAME_SIZE,
                                           std::vector(GAME_SIZE, 0));

  for (auto &ship : ships) {
    if (ship.is_horizontal) {
      if (!areInBounds(ship.y))
        return false;

      for (int x = ship.x; x < ship.x + ship.length; x++) {
        if (!areInBounds(x))
          return false;

        if (test_field[ship.y][x] != 0)
          return false;
        test_field[ship.y][x] = 2;

        if (areInBounds(ship.y - 1) && areInBounds(x))
          test_field[ship.y - 1][x] = 1;
        if (areInBounds(ship.y + 1) && areInBounds(x))
          test_field[ship.y + 1][x] = 1;
        if (areInBounds(ship.y - 1) && areInBounds(x - 1))
          test_field[ship.y - 1][x - 1] = 1;
        if (areInBounds(ship.y - 1) && areInBounds(x + 1))
          test_field[ship.y - 1][x + 1] = 1;
        if (areInBounds(ship.y + 1) && areInBounds(x + 1))
          test_field[ship.y + 1][x + 1] = 1;
        if (areInBounds(ship.y + 1) && areInBounds(x - 1))
          test_field[ship.y + 1][x - 1] = 1;
      }

      if (areInBounds(ship.y) && areInBounds(ship.x - 1))
        test_field[ship.y][ship.x - 1] = 1;
      if (areInBounds(ship.y) && areInBounds(ship.x + ship.length))
        test_field[ship.y][ship.x + ship.length] = 1;
    } else {
      if (!areInBounds(ship.x))
        return false;

      for (int y = ship.y; y < ship.y + ship.length; y++) {
        if (!areInBounds(y))
          return false;

        if (test_field[y][ship.x] != 0)
          return false;
        test_field[y][ship.x] = 2;

        if (areInBounds(y) && areInBounds(ship.x + 1))
          test_field[y][ship.x + 1] = 1;
        if (areInBounds(y) && areInBounds(ship.x - 1))
          test_field[y][ship.x - 1] = 1;
        if (areInBounds(y - 1) && areInBounds(ship.x - 1))
          test_field[y - 1][ship.x - 1] = 1;
        if (areInBounds(y - 1) && areInBounds(ship.x + 1))
          test_field[y - 1][ship.x + 1] = 1;
        if (areInBounds(y + 1) && areInBounds(ship.x + 1))
          test_field[y + 1][ship.x + 1] = 1;
        if (areInBounds(y + 1) && areInBounds(ship.x - 1))
          test_field[y + 1][ship.x - 1] = 1;
      }

      if (areInBounds(ship.y - 1) && areInBounds(ship.x))
        test_field[ship.y - 1][ship.x] = 1;
      if (areInBounds(ship.y + ship.length) && areInBounds(ship.x))
        test_field[ship.y + ship.length][ship.x] = 1;
    }
  }
```

```
  return true;
}

bool Field::areInBounds(int pos) { return pos >= 0 && pos < GAME_SIZE; }
```

src \models \game.cpp

```
#include <models/game.h>
```

src \models \ship.cpp

```
#include <models/ship.h>

Ship::Ship(bool is_horizontal, int length, int x, int y)
    : is_horizontal(is_horizontal), length(length), x(x), y(y) {}
```

src \ui \game.ui

```
<?xml version="1.0" encoding="UTF-8"?>
<ui version="4.0">
 <class>GameWindow</class>
 <widget class="QDialog" name="GameWindow">
  <property name="geometry">
   <rect>
    <x>0</x>
    <y>0</y>
    <width>950</width>
    <height>600</height>
   </rect>
  </property>
  <property name="windowTitle">
   <string>Морской бой</string>
  </property>
  <property name="windowIcon">
   <iconset resource="../../resources.qrc">
    <normaloff>:/src/assets/icon.png</normaloff>:/src/assets/icon.png</iconset>
  </property>
  <widget class="QWidget" name="centralwidget" native="true">
   <property name="geometry">
    <rect>
     <x>0</x>
     <y>0</y>
     <width>950</width>
     <height>600</height>
    </rect>
   </property>
   <widget class="QWidget" name="verticalLayoutWidget">
    <property name="geometry">
     <rect>
      <x>25</x>
      <y>25</y>
      <width>900</width>
      <height>550</height>
     </rect>
    </property>
    <layout class="QVBoxLayout" name="verticalLayout">
     <item>
      <layout class="QHBoxLayout" name="horizontalLayout">
       <item>
        <layout class="QVBoxLayout" name="verticalLayout_2">
         <item>
          <widget class="QLabel" name="label_2">
           <property name="styleSheet">
            <string notr="true">font: 700 14pt &quot;Segoe UI&quot;; color: rgb(0, 0, 0);</string>
           </property>
           <property name="text">
            <string>Поле соперника:</string>
           </property>
          </widget>
         </item>
         <item>
          <widget class="QGraphicsView" name="enemyfield">
           <property name="sizePolicy">
            <sizepolicy hsizetype="Fixed" vsizetype="Fixed">
             <horstretch>0</horstretch>
             <verstretch>0</verstretch>
            </sizepolicy>
           </property>
           <property name="minimumSize">
            <size>
             <width>400</width>
             <height>400</height>
            </size>
           </property>
           <property name="maximumSize">
            <size>
             <width>400</width>
             <height>400</height>
            </size>
           </property>
           <property name="verticalScrollBarPolicy">
            <enum>Qt::ScrollBarAlwaysOff</enum>
           </property>
           <property name="horizontalScrollBarPolicy">
```

```
            <enum>Qt::ScrollBarAlwaysOff</enum>
           </property>
          </widget>
         </item>
        </layout>
       </item>
       <item>
        <spacer name="horizontalSpacer">
         <property name="orientation">
          <enum>Qt::Horizontal</enum>
         </property>
         <property name="sizeHint" stdset="0">
          <size>
           <width>40</width>
           <height>20</height>
          </size>
         </property>
        </spacer>
       </item>
       <item>
        <layout class="QVBoxLayout" name="verticalLayout_3">
         <item>
          <widget class="QLabel" name="label_3">
           <property name="styleSheet">
            <string notr="true">font: 700 14pt &quot;Segoe UI&quot;; color: rgb(0, 0, 0);</string>
           </property>
           <property name="text">
            <string>Ваше поле:</string>
           </property>
          </widget>
         </item>
         <item>
          <widget class="QGraphicsView" name="yourfield">
           <property name="sizePolicy">
            <sizepolicy hsizetype="Preferred" vsizetype="Preferred">
             <horstretch>0</horstretch>
             <verstretch>0</verstretch>
            </sizepolicy>
           </property>
           <property name="minimumSize">
            <size>
             <width>400</width>
             <height>400</height>
            </size>
           </property>
           <property name="maximumSize">
            <size>
             <width>400</width>
             <height>400</height>
            </size>
           </property>
           <property name="verticalScrollBarPolicy">
            <enum>Qt::ScrollBarAlwaysOff</enum>
           </property>
           <property name="horizontalScrollBarPolicy">
            <enum>Qt::ScrollBarAlwaysOff</enum>
           </property>
          </widget>
         </item>
        </layout>
       </item>
      </layout>
     </item>
     <item>
      <widget class="QLabel" name="whose_turn">
       <property name="styleSheet">
        <string notr="true">font: 700 16pt &quot;Segoe UI&quot;; color: rgb(0, 0, 0);</string>
       </property>
       <property name="text">
        <string>Ожидаем противника...</string>
       </property>
       <property name="alignment">
        <set>Qt::AlignCenter</set>
       </property>
      </widget>
     </item>
     <item>
      <spacer name="verticalSpacer">
       <property name="orientation">
        <enum>Qt::Vertical</enum>
       </property>
       <property name="sizeHint" stdset="0">
        <size>
         <width>20</width>
         <height>40</height>
        </size>
       </property>
      </spacer>
     </item>
     <item>
      <layout class="QHBoxLayout" name="horizontalLayout_2">
       <item>
        <spacer name="horizontalSpacer_2">
         <property name="orientation">
          <enum>Qt::Horizontal</enum>
         </property>
         <property name="sizeHint" stdset="0">
          <size>
           <width>40</width>
           <height>20</height>
          </size>
         </property>
        </spacer>
       </item>
       <item>
        <widget class="QPushButton" name="surrender">
         <property name="sizePolicy">
          <sizepolicy hsizetype="Maximum" vsizetype="Fixed">
           <horstretch>0</horstretch>
           <verstretch>0</verstretch>
          </sizepolicy>
         </property>
         <property name="text">
          <string>Выйти из игры</string>
         </property>
        </widget>
       </item>
      </layout>
     </item>
    </layout>
   </widget>
  </widget>
 </widget>
 <resources>
  <include location="../../resources.qrc"/>
 </resources>
 <connections/>
</ui>
```

src \ui \initgame.ui

```
<?xml version="1.0" encoding="UTF-8"?>
<ui version="4.0">
 <class>InitGame</class>
 <widget class="QMainWindow" name="InitGame">
  <property name="geometry">
   <rect>
    <x>0</x>
    <y>0</y>
    <width>650</width>
    <height>450</height>
   </rect>
  </property>
  <property name="windowTitle">
   <string>Морской Бой</string>
  </property>
  <property name="windowIcon">
   <iconset resource="../../resources.qrc">
```

```
    <normaloff>:/src/assets/icon.png</normaloff>:/src/assets/icon.png</iconset>
  </property>
  <widget class="QWidget" name="centralwidget">
   <widget class="QWidget" name="horizontalLayoutWidget">
    <property name="geometry">
     <rect>
      <x>25</x>
      <y>25</y>
      <width>600</width>
      <height>400</height>
     </rect>
    </property>
    <layout class="QHBoxLayout" name="horizontalLayout" stretch="2,1">
     <item>
      <widget class="QGraphicsView" name="field">
       <property name="sizePolicy">
        <sizepolicy hsizetype="Maximum" vsizetype="Maximum">
         <horstretch>0</horstretch>
         <verstretch>0</verstretch>
        </sizepolicy>
       </property>
       <property name="maximumSize">
        <size>
         <width>600</width>
         <height>400</height>
        </size>
       </property>
       <property name="verticalScrollBarPolicy">
        <enum>Qt::ScrollBarAlwaysOff</enum>
       </property>
       <property name="horizontalScrollBarPolicy">
        <enum>Qt::ScrollBarAlwaysOff</enum>
       </property>
      </widget>
     </item>
     <item>
      <layout class="QVBoxLayout" name="verticalLayout">
       <item>
        <spacer name="verticalSpacer">
         <property name="orientation">
          <enum>Qt::Vertical</enum>
         </property>
         <property name="sizeHint" stdset="0">
          <size>
           <width>20</width>
           <height>40</height>
          </size>
         </property>
        </spacer>
       </item>
       <item alignment="Qt::AlignHCenter">
        <widget class="QPushButton" name="begin_bot">
         <property name="sizePolicy">
          <sizepolicy hsizetype="Maximum" vsizetype="Fixed">
           <horstretch>0</horstretch>
           <verstretch>0</verstretch>
          </sizepolicy>
         </property>
         <property name="layoutDirection">
          <enum>Qt::LeftToRight</enum>
         </property>
         <property name="text">
          <string>Начать игру с ботом</string>
         </property>
        </widget>
       </item>
       <item>
        <spacer name="verticalSpacer_3">
         <property name="orientation">
          <enum>Qt::Vertical</enum>
         </property>
         <property name="sizeHint" stdset="0">
          <size>
           <width>20</width>
           <height>40</height>
          </size>
         </property>
        </spacer>
       </item>
       <item>
        <layout class="QHBoxLayout" name="horizontalLayout_2" stretch="2,1">
         <item>
          <widget class="QTextEdit" name="join_ip">
           <property name="sizePolicy">
            <sizepolicy hsizetype="Preferred" vsizetype="Maximum">
             <horstretch>0</horstretch>
             <verstretch>0</verstretch>
            </sizepolicy>
           </property>
           <property name="maximumSize">
            <size>
             <width>16777215</width>
             <height>30</height>
            </size>
           </property>
           <property name="placeholderText">
            <string>IP-адрес</string>
           </property>
          </widget>
         </item>
         <item>
          <widget class="QTextEdit" name="join_port">
           <property name="sizePolicy">
            <sizepolicy hsizetype="Preferred" vsizetype="Maximum">
             <horstretch>0</horstretch>
             <verstretch>0</verstretch>
            </sizepolicy>
           </property>
           <property name="maximumSize">
            <size>
             <width>16777215</width>
             <height>30</height>
            </size>
           </property>
           <property name="placeholderText">
            <string>Порт</string>
           </property>
          </widget>
         </item>
        </layout>
       </item>
       <item alignment="Qt::AlignHCenter">
        <widget class="QPushButton" name="begin_join">
         <property name="sizePolicy">
          <sizepolicy hsizetype="Maximum" vsizetype="Fixed">
           <horstretch>0</horstretch>
           <verstretch>0</verstretch>
          </sizepolicy>
         </property>
         <property name="text">
          <string>Присоединиться к игре</string>
         </property>
        </widget>
       </item>
       <item>
        <spacer name="verticalSpacer_4">
         <property name="orientation">
          <enum>Qt::Vertical</enum>
         </property>
         <property name="sizeHint" stdset="0">
          <size>
           <width>20</width>
           <height>40</height>
          </size>
         </property>
        </spacer>
       </item>
       <item alignment="Qt::AlignHCenter">
        <widget class="QPushButton" name="begin_create">
         <property name="sizePolicy">
```

```
          <sizepolicy hsizetype="Maximum" vsizetype="Fixed">
           <horstretch>0</horstretch>
           <verstretch>0</verstretch>
          </sizepolicy>
         </property>
         <property name="text">
          <string>Создать игру</string>
         </property>
        </widget>
       </item>
       <item>
        <spacer name="verticalSpacer_2">
         <property name="orientation">
          <enum>Qt::Vertical</enum>
         </property>
         <property name="sizeHint" stdset="0">
          <size>
           <width>20</width>
           <height>40</height>
          </size>
         </property>
        </spacer>
       </item>
      </layout>
     </item>
    </layout>
   </widget>
  </widget>
 </widget>
 <resources>
  <include location="../../resources.qrc"/>
 </resources>
 <connections/>
</ui>
```

src \utils \moveableobjectship.cpp

```
#include <utils/moveableobjectship.h>

#include <widgets/fieldwidget.h>

MoveableObjectShip::MoveableObjectShip(QGraphicsView *parent, Ship object,
                                       QPointF offset, FieldStyle *style)
    : MoveableObjectAdapter<Ship>(parent, object, offset, style) {
  init();
}

QGraphicsItem *MoveableObjectShip::construct_object() {
  double height = parent->height() - style->getPenGrid().width();
  double width = parent->width() - style->getPenGrid().width();
  double tile_size_height = height / GAME_SIZE;
  double tile_size_width = width / GAME_SIZE;

  double beg_x = style->getPaddingPercent() * tile_size_width;
  double end_x = (((this->object.is_horizontal ? this->object.length : 1)) -
                  style->getPaddingPercent()) *
                 tile_size_width;
  double beg_y = style->getPaddingPercent() * tile_size_height;
  double end_y = (((this->object.is_horizontal ? 1 : this->object.length)) -
                  style->getPaddingPercent()) *
                 tile_size_height;

  auto res = new QGraphicsRectItem(beg_x, beg_y, end_x, end_y);
  res->setPen(style->getPenShip());
  res->setBrush(style->getBrushShip());

  return res;
}
```

src \widgets \fieldstyle.cpp

```
#include <QImage>
#include <widgets/fieldstyle.h>

double FieldStyle::DEFAULT_PADDING_PERCENT = 0.15;
QPen FieldStyle::DEFAULT_PEN_GRID = QPen(Qt::gray, 3);
QPen FieldStyle::DEFAULT_PEN_SHIP = QPen(Qt::blue, 3);
QBrush FieldStyle::DEFAULT_BRUSH_SHIP = QColor(0, 0, 255, 30);
std::string FieldStyle::DEFAULT_CROSS = ":/src/assets/cross_self.png";
std::string FieldStyle::DEFAULT_EXPLOSION = ":/src/assets/boom.png";

FieldStyle FieldStyle::STYLE_EDIT = FieldStyle(1);
FieldStyle FieldStyle::STYLE_PLAY_SELF = FieldStyle(1);
FieldStyle FieldStyle::STYLE_PLAY_ENEMY = FieldStyle(1);

FieldStyle::FieldStyle(std::optional<double> padding_percent,
                       std::optional<QPen> pen_grid,
                       std::optional<QPen> pen_ship,
                       std::optional<QBrush> brush_ship,
                       std::optional<std::string> cross,
                       std::optional<std::string> explosion)
    : padding_percent(
          padding_percent.value_or(FieldStyle::DEFAULT_PADDING_PERCENT)),
      pen_grid(pen_grid.value_or(FieldStyle::DEFAULT_PEN_GRID)),
      pen_ship(pen_ship.value_or(FieldStyle::DEFAULT_PEN_SHIP)),
      brush_ship(brush_ship.value_or(FieldStyle::DEFAULT_BRUSH_SHIP)) {
```

```
  std::string cross_path = cross.value_or(FieldStyle::DEFAULT_CROSS);
  std::string explosion_path =
      explosion.value_or(FieldStyle::DEFAULT_EXPLOSION);
  this->cross_img = new QPixmap(QString::fromStdString(cross_path));
  this->explosion_img = new QPixmap(QString::fromStdString(explosion_path));
}

FieldStyle::FieldStyle(int _) {
  delete this->cross_img;
  delete this->explosion_img;
}

void FieldStyle::initStyles() {
  FieldStyle::STYLE_EDIT = FieldStyle();
  FieldStyle::STYLE_PLAY_SELF = FieldStyle();
  FieldStyle::STYLE_PLAY_ENEMY =
      FieldStyle(std::nullopt, std::nullopt,
                 QPen(Qt::red, FieldStyle::DEFAULT_PEN_SHIP.widthF()),
                 QColor(255, 0, 0, 30), ":/src/assets/cross_enemy.png",
                 ":/src/assets/boom.png");
}

FieldStyle::~FieldStyle() {}

double FieldStyle::getPaddingPercent() { return this->padding_percent; }
QPen FieldStyle::getPenGrid() { return this->pen_grid; }
QPen FieldStyle::getPenShip() { return this->pen_ship; }
QBrush FieldStyle::getBrushShip() { return this->brush_ship; }
QPixmap &FieldStyle::getCrossImg() { return *this->cross_img; }
QPixmap &FieldStyle::getExplosionImg() { return *this->explosion_img; }
```

src \widgets \fieldwidget.cpp

```
#include <widgets/fieldwidget.h>

#include <QMouseEvent>
#include <QPixmap>

FieldWidget::FieldWidget(QGraphicsView *parent, FieldStyle *style)
      : QGraphicsScene(parent), style(style) {}

void FieldWidget::setField(Field field) {
  this->field = field;

  redraw();
}

Field FieldWidget::getField() { return this->field; }
```

```
void FieldWidget::redraw() {
  this->clear();
  auto parent = reinterpret_cast<QGraphicsView *>(this->parent());
  double height = parent->height() - style->getPenGrid().width();
  double width = parent->width() - style->getPenGrid().width();
  double tile_size_height = height / GAME_SIZE;
  double tile_size_width = width / GAME_SIZE;

  for (int i = 0; i < GAME_SIZE + 1; i++) {
    this->addLine(0, i * tile_size_height, parent->width(),
                  i * tile_size_height, style->getPenGrid());
    this->addLine(i * tile_size_width, 0, i * tile_size_width, parent->height(),
                  style->getPenGrid());
  }

  for (auto &ship : field.ships) {
    auto ship_data = getShipScenePos(ship);

    this->addRect(ship_data.first.x(), ship_data.first.y(),
                  ship_data.second.x() - ship_data.first.x(),
                  ship_data.second.y() - ship_data.first.y(),
                  style->getPenShip(), style->getBrushShip());
  }

  for (int y = 0; y < GAME_SIZE; y++) {
    for (int x = 0; x < GAME_SIZE; x++) {
      if (field.field[y][x] == FieldElement::EMPTY_CHECKED) {
        auto p = new QGraphicsPixmapItem(style->getCrossImg().scaled(
            tile_size_width * (1 - style->getPaddingPercent()),
            tile_size_height * (1 - style->getPaddingPercent())));
        p->setPos((x + style->getPaddingPercent()) * tile_size_width,
                  (y + style->getPaddingPercent()) * tile_size_height);
        this->addItem(p);
      } else if (field.field[y][x] == FieldElement::EXPOLSION_CHECKED) {
        auto p = new QGraphicsPixmapItem(style->getExplosionImg().scaled(
            tile_size_width * (1 - style->getPaddingPercent()),
            tile_size_height * (1 - style->getPaddingPercent())));
        p->setPos((x + style->getPaddingPercent()) * tile_size_width,
                  (y + style->getPaddingPercent()) * tile_size_height);
        this->addItem(p);
      }
    }
  }
}

int FieldWidget::getCollidedShipIndex(QPointF pos) {
  for (int i = 0; i < this->field.ships.size(); i++) {
    auto ship_data = getShipScenePos(this->field.ships[i]);
    if (pos.x() >= ship_data.first.x() && pos.x() <= ship_data.second.x() &&
        pos.y() >= ship_data.first.y() && pos.y() <= ship_data.second.y())
      return i;
  }

  return -1;
}

std::pair<QPointF, QPointF> FieldWidget::getShipScenePos(Ship &ship) {
  auto parent = reinterpret_cast<QGraphicsView *>(this->parent());
  double height = parent->height() - style->getPenGrid().width();
  double width = parent->width() - style->getPenGrid().width();
  double tile_size_height = height / GAME_SIZE;
  double tile_size_width = width / GAME_SIZE;

  double beg_x = (ship.x + style->getPaddingPercent()) * tile_size_width;
  double end_x = ((ship.x + (ship.is_horizontal ? ship.length : 1)) -
                  style->getPaddingPercent()) *
                 tile_size_width;
  double beg_y = (ship.y + style->getPaddingPercent()) * tile_size_height;
  double end_y = ((ship.y + (ship.is_horizontal ? 1 : ship.length)) -
                  style->getPaddingPercent()) *
                 tile_size_height;

  return {QPointF(beg_x, beg_y), QPointF(end_x, end_y)};
}

QPoint FieldWidget::getCellCoordinate(QPointF scene_pos) {
  auto parent = reinterpret_cast<QGraphicsView *>(this->parent());
  double height = parent->height() - style->getPenGrid().width();
  double width = parent->width() - style->getPenGrid().width();
  double tile_size_height = height / GAME_SIZE;
  double tile_size_width = width / GAME_SIZE;

  int x = scene_pos.x() / tile_size_width;
  int y = scene_pos.y() / tile_size_height;

  return {x, y};
}
```

src \widgets \fieldwidgetedit.cpp

```
#include <widgets/fieldwidgetedit.h>

FieldWidgetEdit::FieldWidgetEdit(QGraphicsView *parent, FieldStyle *style)
    : FieldWidget(parent, style) {}

void FieldWidgetEdit::mouseMoveEvent(QGraphicsSceneMouseEvent *event) {
  if (moveable_object != nullptr) {
    QPointF newPos = event->scenePos();
    moveable_object->onUpdateScenePos(newPos);
  }
}

void FieldWidgetEdit::mousePressEvent(QGraphicsSceneMouseEvent *event) {
  QPointF newPos = event->scenePos();
  if (event->button() == Qt::LeftButton) {
    auto index = getCollidedShipIndex(event->scenePos());
    if (index == -1)
      return;

    Ship ship = this->field.ships[index];
    auto ship_data = getShipScenePos(ship);
    this->field.ships.erase(this->field.ships.begin() + index);
    this->redraw();

    if (moveable_object != nullptr)
      delete moveable_object;
    this->moveable_object = new MoveableObjectShip(
        reinterpret_cast<QGraphicsView *>(this->parent()), ship,
        QPointF(ship_data.first.x() - event->scenePos().x(),
                ship_data.first.y() - event->scenePos().y()),
        style);
    this->moveable_object->onUpdateScenePos(newPos);
  } else if (event->button() == Qt::RightButton && this->moveable_object) {
    auto ship = this->moveable_object->getObject();
    ship.is_horizontal = !ship.is_horizontal;
    auto offset = this->moveable_object->getOffset();

    delete this->moveable_object;
    this->moveable_object = new MoveableObjectShip(
        reinterpret_cast<QGraphicsView *>(this->parent()), ship, offset, style);
    this->moveable_object->onUpdateScenePos(newPos);
  }
}

void FieldWidgetEdit::mouseReleaseEvent(QGraphicsSceneMouseEvent *event) {
  if (event->button() == Qt::LeftButton && moveable_object) {
    auto parent = reinterpret_cast<QGraphicsView *>(this->parent());
    double height = parent->height() - style->getPenGrid().width();
    double width = parent->width() - style->getPenGrid().width();
    double tile_size_height = height / GAME_SIZE;
    double tile_size_width = width / GAME_SIZE;
    auto ship = moveable_object->getObject();
    auto cell = getCellCoordinate(
        {event->scenePos().x() + moveable_object->getOffset().x() +
             0.5 * tile_size_width, // moveable_object->getOffset().x(),
         event->scenePos().y() + moveable_object->getOffset().y() +
              0.5 * tile_size_height}); //- moveable_object->getOffset().y()});
    ship.x = cell.x();
    ship.y = cell.y();

    if (ship.x < 0)
      ship.x = 0;
    if (ship.y < 0)
      ship.y = 0;
    if (ship.x + (ship.is_horizontal ? ship.length : 1) > GAME_SIZE)
      ship.x = GAME_SIZE - (ship.is_horizontal ? ship.length : 1);
    if (ship.y + (!ship.is_horizontal ? ship.length : 1) > GAME_SIZE)
      ship.y = GAME_SIZE - (!ship.is_horizontal ? ship.length : 1);

    delete this->moveable_object;
    moveable_object = nullptr;

    this->field.ships.push_back(ship);
    this->redraw();
  }
}
```

src \widgets \fieldwidgetplayenemy.cpp

```
#include <widgets/fieldwidgetplayenemy.h>

FieldWidgetPlayEnemy::FieldWidgetPlayEnemy(GameClient *client,
                                           QGraphicsView *parent,
                                           FieldStyle *style)
    : FieldWidget(parent, style), client(client) {}

void FieldWidgetPlayEnemy::mousePressEvent(QGraphicsSceneMouseEvent *event) {
  if (event->button() == Qt::LeftButton) {
    auto cell =
        getCellCoordinate({event->scenePos().x(), event->scenePos().y()});

    this->client->onStep(cell.x(), cell.y());
  }
}
```

src \widgets \gamewindow.cpp

```
#include <QPen>
#include <QTcpServer>
#include <game/client/connection.h>
#include <widgets/fieldwidgetplayenemy.h>
```

```cpp
#include <widgets/gamewindow.h>

#include "ui_game.h"

GameWindow::GameWindow(std::vector<Ship> ships, QWidget *parent)
    : QDialog(parent), ui(new Ui::GameWindow) {
  ui->setupUi(this);
  this->ships = ships;

  ui->enemyfield->setScene(nullptr);
  ui->yourfield->setScene(nullptr);

  this->connect(ui->surrender, &QPushButton::clicked, this,
                &GameWindow::surrender);
}

GameWindow::~GameWindow() {
  delete enemy_field;
  delete ui;
}

void GameWindow::showEvent(QShowEvent *event) {
  QDialog::showEvent(event);

  if (this->ui->enemyfield->scene() == nullptr) {
    this->enemy_field = new FieldWidgetPlayEnemy(this, ui->enemyfield,
                                                 &FieldStyle::STYLE_PLAY_ENEMY);
    this->ui->enemyfield->setScene(this->enemy_field);
    this->enemy_field->field = this->game.enemy_field;
    this->enemy_field->redraw();
  }
  if (this->ui->yourfield->scene() == nullptr) {
    this->own_field =
        new FieldWidget(ui->yourfield, &FieldStyle::STYLE_PLAY_SELF);
    this->ui->yourfield->setScene(this->own_field);
    this->own_field->field = this->game.own_field;
    this->own_field->redraw();
  }
}

void GameWindow::onUpdate(Game g) {
  this->game = g;

  if (this->enemy_field) {
    this->enemy_field->field = this->game.enemy_field;
    this->enemy_field->redraw();
  }
  if (this->own_field) {
    this->own_field->field = this->game.own_field;
    this->own_field->redraw();
  }

  if (!this->game.game_over) {
    if (this->game.youre_going) {
      this->ui->whose_turn->setText("Ваш ход");
    } else {
      this->ui->whose_turn->setText("Ход противника");
    }
  } else {
    if (this->game.youre_winner) {
      if (this->game.reason == WinningReason::FAIR)
        this->ui->whose_turn->setText("Вы победили");
      else if (this->game.reason == WinningReason::SURRENDER)
        this->ui->whose_turn->setText("Противник сдался");
    } else {
      this->ui->whose_turn->setText("Вы проиграли");
    }
  }
}

void GameWindow::onError(ErrorCode error) {
  switch (error) {
  case NO_HANDSHAKE:
  case BAD_HANDSHAKE:
    handshake_ok = false;
    this->close();
    break;
  default:
    break;
  }
}

void GameWindow::init() {
  this->handshake_ok = true;
  this->conn->sendHandshake(this->ships);
}

void GameWindow::closeEvent(QCloseEvent *event) { this->onSurrender(); }

void GameWindow::surrender() { this->close(); }
```

src \widgets \initgame.cpp

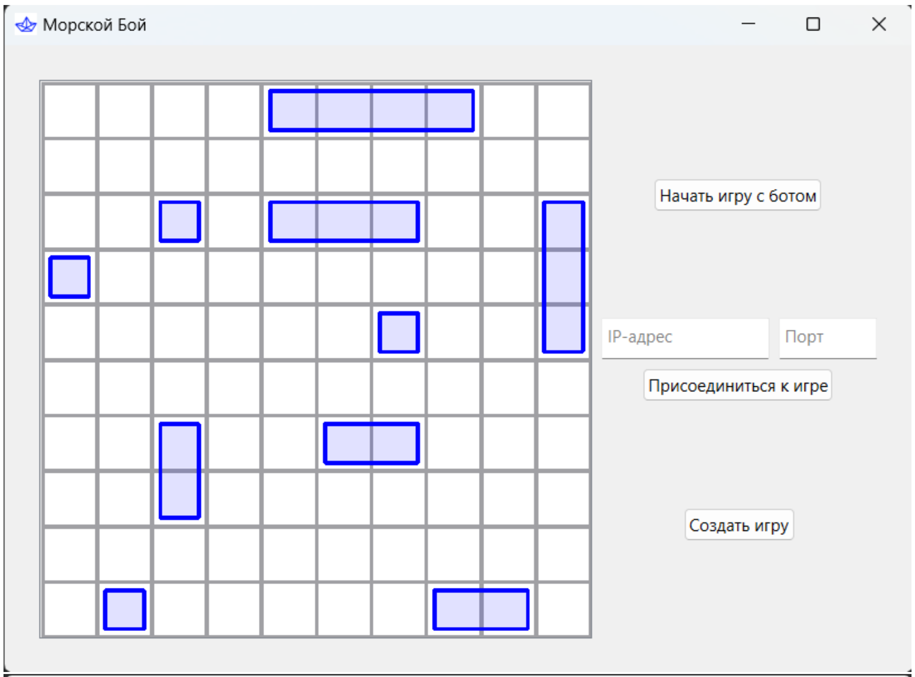
```
#include <widgets/initgame.h>

#include <game/client/botclient.h>
#include <game/client/tcpconnectionstrategy.h>
#include <game/gamebuilder.h>
```

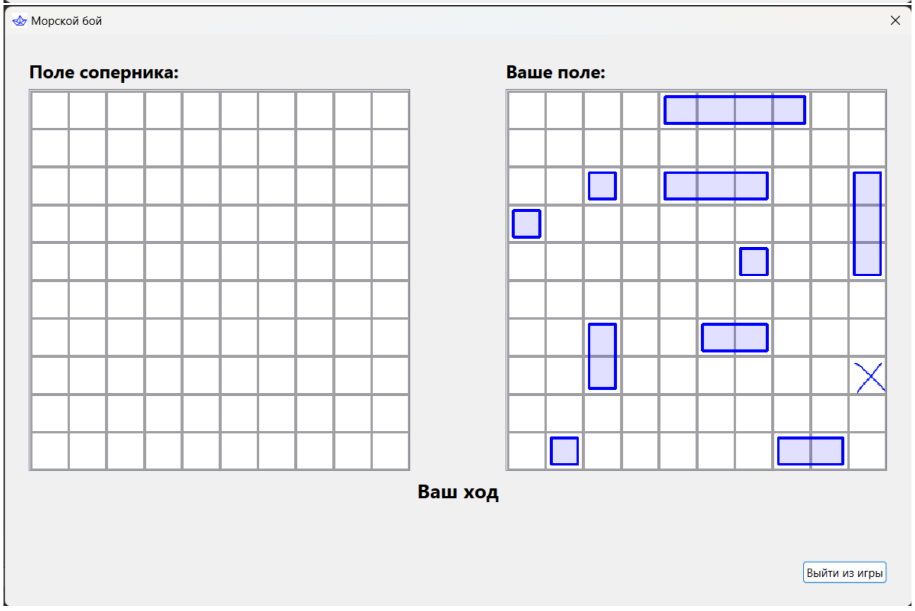
```
#include <widgets/gamewindow.h>

#include <QNetworkInterface>
#include <QTcpSocket>
#include <sstream>

#include "ui_initgame.h"

InitGame::InitGame(QWidget *parent)
    : QMainWindow(parent), ui(new Ui::InitGame) {
  ui->setupUi(this);

  ui->field->setMouseTracking(true);
  ui->field->setScene(nullptr);

  this->connect(ui->begin_bot, &QPushButton::clicked, this,
                &InitGame::beginBot);
  this->connect(ui->begin_create, &QPushButton::clicked, this,
                &InitGame::beginCreate);
  this->connect(ui->begin_join, &QPushButton::clicked, this,
                &InitGame::beginJoin);
}

void InitGame::beginJoin() {
  if (game_going)
    return;
  if (this->server)
    return;
  auto ip = ui->join_ip->toPlainText().toStdString();
  auto port = ui->join_port->toPlainText().toInt();

  QTcpSocket *socket = new QTcpSocket(this);
  socket->connectToHost(QHostAddress(QString::fromStdString(ip)), port);

  if (socket->waitForConnected()) {
    game_window = new GameWindow(
        reinterpret_cast<FieldWidgetEdit *>(ui->field->scene())->field.ships);
    game_window->conn = new ClientConnection(
        new TCPClientConnectionStrategy(game_window, socket, this));

    this->hide();
    game_going = true;
    game_window->init();
    game_window->exec();
    this->show();

    delete game_window;

    game_going = false;
  }
```

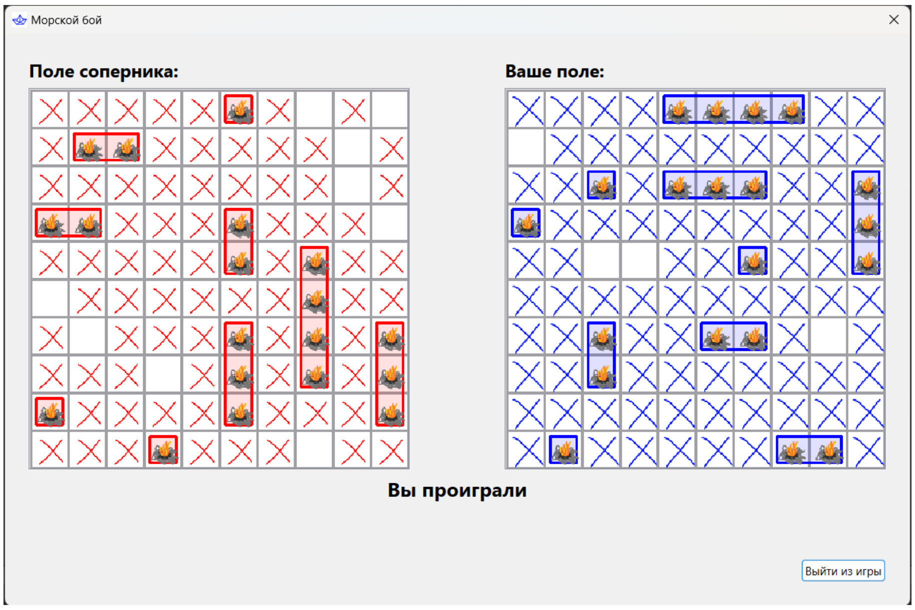
```
}

void InitGame::newConnection() {
  QTcpSocket *socket = this->server->nextPendingConnection();
  if (game_going) {
    socket->close();
    return;
  }

  game_window = new GameWindow(
      reinterpret_cast<FieldWidgetEdit *>(ui->field->scene())->field.ships);
  auto game_server = GameBuilder().playing(game_window)->vs(socket)->begin();

  if (game_window->handshake_ok) {
    this->hide();
    game_going = true;
    game_window->exec();
  }
  this->show();

  delete game_window;
  delete game_server;
  game_going = false;
}

void InitGame::downServer() {
  if (!this->server)
    return;
  this->server->close();
  delete this->server;
  this->server = nullptr;
  this->ui->begin_bot->setEnabled(true);
  this->ui->begin_join->setEnabled(true);

  this->ui->begin_create->setText("Создать игру");
}

void InitGame::setupServer() {
  if (this->server)
    return;
  std::stringstream btntext;
  btntext << "Порт для подключения: ";
  this->server = new QTcpServer(this);
  this->server->listen(QHostAddress::LocalHost);
  btntext << this->server->serverPort();
  this->ui->begin_create->setText(QString::fromStdString(btntext.str()));
  this->ui->begin_bot->setEnabled(false);
  this->ui->begin_join->setEnabled(false);

  this->connect(this->server, &QTcpServer::newConnection, this,
                &InitGame::newConnection);
}

void InitGame::beginCreate() {
  if (this->server) {
    downServer();
  } else {
    setupServer();
  }
}

InitGame::~InitGame() { delete ui; }

void InitGame::showEvent(QShowEvent *event) {
  QMainWindow::showEvent(event);

  if (ui->field->scene())
    return;
  auto scene = new FieldWidgetEdit(ui->field);
  scene->setField(Field::generateRandom());

  ui->field->setScene(scene);
}

void InitGame::beginBot() {
  if (game_going)
    return;
  if (this->server)
    return;
  game_window = new GameWindow(
      reinterpret_cast<FieldWidgetEdit *>(ui->field->scene())->field.ships);
  auto bot_view = new BotGameClient();
  auto game_server = GameBuilder().playing(game_window)->vs(bot_view)->begin();

  if (game_window->handshake_ok) {
    this->hide();
    game_going = true;
    game_window->exec();
  }
  this->show();

  delete game_window;
  delete bot_view;
  delete game_server;
  game_going = false;
}
```

Ссылка на репозиторий: https://github.com/IAmProgrammist/cbattle

4 Результат работы, на предложенных тестовых данных







5 Вывод о проделанной работе

В ходе работы обобщены и закреплены знания о паттернах, используемых в объектно-ориентированном программировании, техниках рефакторинга, SOLID, создания графического интерфейса программы при использовании инструментов C++ и QT, проектирования системы клиент-сервер. В результате работы была разработана программа, моделирующая игру Морской Бой, позволяющая играть в неё как с компьютером, так и с другим игроком при помощи протокола TCP.

6 Список источников и литературы

1. QT Documentation [Электронный ресурс]
   Режим доступа: https://doc.qt.io/

2. Паттерны проектирования на C++ [Электронный ресурс]
   Режим доступа: https://refactoringguru.cn/ru/design-patterns/cpp

3. C++ Reference [Электронный ресурс]
   Режим доступа: https://en.cppreference.com/w/