Board Game Framework

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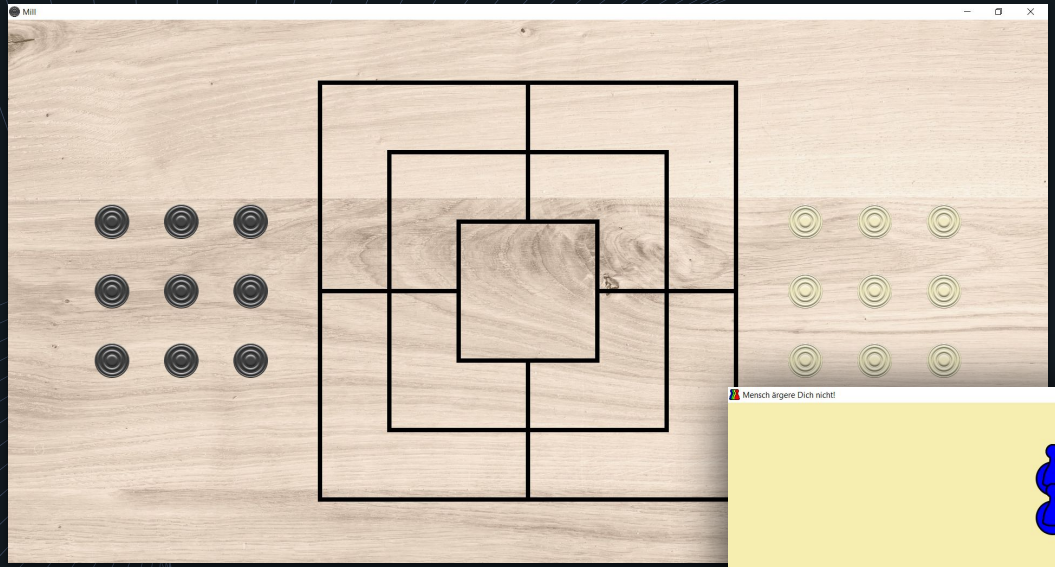
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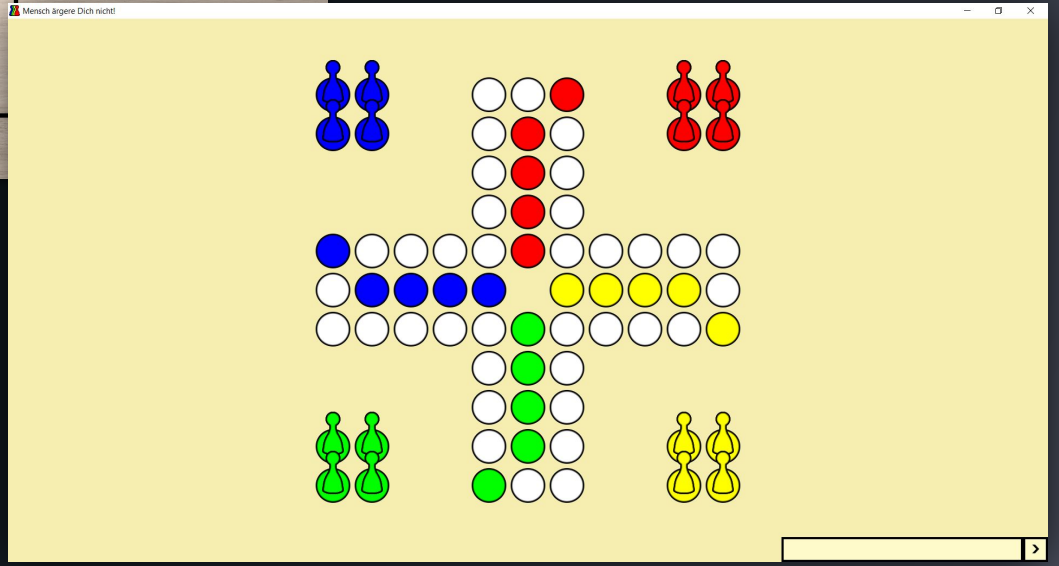
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Used Dependencies

- Java Development Kit 16
  - Java Sockets
- LWJGL 3 (“Lightweight Java Game Library”)
  - OpenGL
  - GLFW
  - JOML
- Gson
- Maven

https://www.lwjgl.org/customize

Game Loop

```
while(!isCloseRequested()) {
    currentMillis += System.currentTimeMillis() - lastMillis;
    lastMillis = System.currentTimeMillis();

    if(currentMillis >= MILLIS_PER_TICK) {
        update();
        currentMillis -= MILLIS_PER_TICK ;
    }

    render((double) currentMillis / MILLIS_PER_TICK) ;
}
```

Render vs. Update

Render Tick

- All ticks are render ticks
- Irregularly, untimed, unsteady
- Update visual representation (interpolation)
- A.k.a. “frame”, “FPS”

Update Tick

- Not all ticks are update ticks
- Regularly, timed, steady
- Update game logic, input listeners, received packets
- A.k.a. “tick”, “TPS”

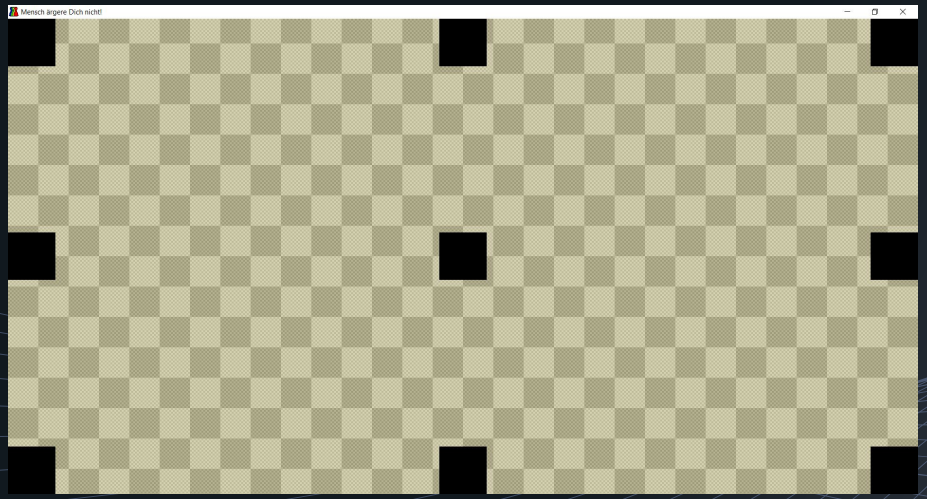
Engine

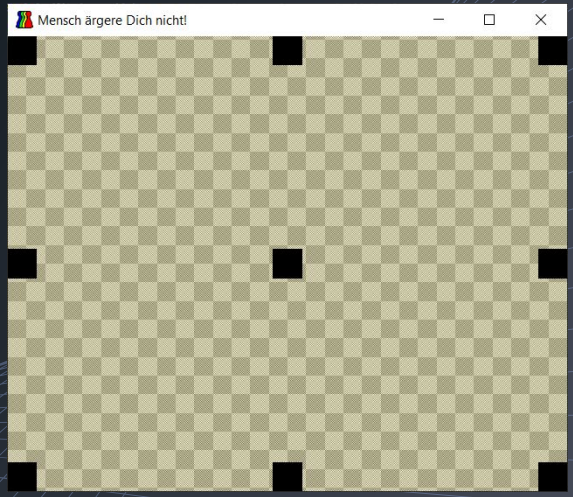
- 1 main game instance
- 1 engine instance
- 1 window instance
- ...

→ Singleton design pattern

User Interface FW

Anchor-Points





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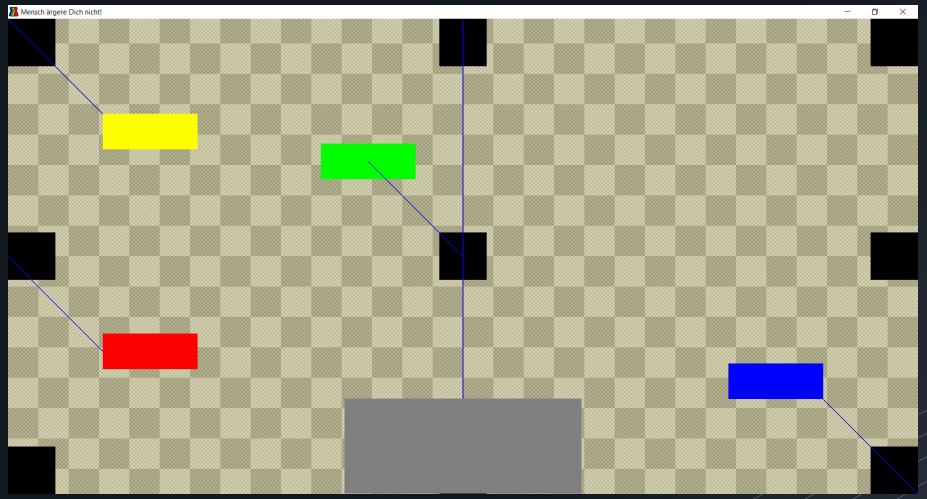
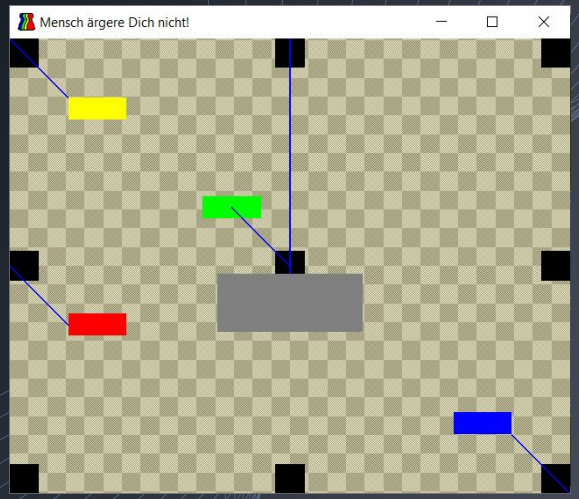




Widgets

- No-functionality widget (visuals only)
- Button widget
- Selectable widget (checkmark)
- Text input widget
- ...

- Ludo nodes, figures, dice animation...

Widgets

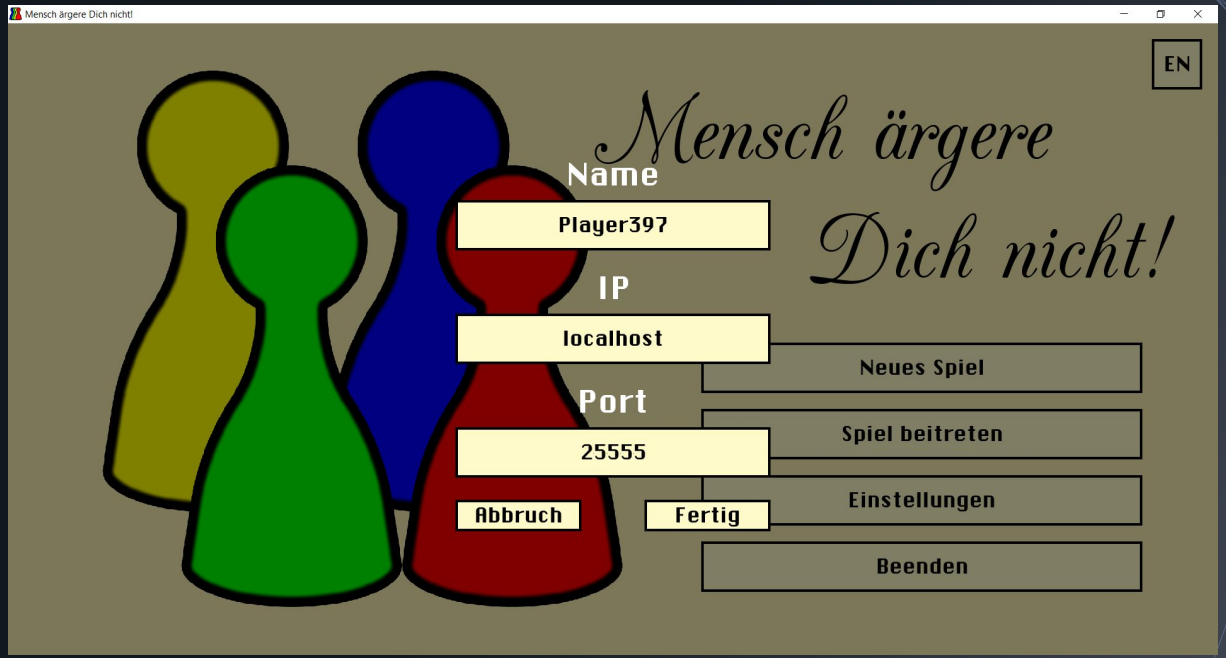
```
void update(int mouseX, int mouseY);
void render(float deltaTick, int mouseX, int mouseY);
void mouseButtonPressed(int mouseX, int mouseY, int mouseButton, int mods);
void mouseButtonReleased(int mouseX, int mouseY, int mouseButton, int mods);
void keyPressed(int key, int mods);
void keyRepeated(int key, int mods);
void keyReleased(int key, int mods);
void charTyped(char character);
```

Styles

- Textures
- Text
- Colored quads and borders
- Mouse-hovering based styles
- ...
- Styles are stackable, customizable, mergeable...
- → Decorator design pattern

Example Screens

Example Screens



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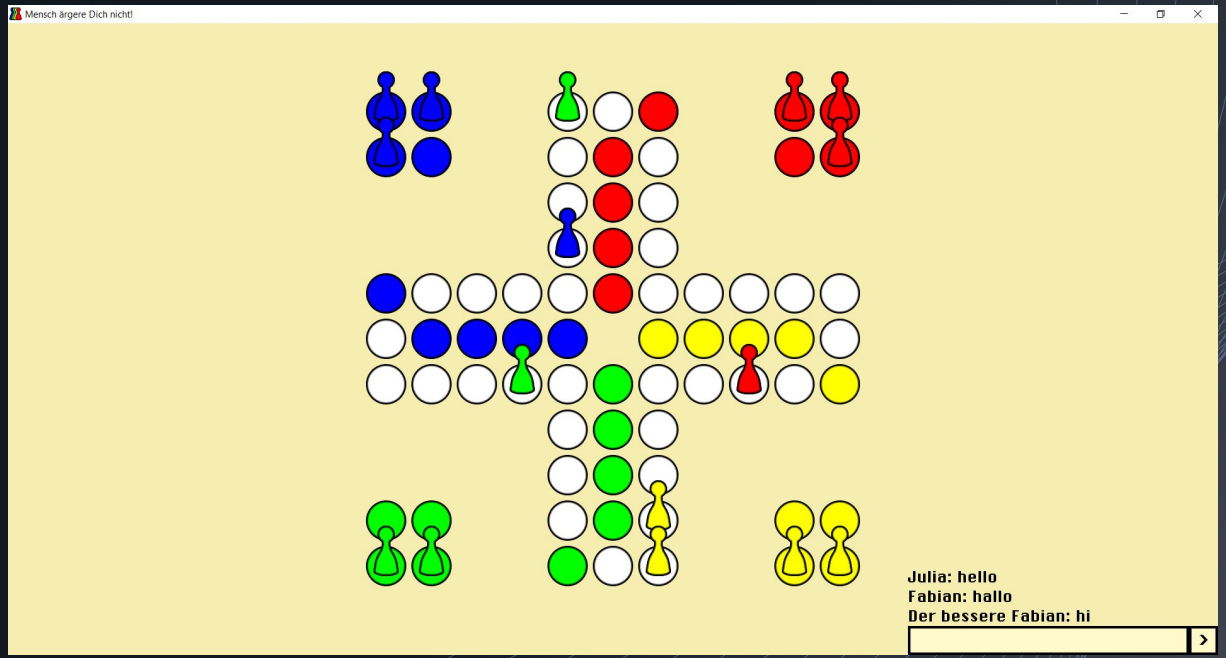

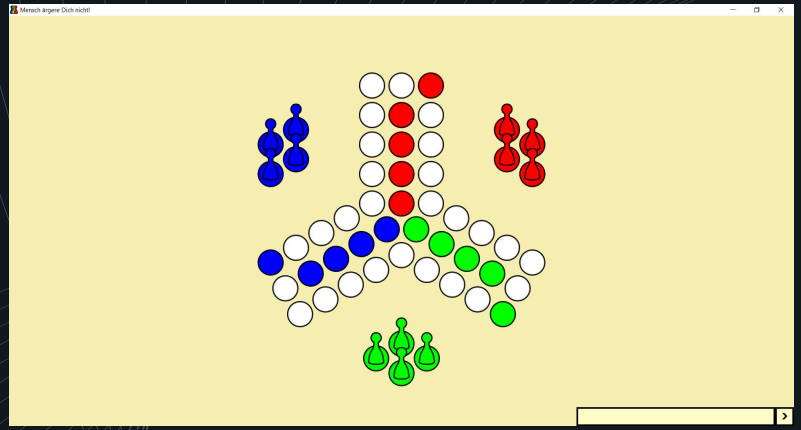
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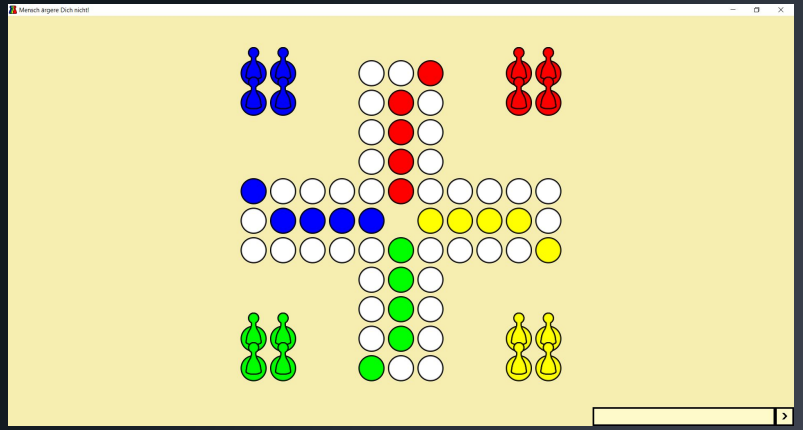
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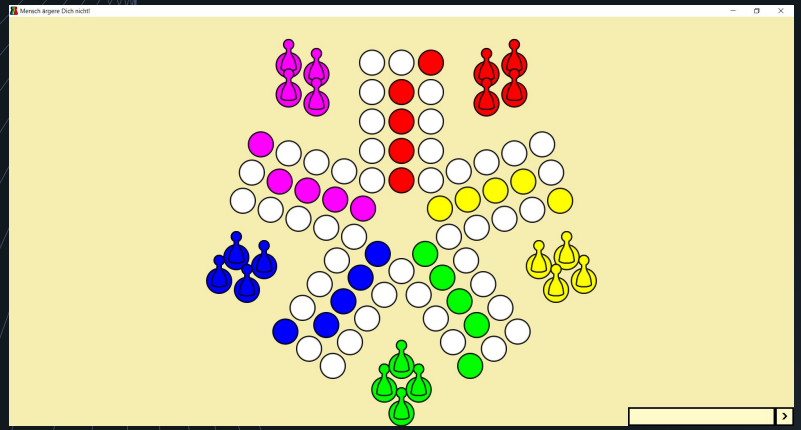
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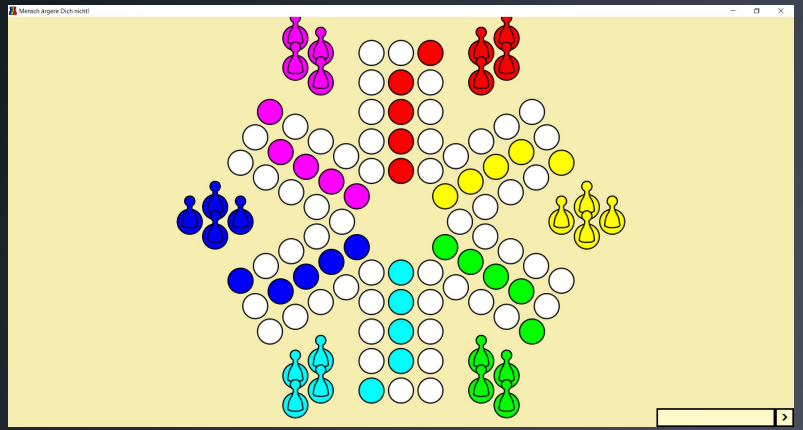
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Example Screens

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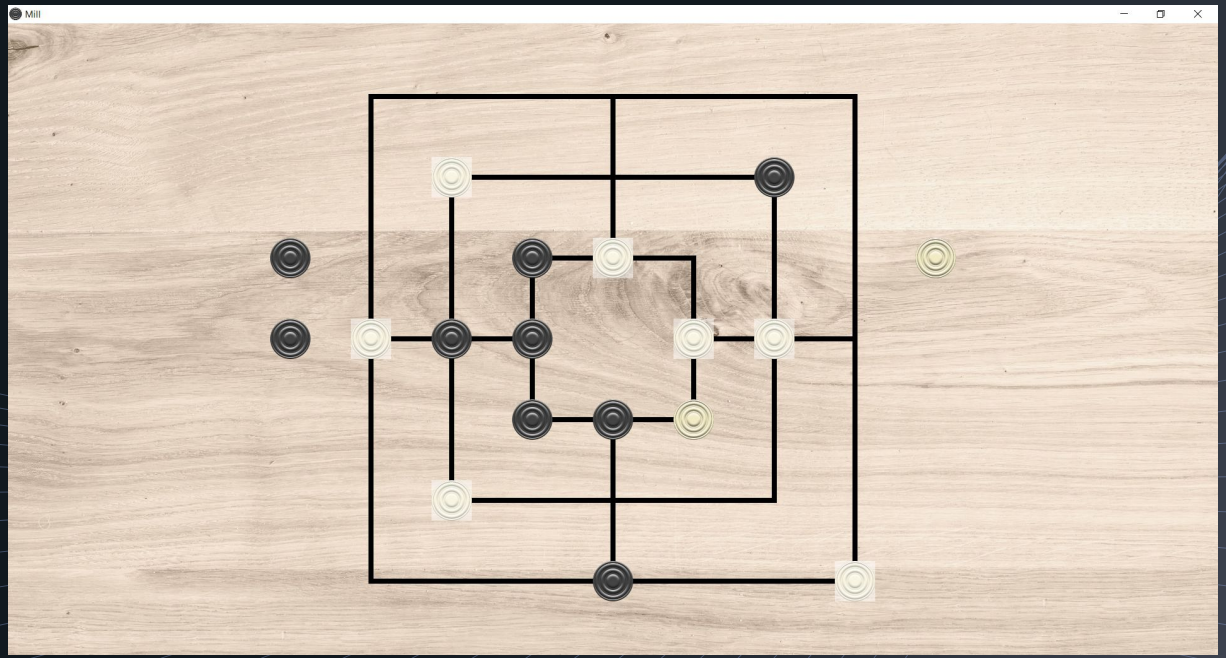

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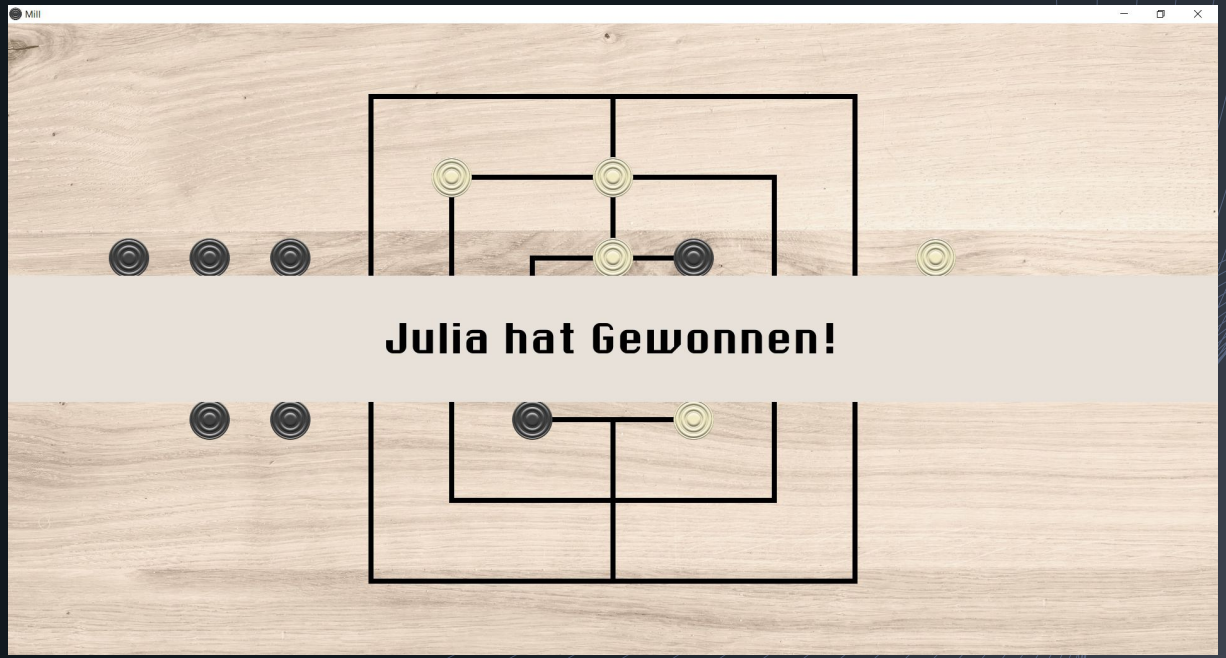


Board Game FW

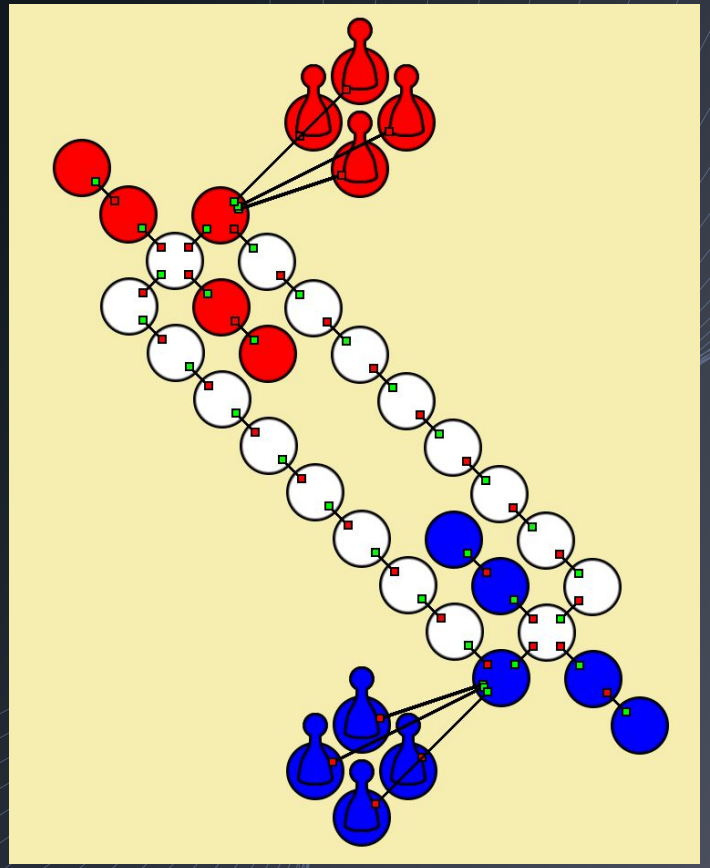
Structure

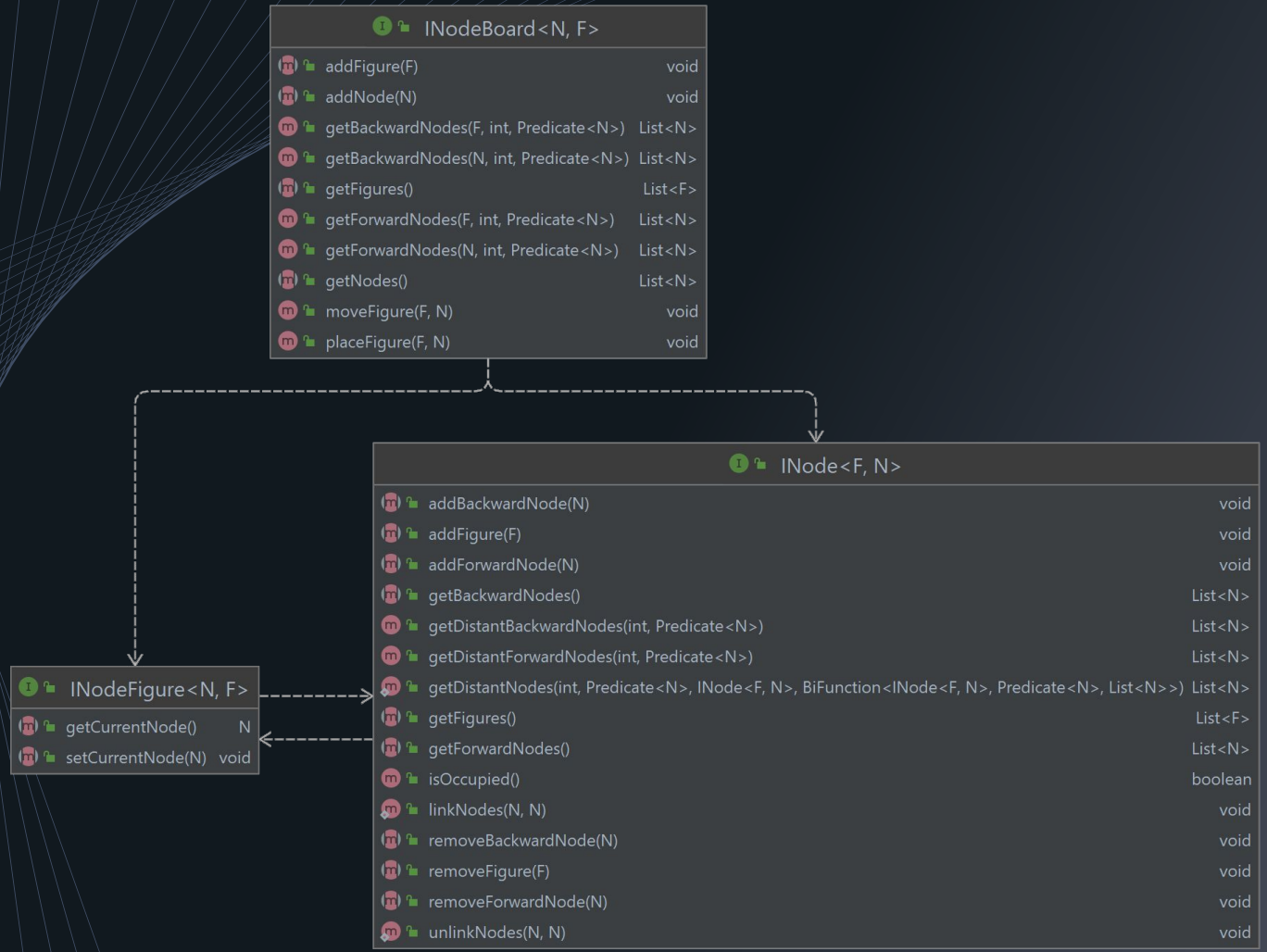
Nodes

- Board as graph like structure
- Nodes linked to neighbours

Alternative: Array or matrix

- Fields structure as array
- For games like chess




INodeBoard<N, F>
addFigure(F) void
addNode(N) void
getBackwardNodes(F, int, Predicate<N>) List<N>
getBackwardNodes(N, int, Predicate<N>) List<N>
getFigures() List<F>
getForwardNodes(F, int, Predicate<N>) List<N>
getForwardNodes(N, int, Predicate<N>) List<N>
getNodes() List<N>
moveFigure(F, N) void
placeFigure(F, N) void
INode<F, N>
addBackwardNode(N) void
addFigure(F) void
addForwardNode(N) void
getBackwardNodes() List<N>
getDistantBackwardNodes(int, Predicate<N>) List<N>
getDistantForwardNodes(int, Predicate<N>) List<N>
getDistantNodes(int, Predicate<N>, INode<F, N>, BiFunction<INode<F, N>, Predicate<N>, List<N>>) List<N>
getFigures() List<F>
getForwardNodes() List<N>
isOccupied() boolean
linkNodes(N, N) void
removeBackwardNode(N) void
removeFigure(F) void
removeForwardNode(N) void
unlinkNodes(N, N) void
INodeFigure<N, F>
getCurrentNode() N
setCurrentNode(N) void

Further Important Classes

Dice

- Generic dice implementation
- Custom faces and face number

TeamColor

- TeamNode
- TeamNodeFigure
- Nodes and figures with team and color

General Game Implementation

- Board
  - Stores current game state
- Screen
  - Displays board and subscreens
- GameLogic
  - Controls the gameflow
- MVC Pattern

Internationalization

- Multi-Language Support
  - English
  - German

- Language set in Json-file
  - Loaded via Gson
  - Input key to get localized output
    (eg. “menu.main.connect” -> “Spiel beitreten”)

Networking FW

About Networking

- Java Sockets (TCP)
- Packet/Message based
- Host-Client network
  - The host is also a client!
- No dedicated server
- Internet + LAN
- Very easy usage!

Host vs. Client

Host

- Integrated server
- No message delay
- Messages to integrated server are run immediately (also for server → host-client)

Client

- Connected to server (host)
- Message delay (ping)
- Messages to server are encoded, decoded, then run (also for server → client)

→ Host and client are only different in what interface they used to send messages to the server; otherwise their client-code is the same!

Simple vs. Advanced Networking

Simple Networking Protocol

- Connect to or host a server
- Send messages
- Receive and run messages
- Close the connection
- Know when a client has connected

Advanced Networking Protocol

- Simple networking included
- Authentication + Player names
- Know when the other side closed their connection
- Know when the connection has been lost (heartbeating)
- Know when you got kicked
- ...

Example Usages

```
hostManager = NetworkHelper.advancedHost(protocol, hostEventsListener,
                LudoClient::new, playerName, port);
hostManager.sendMessageToAllClients(new ChatMessage(client.getName(), text));
hostManager.kickClient(client, "No cheating!");
```

```
clientManager = NetworkHelper.advancedConnect(protocol, clientEventsListener,
                  playerName, ip, port);
clientManager.sendMessageToServer(new ChatMessage(inputWidget.getText()));
```

Open Source!

https://github.com/CAS-ual-TY/plus-board-game-framework