Note!

The program requires a working connection to the internet and using a VPN might make the suggestions provided somewhat weird as the program uses the machine's public IP to favour search results in the same country.

The use of this program requires a valid API key (NOT INCLUDED!) to the OpenWeatherAPI and that the key has been run through the KeyGen (found in package fi.tuni.prog3.keygen). The recommended encrypted key location and name is: "{working_dir}/secrets/ApiKeys/OpenWeather".

If used with another location than the one specified above, the file (with location) must be supplied as the first commandline argument to WeatherApp.

If for some reason the encryption system doesn't work or the user can't be bothered with using it, it can be nerfed by a quick modification to Key.Java.

For bugs/todos see TODO.md

1. Program structure and instructions

This program has been mainly divided into two different sections:

1. The frontend
2. The backend

1.1 Frontend structure and instructions for use

The frontend consists of one JavaFX stage (window) that then either displays a search scene or a weather scene to the user.

1.1.1 Search scene

The search scene consists of all a query field where the user can type a cities name and possibly a country code to specify the country (separated with ", ").

If the user clears the text-field they are displayed with their favourite cities and search history. As the user also starts to type for some city the program provides the user with some suggestions. To use an entry from the suggestion box simply click on the entry. Also pressing enter once ready with the typed query works as well.

Before querying for a result the user can also specify what units should be used. This is done by selecting the preferred unit from the dropdown under

1.1.2 Weather scene

Once the user queries for a city the program will switch from the search scene to the weather scene. If the user's query was erroneous (query wasn't found from the OpenWeather database), the user is simply prompted with a message of this error.

If the user's query was OK, the user will be provided with the following views or panes:

1. Current weather at the location
2. Daily weather forecast
3. Hourly weather forecast or 5-day forecast with 3 hour steps (depends on the on if the supplied API key has the permissions for the hourly forecasts)
4. A weather map centered around the given location

As the weather map by default consists of a 10x10 grid of images with 6 layers (1 base map + 5 weather layers) the program has to make 600 api calls it might take a few seconds for the map to appear (happens mostly in parallel but still might have a small delay). As this happens asynchronously, the text "Map is loading..." is displayed while the map formation takes place. Panning the map happens with scrolling (shift for horizontal) and selecting the weather layer happens from the dropdown on top of the map (top left corner).

To favourite a search result press the star symbol at the top of the window. To un-favourite uses the same mechanism.

To return to the search scene to press the magnifying glass symbol next to the star symbol.

To delete search history can also be done from the "Reset history" button.

1.2 Backend structure

The backend can be divided into "APIs" and "databases". These APIs are classes that can make API calls and databases are classes that work with local data. The backend can be divided into the following:

1. IPService (singleton for managing the IP_Getter API class)
2. OpenWeather API class
3. MaxMindGeoIP2 database class
4. Cities database class

To better understand the functionality of how API classes especially function, it strongly recommended to go and read the README.md files found inside: /backend/api/general/

1.2.1 IPService and IP_Getter

IP_Getter is a class that provides functionality for gaining the machine's public ip address. IP_Getter is class or a "structure" which only contains other classes/records which can be used for forming an IP_Getter API and then multiple different methods used to construct "callables" for the IP_Getter API (see /backend/api/general/README.md for a more concrete explanation of "callables").

IPService is basically an extension of IP_Getter as it simply is a singleton that goes through all the different defined callables in IP_Getter.callables and sets the IP address to the first valid result. This service can then be used anywhere around the code with simply calling IPService.getInstance().

1.2.2 OpenWeather API

This project utilizes the OpenWeather API for weather data. The OpenWeather API is called with just the API class, which is supplied with a so called "callable" (see /backend/api/general/README.md) that dictates the actual call url and the arguments passed. The responses to these calls can then be turned to their corresponding Java objects found from inside the same class as the callables themselves.

This fact can be utilized when making calls through the backend.

In addition to OpenWeather API calls the OpenWeather class is actually also able to call the OpenStreetMaps API in the WeatherMaps classes.

1.2.3 MaxMindGeoIP2 database

The MaxMindGeoIP2 database is a class that supplies is able to load the MaxMind GeoLite 2 Cities database and query it for an approximate geolocation based on a given IP address.

1.2.4 Cities database

For frontend to supply valid city suggestions the program includes a custom Cities database that contains all the possible cities in OpenWeather, and it supplies the top N guesses of what the user is trying to search for which the frontend then displays to the user. For a more in-depth description see the README.md files located inside: /backend/database/Cities/

2 Features and requirements

Requirements	Status/Location
The program compiles	Yes
The program uses the course provided user interface as its main window	Uses custom
The program allows the user to search for different locations	Yes
The program displays the current weather and a simple forecast	Yes
The program uses the weather icons provided by OpenWeatherMap	Uses custom
Uses at least one of the provided interfaces	Kinda[1]
The project version history is visible in gitlab	Yes[2]
A final document	Yes
A graphical user interface has been implemented by the team	Yes, me
The program allows saving locations as favourites	Yes
The state of the program is saved	Yes
Instead of the simple forecast a more detailed forecast is implemented	Yes
The program uses a custom set of icons	Yes[3]
The program handles errors during file processing	Yes[4]
Unit tests have been implemented for the program	Small, but yes

1 = The these interfaces don't exist anymore, as they didn't make any sense to keep. I could have implemented some class that writes some string to a file at the start and reads it just to conform to this

requirement. As I thought this was a useless feature I left it out as I also believe my code does show I understand interfaces in Java.

2 = See responsibilities section below.

3 = I made a completely new set of svg images with Adobe Illustrator of basic weather symbols and turned them into a font. Basically all icons that are displayed are composite glyphs, which allowed me to squeeze the font file to 6kb. The actual font can be viewed by opening the .sfd file with FontForge. Original inspiration for this method: https://www.reddit.com/r/Windows11/comments/1blat1r/windows_uses_fonts_for_loading_bars/

4 = Nuking MaxMind GeoLite2 and Fonts may result in the app not working (untested). I would have added a similar system to GeoLite as I did with Cities (loading from the web), but as this is behind an account I did not feel comfortable implementing such a solution and as I think this is more intended to relate to userdata.

In addition to the requirements the program also has quite a few additional features. The additional features implemented:

1. Weather Maps
2. Location search history
3. Supporting multiple systems of units of measurement
4. Own features:
    1. Public IP extraction and conversion to geolocation
    2. Suggestive autofill and cities database
    3. Parallel processing in most computationally expensive (aka slow) functions
    4. API Key encryption and decryption

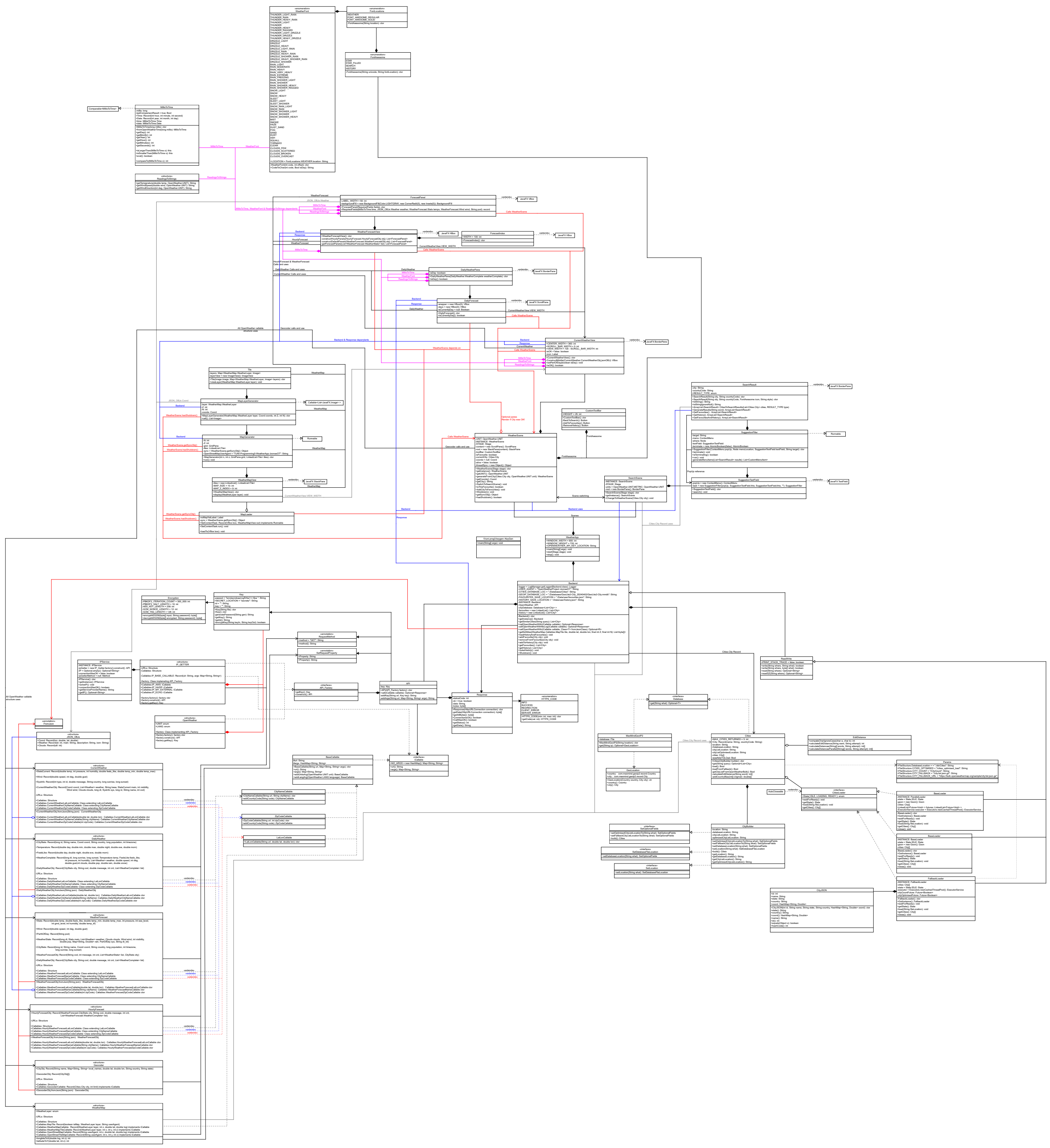
3 Responsibilities

This has completely been a one-man-show so 100% my very own work. This project has required me to pull 3 all-nighters so arguably is as far as I could have reached during this time limit. Also, as I started this project before receiving my gitlab repo, most of the work at the start was done over at my GitHub (https://github.com/JoonasOT/OpenWeatherTesting) so a more detailed history of the starting commits can be found from there.

4 The UML class diagram

The best descriptions of class responsibilities etc. can be found from the README.md files in each directory and from code comments.

The most recent version of the UML class diagram is the following (is a svg image so feel free to zoom as much as you like):



Note! This is not an excellent depiction of the classes included, but is the best I can do with my limited time.