Efficient Route Planning
SS 2012

Lecture 5, Wednesday May 23\textsuperscript{rd}, 2012
(Web application, Google Maps API)

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Overview of this lecture

- Organizational
  - Feedback and results from Exercise Sheet 4 (Arc Flags)
  - Date of the **exam**

- A route planner web application
  - We will build a full-fledged web app together today
  - You will learn about and see applied:
    - Google Maps API, HTML, DOM, CSS, JavaScript, jQuery, AJAX, JSON / JSONP, socket communication, ...
  - Our web app will let us specify an arbitrary source and target on the map ... and draw a straight line between them
  - **Exercise Sheet 5**: Same but with the **shortest path**
    - as computed by one of our fancy algorithms so far
Your Feedback on Ex. Sheet 4 (Arc Flags)

Summary / excerpts

- Didn't take as much time as the last exercises
- Implementation of arc flags doable in a few hours
- If more time, then due to code refactoring or stupid mistakes
- Both implementation advice and feedback from the tutors was again very useful
- Is it possible to combine A* with Arc Flags?
- Additional bookkeeping (like parent pointers) slows down Dijkstra significantly ... does it really?
- Google Fusion Tables are nice
  - but unhappy about need to create a Google Account
- Video recording was missing ... no it wasn't!
Your experimental results (Arc Flags)

See the table on the Wiki

- Comparison Dijkstra / A*-Landmarks / Arc Flags
- Let's look at the figures for BaWü
  - settled nodes: 1.2M / 50K / 20K
  - query time: 0.5s / 20ms / 10ms
  - precomputation time: 0 / 1min / 2min for one region
- That is (only) a factor-2 improvement in query time
  - at the price of a much higher precomputation cost
Final exam

- We need to agree on a date
  - Any preferences on your side?
  - It must be in the period **August 13 - September 28**
  - Suggestion: **Tuesday, August 21, 2:00pm**
Components of a web-based route planner

- **Backend**
  - Your code to solve the shortest path problem
  - Additional code to listen to queries on a given port
  - And to send the result in a form suitable for the frontend

- **Frontend**
  - Code that runs on the client's browser
  - Registers events, like a click on the map somewhere
  - Sends queries to the backend
  - Visualizes results sent from backend
Technologies needed  1/2

- On the side of the backend
  - Socket communication
    - Listen for requests on a given port
    - Parse request string
    - Sent back answer string
  - In C++ easy with `boost::asio` (asio = asynchronous IO)
  - In Java easy with `java.net.Socket / java.net.ServerSocket`
  - See code examples in the SVN ... under `lectures/lecture-5`
Technologies needed  2/2

- **On the frontend side** (very briefly, see references for details)
  - **HTML**: for a web page that holds the map
  - **DOM**: the elements of the HTML page
  - **CSS**: the layout of the elements of the HTML page
  - **JavaScript**: code loaded and run along with the web page
  - **jQuery**: JavaScript library with lots of useful functions
  - **Google Maps API**: JavaScript library with lots of useful functions to draw maps and manipulate with them...
  - **AJAX**: sending queries from the client to a server and receiving results *asynchronously*
  - **JSON/JSONP**: a string containing JavaScript code
Maps Demo

- We will now write a complete web app together
  - Display a map (as we know it from Google Maps)
  - Place to markers on it (source and target)
  - Make the markers draggable
  - Whenever one of the markers is dragged:
    - sent coordinates of markers to the server
    - receive path between markers from the server
    - draw that line
  - This will contain **all** the technological elements from the last two slides ... which you also need for Ex. Sheet 5
References

- **Google Maps JavaScript API V3**

- **JavaScript und CSS**
  - [http://www.w3schools.com/js/default.asp](http://www.w3schools.com/js/default.asp)
  - [http://www.w3schools.com/css/default.asp](http://www.w3schools.com/css/default.asp)

- **jQuery**
  - [http://jquery.com/](http://jquery.com/)

- **AJAX, JSON, JSONP, ...**