Train Ultraprecise Monitoring

Praktikum: Network Simulation

Moodle Specification

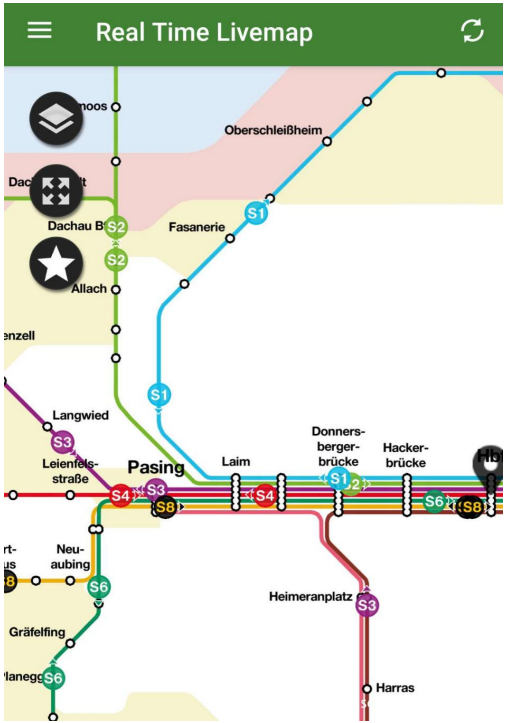
As announced in today's lecture, we are slowly approaching the hand-out date of the first assignment. In preparation, we would like to ask you to do two things:In your newly found groups, please think about what application you could implement for the first assignment as teased in today's lecture. You will be tasked with an implementation of an application into OMNeT++ and INET Framework.
Your application will have to fulfil the following requirements:

- Needs to be able to adapt to network conditions and configuration inputs (e.g., request different volume of data based on intervals between received packets, or transmits data based on fake/randomized user input)
- Needs to support communication with a freely selectable number of servers in parallel
- Requires your own implementation of a server with a logic supporting the application
- Should be based on a real application (source required)
- Note: The volume of traffic, not the actual content is important!
- Note: Keep in mind that at some point you'll have to use it as a mobile application!
- Some examples: Online Games, Video on Demand streaming, VR streaming, tele surgery, etc.

We are looking forward to your ideas next Friday. We would appreciate if you could prepare a slide describing your idea, so we can have some discussions.

Real-time Train Live Map

- Three actors
  - **Clients -** Users of the App
  - **Servers -** Contain information about trains
  - **Train Information Point -** Updates servers with train locations
- Simulate two different types of communications
  - **Train Information Points to Server -** Time and place of the train
  - **Client to Server -** Request train locations in real-time
- Simulate one of two paradigms
  - **Request Reply -** Clients initiate requests to server
  - **Publish Subscribe -** Server publishes information to clients (subscribers)
- Supports requesting varying volumes of data
  - Vary train information size
  - Increase frequency of train updates
  - Increase the number of clients, trains, tracks
- Easily parameterizable
  - Tracks + Trains
  - Clients
  - Servers



Source: München Navigator App

Traffic Patterns

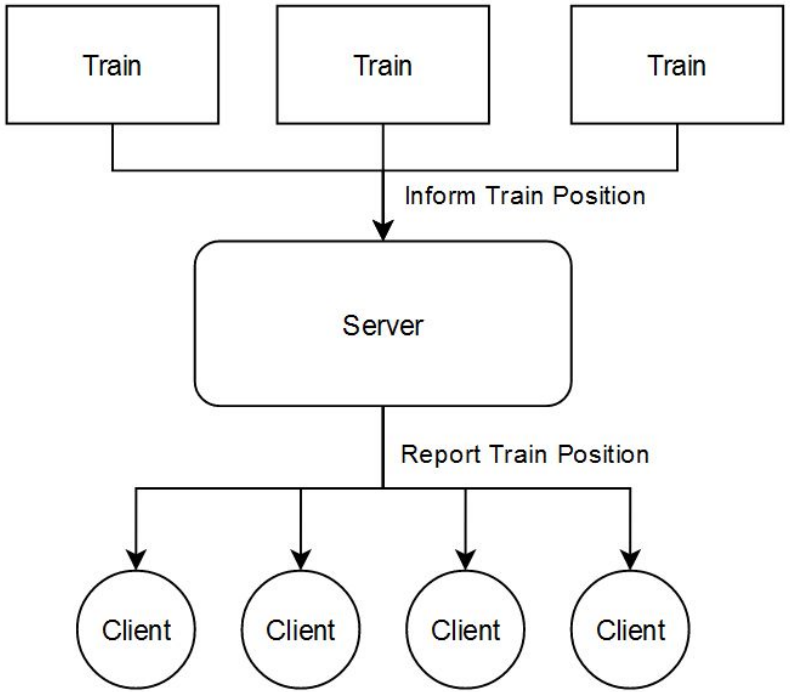
Clients

- Many simultaneous clients connected
- Most remain interested in updates for short periods of time
- Mobile-based users

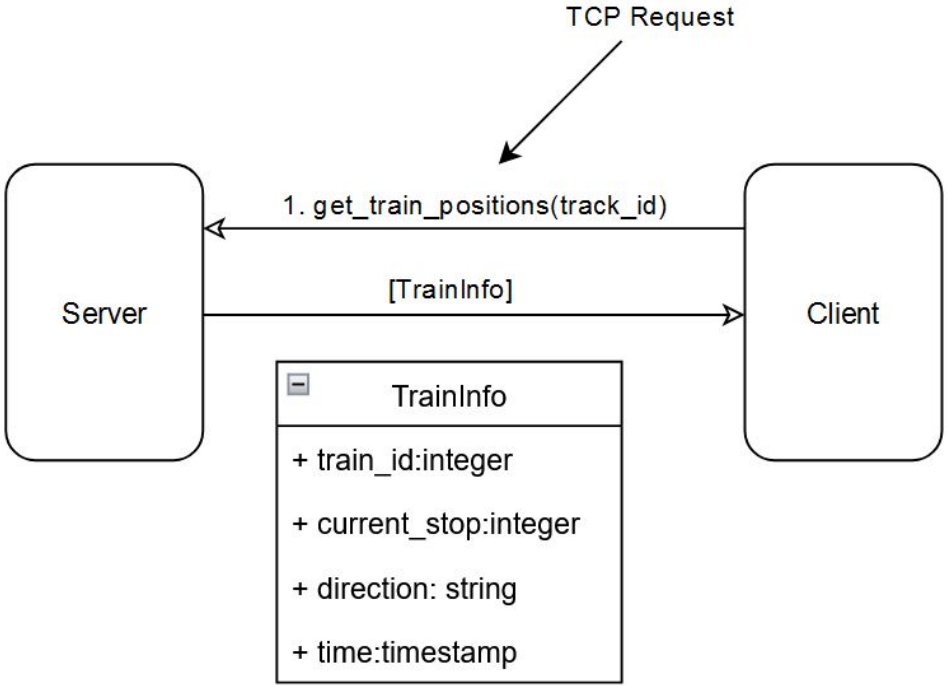
Trains

- Variable number of trains at any given time
- Every train periodically reports their position
- Infrequent loss of messages is acceptable

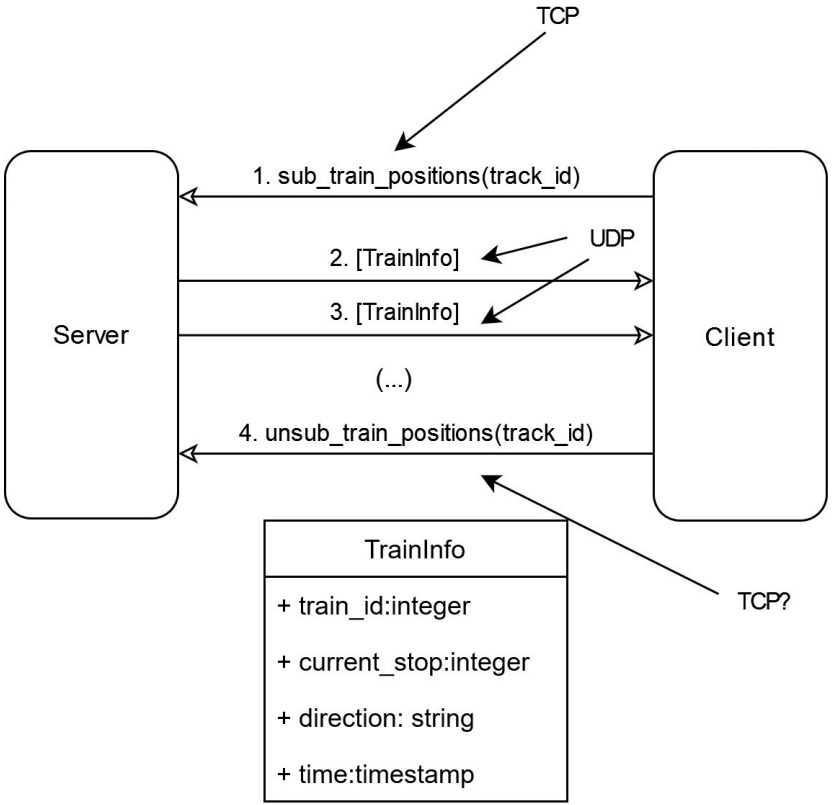
High-Level System Diagram



Client-Server Communication



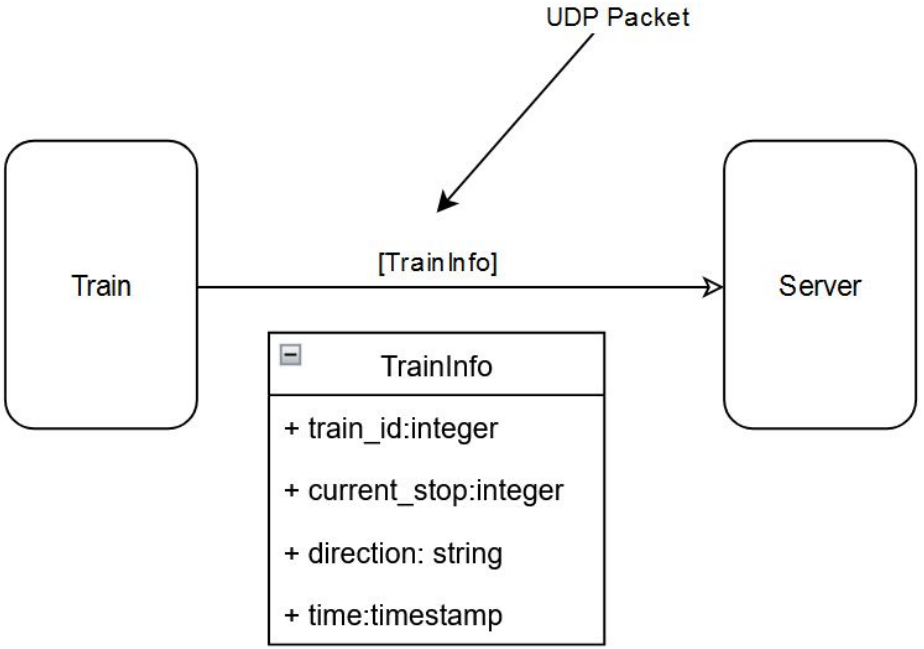
Client-Server Communication



Train-Server Communication

The trains regularly send their current state to the server

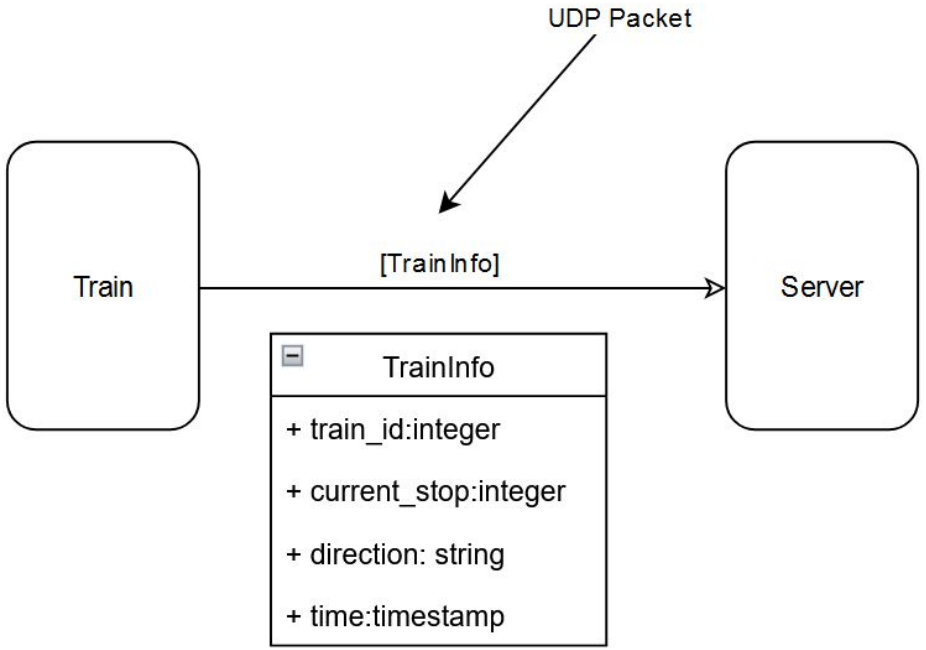
- Each train chooses a random delay (ex: every 5-10 seconds) to use between each update
- This value will be configurable



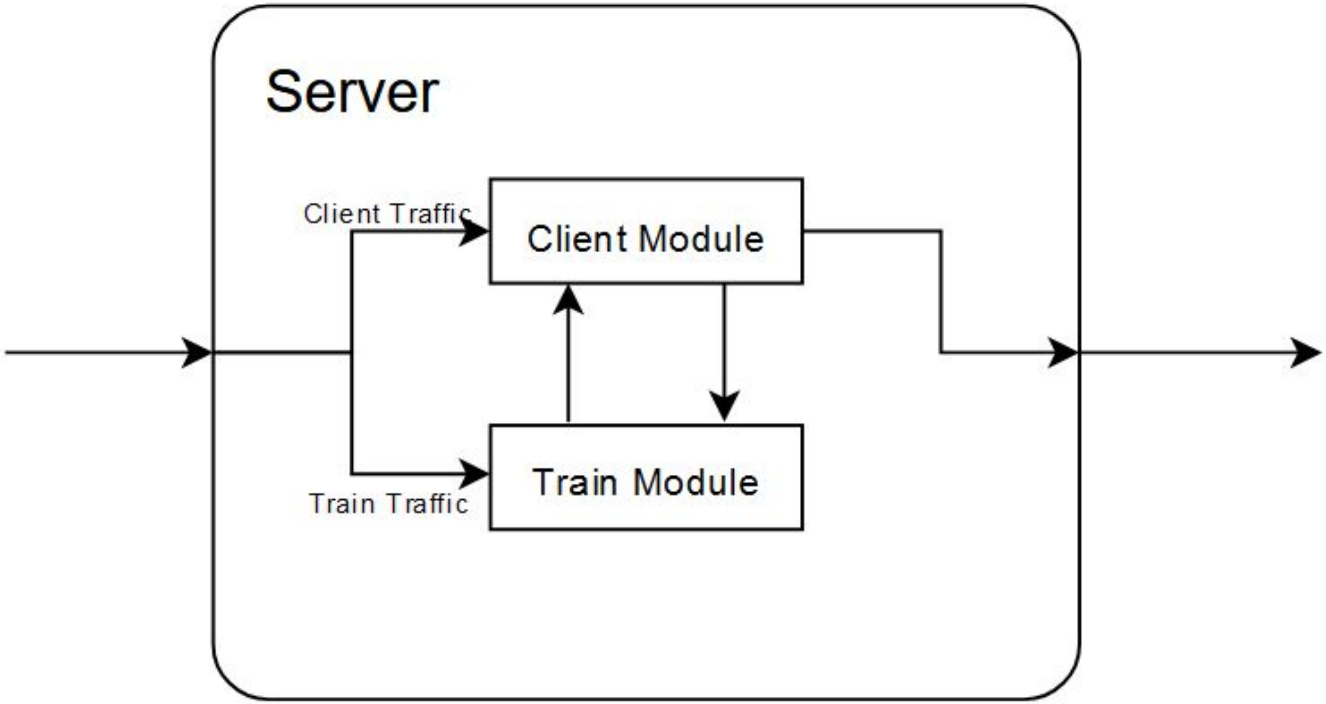
Train-Server Communication

During this stage, the provided information will be random

- May lead to trains being on the same station at once, inconsistent stops, etc ...
- We may improve this further, trying to depict a decently accurate train system



Server Module Architecture



Real Data

GTFS für Deutschland offers data about the German train network

The dataset contains ‘over 20.000 lines, more than 500.000 stop points and nearly 2 million regular vehicle journeys, this is one of the largest GTFS datasets in the world.’

Later a python script will be required to filter and parse this information to generate Omnet++ configuration

```
stop_id,stop_name,stop_lat,stop_lon,location_type,parent_station,platform_code,stop_url
de:09162:10,Pasing,48.1488320687913,11.4606435143223,1,,,https://efa.mvv-muenchen.de/index.ht
origin=de:09162:10
de:09162:10:2:2,Pasing,48.1491257514683,11.4600775756932,,de:09162:10,,https://efa.mvv-muench
dex.html?name_origin=de:09162:10
de:09162:10:6:6,Pasing,48.1488800170983,11.4603919860427,,de:09162:10,,https://efa.mvv-muench
dex.html?name_origin=de:09162:10
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html?name_origin=de:09162:1010
de:09162:1010:2:2,Neuperlach Süd,48.0898817381379,11.6444927203958,,de:09162:1010,,https://ef
enchen.de/index.html?name_origin=de:09162:1010
```

```
trip_id,arrival_time,departure_time,stop_id,stop_sequence,pickup_type,drop_off_type,timepoint
21.T0.19-379-s22-1.22.R,07:01:00,07:01:00,de:09173:4760:2:6,1,0,0,
21.T0.19-379-s22-1.22.R,07:03:00,07:03:00,de:09173:4752:0:1,2,0,0,
21.T0.19-379-s22-1.22.R,07:05:00,07:05:00,de:09173:4754:0:2,3,0,0,
21.T0.19-379-s22-1.22.R,07:07:00,07:07:00,de:09173:4756:0:2,4,0,0,
21.T0.19-379-s22-1.22.R,07:09:00,07:09:00,de:09173:4762:0:2,5,0,0,
21.T0.19-379-s22-1.22.R,07:11:00,07:11:00,de:09173:4764:0:2,6,0,0,
21.T0.19-379-s22-1.22.R,07:12:00,07:12:00,de:09173:4766:0:2,7,0,0,
21.T0.19-379-s22-1.22.R,07:14:00,07:14:00,de:09173:4768:0:2,8,0,0,
21.T0.19-379-s22-1.22.R,07:15:00,07:15:00,de:09173:4770:0:2,9,0,0,
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