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Microscopy on Demand at DB Netz: First Steps in the Wild

Since autumn 2020, the Timetable Concept Consulting and Market Launch Management department of DB Netz AG has been using Microscopy on Demand (MoD) productively. This enables their employees during early planning phases to carry out partial microscopic level analyses with reduced effort compared to previously. The integration of both micro- and macroscopic modelling worlds has increased their efficiency and planning quality. This is because the integration between macroscopic long-term planning and short-term microscopic planning avoids awkward switches between separate systems for the user, and reduces or even eliminates the number of iterations through both the microscopic and macroscopic worlds. This frees up valuable time for the user that can be used for productive planning tasks.

MoD combines the strengths of microscopic and macroscopic modelling without having to accept the disadvantages of them. At the macroscopic level, the infrastructure can be modelled with little effort and a largely conflict-free timetable can be quickly created for a larger network. However, operational characteristics such as routes with long separation times or overlap conflicts in the stations cannot be easily detected at a macroscopic level and often require microscopic analysis.

Our video illustrates this situation with two examples from Eiderbrücke and Husum on the Hamburg - Westerland line. In the illustrated timetable, no conflicts are initially discernible at the macroscopic level. However, the microscopic conflict detection shows problems in the two stations. The detailed view in the expander provides initial information on the type and duration of the conflicts. By opening the Topo Viewer in Viriato, the user can see that at the Eiderbrücke station there is a short single track within the station, which cannot be depicted in the macroscopic model. The conflict there can be solved by creating sufficient separation times between the oncoming trains. A comparable situation exists at the Husum depot. In addition, the route of the train shown is not yet fully set, which can be remedied directly using the Topo Viewer. From the 2021 Viriato spring release, the Topo Viewer can also be opened directly from the conflict detection in a graphic timetable.

The concept of Microscopy on Demand includes two essential features that contribute to increasing the planning quality while reducing the workload:

– It is possible to plan station areas at a macroscopic level with a clear focus on their routes, and thus largely without conflicts at this stage, which significantly reduces the amount of rework needed at the microscopic level along with the number of necessary process iterations.

– The requirement to align the models to each other before starting the work, in particular to ensure that the base data framework (e.g. the nodes, sections and their relationship to form lines) are identical in both models. This alignment makes the subsequent data exchange much easier.

Viriato's Topo Viewer provides the user with an easy-to-use tool to quickly set the desired route of a train.

For model synchronisation, lightweight services are available to either create a macroscopic database from microscopic data, or to harmonise an existing database with this data.

Integrated Planning Use Case:

Integrated planning, such as for a Taktfahrplan system, can only be carried out at a microscopic level with great effort, while important detailed information on sectional running times, routes and possible conflicts is often missing at the macroscopic level. Through macroscopic planning with simultaneous access to microscopic services, such as for running times, block occupancy and conflict detection, high quality planning can be carried out efficiently.

Timetable-based infrastructure development use case:

In a highly congested rail network, service level increases often trigger a need for infrastructure developments. By iterating proposed timetable variants with a range of infrastructure variants, the benefit-cost ratio of these changes can be optimised. However, a large range of variants quickly arises, which can only be meaningfully processed using a macroscopic model. The modelling of large volumes of infrastructure variants in a microscopic model is especially time-consuming. By only using macroscopic modelling initially, a lot of time can be saved and by then using MoD for the area of the study in which the infrastructure remains unchanged, the planning quality can be significantly increased, even in early phases of the planning process.

There are numerous questions that could previously only be answered approximately, if at all, at the macroscopic level. These types of issues can be considered with a significant increase in planning quality through the use of MoD, including:

– Headway times in sections
– Track re-occupation times in the station
– Separation times for route limitations
– Overlap conflicts or the detection of route exclusions due to overlaps.

With MoD suitable routes for conflict resolution can be selected at the macroscopic level (e.g. routes with lower entry speed or modified overlaps).