Prioritising trains next?

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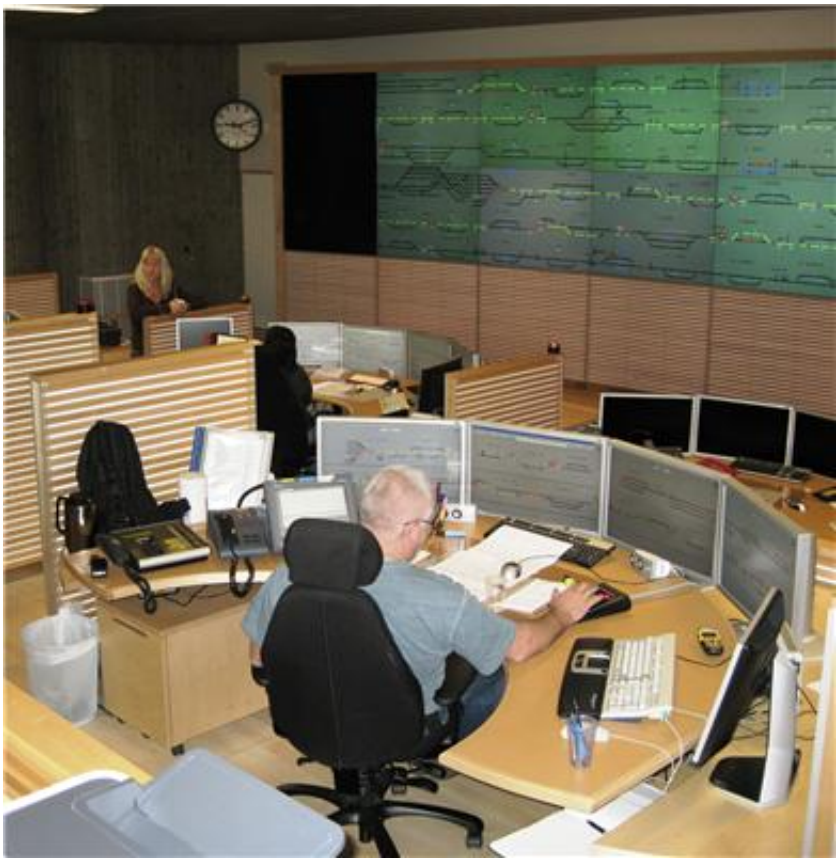

Traffic controllers follow a fixed timetable that tells them exactly where every train should be and when it should move. Credit: Jens Heiberg/Norsk toglederforening.

A new tool could put a delayed train back on schedule. The Traffic Control Centre in Stavanger in Norway is currently testing the tool that will provide an optimum solution in just a few seconds.

Everyone has heard of air traffic controllers – who sit glued to their screens, making sure that our planes take off and land in the right order. The same applies to trains. These have traffic controllers too, sitting in control rooms in front of huge screens, directing train traffic.

Everyone has their own section and region

There are Traffic Control Centres in Oslo, Trondheim, Drammen, Stavanger, Bergen, Hamar, Narvik and Kristiansand, each one controlling its own region.

"Each centre is responsible for traffic in its own region, while individual traffic controllers look after parts of the traffic within that region," explains Arnt Gunnar Lium at SINTEF. "For example, one controller might be looking after trains on the Gjøvik Line, or be responsible for trains running from Drammen to Oslo."

How to handle delays

Traffic controllers follow a fixed timetable that tells them exactly where every train should be and when it should move.

The challenge faced by traffic controllers every day is what to do when delays cause the plan to be abandoned.

"These days, traffic controllers have fixed rules of prioritisation, the main principle of which is to prioritise trains that are on time – as well as assessing the overall situation," says Lium. "But the decision a traffic controller makes in one place will also affect traffic somewhere else. So the challenge facing these teams of traffic controllers is how to work together effectively, despite the fact that each centre controls its own region, and each controller at a given centre directs traffic on their own

section."

First of its kind – tested in the field

A group of SINTEF researchers involved in optimisation have developed methods and software designed to prioritise trains in real time. This has resulted in an optimisation tool that has been tested at the Traffic Control Centre in Stavanger.

Real-time prioritisation is an extremely difficult task, both in theory and in practice, since many decisions must be made within a short period of time. Should Train A or Train B be sent out first? Should Train C use Platform 1 or Platform 2? Should Train A wait for delayed Train B or not?

"With two or three trains, that isn't too difficult, but when the number of trains increases, there can easily be several billion different solutions, since one decision affects many others," says Carlo Mannino at SINTEF ICT.

By using new mathematical optimisation theories, the researchers have managed to develop a new method that finds the optimum solution in just a few seconds. The tool is the first of its kind in the world – and has been tested in real operational situations.

No better solutions

Arnt Gunnar Lium shows a map on his screen, which looks like a huge network of spiders' webs. It has red, blue and black lines, and marked stations such as Moi and Stavanger.

While the black sections indicate the planned train routes, the red

sections show whether something has happened that means that a train is behind or ahead of schedule.

If all the trains are on time, obviously it follows the original plan. But if something happens, the new tool shows the optimum solution for how trains should proceed. "You see these blue sections here," says Lium. "These are proposed solutions, and these are in real time. There are no better solutions based on the targets."

Reduce delays

The researchers believe that the new tool could reduce delays and result in considerable improvements in punctuality.

"The positive thing about a tool like this is that, with relatively cheap research and small investments, it may be possible to reduce the number of cancellations and delays, while making even better use of extremely expensive infrastructure than we do now."

"We're onto something here"

Traffic controller Øyvind Bernhard-Melin at the Traffic Control Centre in Stavanger says that he started using the tool in April as a means of supporting his decisions, and has noticed a distinct benefit in some cases.

The tests are being carried out on a section of several dozen kilometres between Stavanger and Sira. The image on the browser in front of the traffic controller updates every 15 seconds. As soon as a delay occurs, new sections and proposals are drawn into the image.

"On some days there are no changes," says Meling. "We had eight days in April when every train ran on time. But then we have other days when

there are loads of delays. The tool has still not been fully developed, but when it is finished we definitely believe that we will be onto something here," he says.

The traffic controllers will continue with their testing throughout the year, and will provide SINTEF with valuable input which can be used to continue developing the tool.

Provided by SINTEF