Oslo Metro will use commercial mobile networks for signalling and train control

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The Oslo Metro is moving from conventional railway signalling to a modern, communication-based signalling system that uses radio communication to transfer information for real-time train control. Communications-based train control (CBTC) is the choice of mass-transit metro operators today, with over a hundred systems currently installed worldwide. Oslo Metro's new system will replace the old signalling systems, some of which date back to the 1960s, enabling increased line capacity by allowing shorter distances between metro trains travelling on the same line. This safety-related, time-critical application for train control imposes stringent reliability, availability and quality requirements on the radio communication technology used. IEEE 802.11 Wi-Fi has so far prevailed as the preferred radio technology for CBTC, despite being originally developed for stationary use. The Wi-Fi solution comes with a proprietary solution for hand-over between cells along the metro line. More recently we have seen that an increasing number of metro operators in China are using private LTE networks for CBTC.

One of the main reasons for choosing Wi-Fi as the radio communication technology is the freely available industrial, scientific and medical (ISM) frequency bands (CBTC suppliers most commonly use the 2.4GHz and 5GHz bands). This means that metro operators do not have to acquire a licence from a regulatory body. A serious drawback is that if a metro operator can use it for free, so can everybody else (including train passengers using Bluetooth headsets, for example). Observations from other metro operations have raised concerns about interference. Hence, the level of availability of service using these frequency bands cannot be guaranteed.

In contrast, mobile operators typically have exclusive licences over several frequency bands, which enables them to secure the quality of its services for wide-area use. In addition, the use of several frequency bands provides diversity, which can increase the robustness of the solution.

Compared to proprietary solutions for hand-over between cells in a Wi-Fi system, a standardised 3GPP mobility solution already exists and is considered by Oslo Metro as a more robust and future proof choice. These mobile networks are already built and will be maintained for all users, not only Oslo Metro. Hence, the cost is shared between numerous customers (rather than just CBTC users).

The Oslo Metro considers using existing mobile networks to be 'more future-oriented, more reliable and less costly'

The Oslo Metro awarded the main contract for wireless communication in its new CBTC system to the public mobile operator Telia on 19 June 2020. The contract includes strict availability and service-level requirements that require Telia to ensure full mobile coverage at all times across the entire metro and that signalling data is prioritised. In addition, the Oslo Metro will make use of additional public mobile networks to ensure system reliability.

At the public announcement of this contract, the Oslo Metro CEO, Cato Hellesjø, said: 'The level of mobile network coverage in Norway is world-class, and its mobile networks are characterised by their advanced

services, good coverage and high level of stability. By controlling our new signalling over an existing mobile network, we will be using a tried-and-tested technology in a smart way. Norway's mobile networks have already been built and the cost is shared among numerous customers. Sporveien (the Metro) will benefit from technical and commercial developments in the mobile market.'

Sporveien delivers tram, metro and bus transport services, principally in Oslo and Viken. The company also owns and manages the tram and metro systems' real estate and infrastructure. Sporveien is Norway's largest provider of public transport by number of journeys, and delivered 269 million passenger journeys in 2019. The group has around 3350 employees and reports annual revenue of NOK4.8 billion.

"It has been important for Sporveien to have access to leading competence in telecoms solutions, market experience and contract management."

Oslo Metro has co-operated with CBTC suppliers, mobile operators, the telecoms regulator, the government and other stakeholders that are considering the use of commercial networks for their communication solutions. As part of the process, the Oslo Metro has conducted a coverage test on all metro lines, testing signal strength, signal-to-noise ratio, how many cells cover each point on the metro line, round-trip delay and packet loss statistics. In addition, CBTC suppliers have conducted integration tests with the mobile operators.

Contract design is instrumental in achieving the benefits of using commercial networks for specialised services

The CBTC system requires reliable and high-quality radio communication, and mobile operators will need to invest in order to offer the required service. A CBTC operator may decide to use more than one network to allow for lower requirements imposed on each network. The simple reason is that the system can accept more errors from a single network as the error is not likely to happen at the same time on the other network. Hence, the service offered from the MNOs will be closer to ordinary mobile usage and potentially at a much lower cost for the MNOs. The total cost to cover the requirements for a CBTC system can therefore be much lower by using several networks. However, it introduces a new challenge. The number of potential contractors will affect the intensity of competition. This can be critical in most markets where there may be only three to four MNOs that can offer the service. This means that the market situation must be taken into consideration when deciding on the required network performance, contract design and procurement design.

Analysys Mason's Oslo office is involved in this project. Jon Ivar Kroken is the project manager for the datalink solution to the new signalling system.

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