

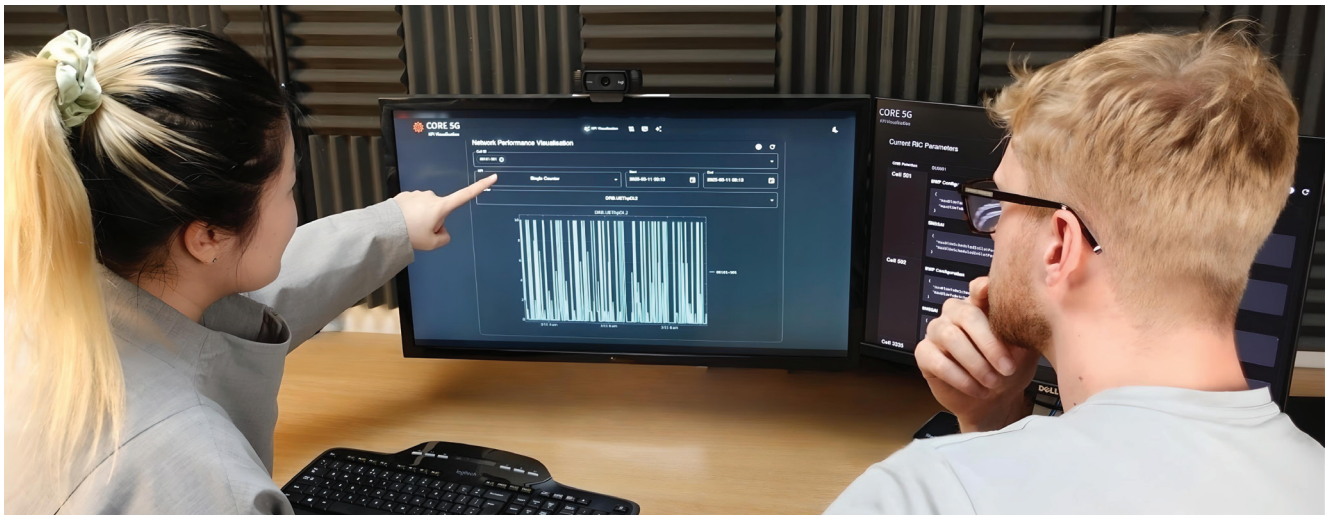


WOLFRAM CONSULTING SERVICES

Bringing Open 5G to Cambridgeshire and Beyond: The CORE Project

Industry: Telecommunications

Applications: Networks optimisation, machine learning, AI/ML



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BACKGROUND

Radio access networks (RANs) are the fundamental building blocks of a mobile network: they are responsible for coordinating communications between user devices, such as smartphones, and the core network infrastructure. Earlier generations of mobile networks, such as 3G and 4G, have typically relied on proprietary RAN hardware and software provided by a small number of vendors. These proprietary RANs offer limited interoperability between vendors. As a result, mobile operators often commit to a single vendor for large portions of their infrastructure, leading to vendor lock-in, higher deployment and maintenance costs, and reduced adaptability to evolving network requirements. To address these challenges in the next generation of networks, the O-RAN ALLIANCE has laid the foundations of an emerging open network infrastructure which facilitates cooperation between different vendors and is capable of supporting high-density environments such as urban areas. Wolfram has partnered with leaders in the UK telecommunications industry and the educational sector to build a proof-of-concept 5G mobile network aimed at bringing the advantages of the O-RAN infrastructure to UK users.

HIGHLIGHTS

20 TO 60 SECONDS

Network engineers' decision time is reduced to **20 to 60 seconds**.

<10MS LATENCY

The observed latency was less than **10ms** in real-world tests.

700 MBPS

Download speeds using commercially available devices were measured at **700 Mbps**.

AN OPEN WAY FORWARD

As the criteria for new generations of networks become more demanding, the hardware and software infrastructure needed to support them grows more complex. It is precisely in the face of such complexity that an open, interoperable network infrastructure that fosters collaboration and healthy competition provides the most benefit. The blueprints for such an open infrastructure have been laid out by the O-RAN ALLIANCE and have been adopted with great success in countries like the United States and Japan, which have become leaders in bringing open, reliable 5G networks to their users. In contrast, open network infrastructures have seen limited adoption in the UK.

Wolfram has collaborated with eight other partners to build and deploy an O-RAN network in the Cambridgeshire area, providing the first open 5G network infrastructure in the UK. In this

implementation, the network is fully compliant with the guidelines set out by the O-RAN ALLIANCE, utilising open and interoperable software and hardware components which have a host of benefits, from improving power management to allowing network operators to access components from different vendors and optimise their deployment for specific use cases.

This deployment not only addresses immediate connectivity and performance requirements, but also positions the Cambridgeshire network as a reference implementation for future open network deployments across the UK. By demonstrating the practical benefits of O-RAN, this proof of concept serves as a valuable model, encouraging broader adoption of open infrastructure in future 5G networks across the UK.

WOLFRAM'S NETWORK OPTIMISATION rAPP

To deliver the increased speeds compared to previous generations of networks, 5G networks rely on both hardware and software improvements and optimisations. A core part of the software stack which powers O-RAN networks are rApps—pieces of software which are responsible for managing and optimising network traffic.

Building upon the extensive algorithm base and built-in automation of Wolfram Language, Wolfram has developed a full-stack rApp solution which uses a combination of algorithms, machine learning and AI to analyse traffic patterns and make predictions and recommendations which network operators can act upon.

“By investigating an O-RAN neutral host solution, the network will be able to support multiple mobile operators over a single site. This will encourage mobile network supply chain diversification—reducing costs for deploying and operating a network, and opening up business opportunities in the O-RAN ecosystem.”

— Michael Stevens,
Connecting Cambridgeshire's Strategy &
Partnership Manager

Wolfram's Network Optimisation rApp consists of two main components: an algorithm-driven back end which continuously analyses network data and predicts traffic patterns and a front-end dashboard which visualises key network performance indicators and provides actionable insights generated by the back-end background analysis.

On the back end, Wolfram's rApp uses machine learning to predict future network performance by analysing past network activity. Specifically, the machine learning model evaluates metrics such as throughput, latency, signal strength and packet loss, among other indicators of network health. Using these indicators as inputs, the model predicts performance trends, detects anomalies and optimises resource allocation—enabling proactive network management and increased efficiency. The overall goal is to maximise network throughput and minimise downtime by using intelligent traffic steering and resource allocation strategies based on the machine learning model's outputs.

On the front end, the rApp provides flexible visualisation of key performance indicators, allowing users to select specific metrics and customise the timeframes for analysis. In addition to standard histograms and scatter plots for simpler data, Wolfram's rApp also supports advanced visualisations tailored specifically for mobile networks.

Beyond highly customisable visualisations, the dashboard's other central feature is its recommendation system generated by the back-end machine learning model. When the back-end model identifies that a different network configuration would better meet current or upcoming network demands, it

presents actionable recommendations directly to the network engineers through the dashboard. As an example, if current network patterns usually lead to increased demand, the back-end model can recommend switching on additional cells to meet that demand.

Importantly, while the model summarises the context of the recommendation and provides as much supporting data as possible, the final decision-making authority remains with the network engineer. As such, the recommendation system acts as a sophisticated summarisation mechanism, translating complex underlying network data into concise, actionable insights. As a result of these synthesised insights, network engineers can make informed decisions that lead to better network performance much more quickly.

By combining a back-end machine learning model trained on key performance indicators of network activity and a front-end dashboard featuring accessible visualisation options and actionable recommendations, Wolfram's full-stack rApp solution provides a reliable software layer designed to work with any O-RAN-compliant hardware to allow for more efficient network management. In the context of the CORE Project, the rApp was successfully integrated with the O-RAN hardware deployed by the CORE partners.



A recommendation on the front-end dashboard recommending a traffic-steering policy informed by the back-end analysis.

THE PROMISE OF OPEN 5G: HIGHER SPEEDS, EXCITING APPLICATIONS

According to internal tests, the CORE network delivers download speeds in real conditions in the range of 700 Mbps, with the potential to easily reach the gigabit range with a combination of software and hardware upgrades. These speeds extend the utility of the network beyond traditional phone usage.

To stress test some of the new 5G infrastructure, the CORE Project partners hosted an augmented-reality live concert event at the historic Cambridge Corn Exchange venue. As part of the event, a live concert taking place at the Corn Exchange was livestreamed to a second venue in a separate location, where participants wore AR headsets and were able to follow all the action in real time. The test was successful, with the CORE network meeting the network

bandwidth demands needed to deliver the AR content while maintaining a 100% uptime rate.

The promise of O-RAN 5G is not just about expanding the network to meet current demands: it is also building an infrastructure which will foster cooperation between different vendors, lower the barriers of entry for emerging vendors and allow mobile operators to use a larger portion of the existing network infrastructure to provide services to their users. The rApp is a crucial component of any 5G network infrastructure, which will allow network engineers to see relevant information and make quicker decisions, ultimately leading to more efficient network management.

“The positive response from the public has sparked discussions on how this technology could be used beyond entertainment—whether in education, healthcare or public services—to create more immersive and accessible experiences. This trial is a major step towards shaping how 5G can benefit communities across Cambridgeshire and beyond.”

— Lorna Dupré,

Chair of Cambridgeshire County Council's
Environment and Green Investment Committee

LET'S TAKE YOUR PROJECT TO THE NEXT LEVEL

Find out how the Wolfram Consulting Services team can jump-start your project with in-depth troubleshooting, code optimisation, custom training or production deployment.