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Wi-Fi's Critical Role in Education

Case Study: Thomas More University

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Thomas More University Faces Major Wi-Fi Capacity Constraints

Digitisation of education drives demand for Wi-Fi

As with virtually every other sector in society, education increasingly relies on wireless connectivity. In universities across the world, Wi-Fi is used extensively to support teaching, communications and research, as well as to enable the smooth and efficient running of a wide range of facilities, from lecture theatres and seminar rooms to laboratories and test equipment.

As education becomes increasingly digital and employs multimedia and artificial intelligence (AI) tools, IT teams rely on Wi-Fi to connect more and more devices. But limited network capacity can mean connectivity isn't always available or isn't sufficiently responsive to support real-time applications. These challenges could be addressed with access to sufficient spectrum, particularly the 6 GHz band (5925-7125 MHz), which is supported by the latest generations of Wi-Fi technologies.

Narrow channels limit throughput

The largest university of applied sciences in Flanders, Thomas More University, consists of 12 campuses that host up to 22,000 students, staff members and researchers. As a pioneer in the 'learning by doing' method, the university offers students tailored learning through high-tech labs, hands-on course methodology and real-world project opportunities.

However, Thomas More University has to tightly limit the Wi-Fi throughput it can provide to its students and staff. As its facilities are used by thousands of people with laptops, tablets and phones, the university has installed large numbers of Wi-Fi access points to ensure staff and students can get connected when they need to. Thomas More has more than 2,000 access points in use across its campuses. At its Geel site, each access point serves an average of 64m² of floor space, while at its De Nayer site, each access point serves an average of 99m².

This high density of access points means there is a relatively high risk of interference. As many of its buildings are multi-storey, Wi-Fi access points can interfere with each other through floors and ceilings, as well as internal walls. “With a design I did for the renovations in a cafeteria, I saw channel interference of at least three access points on one channel,” recalls Dennis Van de Ven, network engineer at Thomas More, while noting that some channels can’t be used because they are reserved for weather radars.

To minimise the risk of interference between access points, Thomas More’s IT team has limited the University’s Wi-Fi channels to 20 MHz, constraining throughput and contributing to higher-than-necessary latency, due to longer transmission times and channel contention. The practical throughput limit of an access point is around 180-200 Mbps in the 5 GHz spectrum band. However, when 15 devices are connected simultaneously, the connection speed of a single client can drop to below 10 Mbps, as multiple clients degrade the overall bandwidth.

Even restricted to 20 MHz channels, the student and staff devices are now using all the licence-exempt spectrum available in the 2.4 GHz and 5 GHz channels, which is also needed to support Internet of Things applications, as well as other licence-exempt technologies, such as Bluetooth.

Peak demand doubles in a year

At peak times, the network is having to handle 15,000 connected devices, and that figure is set to rise as student numbers increase further and education becomes increasingly digital. In terms of traffic, the peak load usually occurs in September at the start of the academic year. In 2024, the peak was 15.7 gigabits per second download and 2.5 gigabits per second upload – about twice the levels of the year before. That increase was driven in part by pent-up demand taking advantage of improvements to the Wi-Fi network related to the adoption of Wi-Fi 6 and other settings changes.

“The hard thing is when people start doing downloads in classrooms,” explains Dennis Van de Ven, network engineer at Thomas More. “Most of the time, in classrooms, the teacher says download this or download that. And, of course, everyone at the same time will access that resource, which makes the whole Wi-Fi drop out.”

As well as using the network for social media, students back-up files and download applications and updates. As they have a OneDrive subscription included in their tuition, students also upload their files to the cloud. “Microsoft is a big part of our total traffic,” notes Dennis Van de Ven.

He explains it would be impractical to use 5G to supplement the Wi-Fi network because most of the student and staff devices connecting to the network are laptops without a 5G connection. While students could use their phones to create local Wi-Fi hotspots, that may require them to upgrade their cellular tariffs (at their own expense) and would cause more interference, given the limited spectrum available. “Hotspots would really hurt our own environment,” says Dennis Van de Ven. As students typically have low levels of income, they tend to select low-cost cellular plans with relatively low limits on the amount of data they can use.

In any case, cellular coverage indoors can be poor, as the radio signals from outdoor base stations can struggle to penetrate walls. “The cellular connection at campus Geel where I work is terrible,” adds Dennis Van de Ven. “If we didn’t have VoWiFi, I would barely be able to make phone calls. Once I wanted to use my phone’s hotspot for testing purposes, but couldn’t because the reception was so bad I was barely able to get a VPN going or connect to a SSH terminal. Those services barely use data.”

In research labs, the connectivity challenges differ from those in the teaching auditoria. While these labs are less densely populated with devices, researchers may need to download or upload very large files and make use of demanding applications, such as AI systems and virtual reality.

As some researchers require significantly higher throughput than that which can be achieved with 20 MHz channels, Thomas More reluctantly deploys cables to provide the connectivity they need. “It’s not always the easiest thing to do, especially if you have to retrofit buildings,” explains Dennis Van de Ven. “Cabling is expensive if you have to rip out infrastructure and to pull a new cable is quite expensive because of the man hours required. You need more switches with more cables. So, it really starts to add up.”

The lower 6 GHz band isn't sufficient

Thomas More is beginning to deploy Wi-Fi 6E networks that can use the 6 GHz band in new buildings, but the positive impact of this new technology will be curtailed by the fact that only 480 MHz of this spectrum is licence-exempt in Europe.

Dennis Van de Ven notes that even with access to this spectrum, the university would still have to employ 20 MHz channels to ensure it can serve the high number of devices that demand simultaneous connectivity. While the number of usable 20 MHz channels available would increase from 20 to 44, these channels will quickly be employed both to meet the existing pent-up demand and to accommodate the growing number of devices trying to connect to the network. However, by remaining on 20 MHz, the connected devices would not enjoy any improvement in performance and would not be able to support more demanding applications that require higher throughputs and lower latencies. In short, employing the lower 6 GHz band won't be sufficient to alleviate the tight constraints on Wi-Fi connectivity across Thomas More's campuses.

The University would like its Wi-Fi networks to have priority access to the entire 6 GHz band. As some of its campuses are in densely-populated parts of Belgium with large numbers of cellular towers, allowing Wi-Fi to use the spectrum only where there is no cellular coverage wouldn't be sufficient.

> With guaranteed access to the entire 6 GHz band, the university could provide connected devices with 40 MHz channels, effectively doubling the connectivity available for individual end-users. That would equate to a step change in throughput and a major reduction in latency, enabling staff and students to take advantage of advanced AI and multimedia applications.