

The unwired campus

Enabling future education and research

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Introduction

The campuses of universities, university medical centres, applied science universities, vocational education and research institutions are evolving more and more into knowledge centres, involving much more than just the primary processes of education and research. Start-ups, shared laboratories, bookshops but also the hospitality services on site add direct or indirect value to the primary process. This primary process itself is also evolving: more and more emphasis is being placed on things like personalised learning and multidisciplinary research, where business is also becoming involved. Education and research increasingly take place off-campus: on the move, in the cities or in businesses. The campus is becoming a city of knowledge.

This change requires a more flexible way of learning and working. Lecturers who are used to lecture to hundreds of students will become coaches of smaller groups. Facility services are increasingly being asked for specific forms of customised support. Researchers share and finance laboratories on campus with start-ups, national and international colleagues, students and businesses. Students want the freedom to pursue their education without being tied down in space or in time, and they also want to benefit from the social aspect of group teaching. Where, for example, caterers need to adapt their services.

Change of demand and impact on ICT services at the campus

This change of behavior and demands from the primary processes influences the facilities at the campus largely. For example, rooms and laboratories are not owned anymore by one (research) party and can be appointed flexibly 24x7 to either home or foreign users. Also, hallways are equipped to be used as working area, centralized and shareable high-specialized laboratories are being built, sustainability is becoming a focus and there is a need for 'smart' tools[1].

How does this influence the ICT services at the campus? According to interviews among responsible ICT infrastructure directors, there is a growing demand for standardization and harmonization across campuses' infrastructure in order to provide the required flexibility. A number of elements of this infrastructure seems obvious: data transmission, authentication, storage, computing power and SaaS. However, one part of this architecture not to be underestimated is the unwired access, given that (almost) every user and every device in future will be connected wirelessly. The way in which the unwired access is set up will eventually determine which equipment, applications and data users can work with, and with what level of quality. This layer also determines to a significant extent the robustness and flexibility of the final architecture.

Unwired as primarily access

Most users, devices and machines are connected unwired. New campus buildings are designed for unwired use only. But which exact unwired technologies are we talking about? Not just about Wi-Fi (wireless) and LTE/4G/5G (mobile) and the gradual merging of these network technologies. Think, for example, about the use of provider's 4G or 5G networks on campuses for more coverage or capacity, the use of MulteFire or the provision of wifi-calling to avoid investments upon Distributed Antenna Systems (DAS). Besides the Wi-Fi and LTE world, there are also sensor networks (IoT) to take into account, both in the licensed band (NB-IoT) and the unlicensed band (LoRa, SigFox).

The requirements for applications such as voice or conferencing services, location-based services, collaboration services or smart campus determines which network technology is the best to use. There is also a dependency on battery capacity, costs, security and privacy aspects.

On campuses, however, the use of unwired technology, such as tablets, smartphones, IoT sensors and their associated SaaS and data services from the (private) is still in its experimental phase. Local experiments and pilots are being deployed with location-based services or sensor networks, but these have not yet been combined. Therefore, there is the risk that the same things are being thought about in many different places, in ways that are not compatible with each other. This will not only make bundling demand and gaining economies of scale highly problematic, but also organizing a secure shared infrastructure and sharing information.

Elements of collaboration

The strategic challenge is how to provide unwired ICT services at the campus in order to support evolving education and research. Or, more to-the-point: how can we provide every person and every machine at each campus an accessible, trusted and excellent unwired service for its specific application(s)?

We have identified the following five main elements of unwired technology at the campuses, where the campus itself should be in control:

1. 802.11 infrastructure, such as Wi-Fi
2. 3gpp infrastructure, such as 3G, LTE
3. IoT infrastructure (and its data), such as LoRaWAN, BLE
4. (local) radio spectrum and "private" networks, such as private LTE and MulteFire
5. Identity, Authentication, Authorization and interfacing, aided by for example the eSIM

As each local and foreign user at the campus have their own devices, sensors, subscriptions and requirements, campus architects have to determine how each of those elements should be deployed. To harmonize these elements among more campuses, collaboration is needed between the ICT service organizations, vendors, operators, national regulators and the NREN. Together, they can avoid commercial lock-ins, prevent lack of bandwidth or mediocre services and build a sustainable unwired campus infrastructure which is ready for education and research of the future.

Conclusion

ICT campus infrastructure needs to change radically in order to facilitate education and research of the future. Harmonization and standardization is key, not in the first place concerning unwired access. There are five main elements where collaboration, direction and management from the intuitions and NRENs is required in order to provide secure and excellent connectivity on the long term, while averting provider or vendor lock-in.

Future work

In December 2017, we will conclude our research and interviews among about 20 institutions in the Netherlands about their ideas or vision about the unwired campus of the future. Starting early 2018, we will create focus groups with people from SURFnet and intuitions to work on blueprints, requirements for each of the identified main elements and

assets. Besides, we will involve the regulator to discuss the use of local frequencies.

References

[1] Campus-NL, investeren in de toekomst, VSNU / TUdelft, 2016,
<https://managingtheuniversitycampus.nl/campus-nl/>

Author Biography

Maurice van den Akker is head of team product management of the network services. He is responsible for the strategy, business models and deployment of (unwired) network services of SURFnet. He is also board member of the Dutch govroam foundation. He joined SURFnet in 2002, after being a consultant for data networks in the telecom industry for several years. Maurice holds master degrees in MBA, Computer Science and Technology Management.