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SUCCESS STORY

Establishing a Modern Network Infrastructure for the Innovative Digital School of the Future

> We established the highway, trained the drivers, and now we can drive forward.

Alenka Starc

Head of the SIO-2020 Programme, Advisor to the Director for Coordination of Educational and Research Services, Arnes

Photo: Aleš Rosa

SMART COM

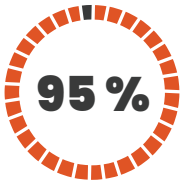
JUNIPER NETWORKS

Technology partner

Academic and Research Network of Slovenia – Arnes is a public institution that provides network services to research, educational and cultural organizations. It connects academic institutions, educational institutions, libraries, etc. into a national academic network, which runs various services that enable members to access the internet, take part in remote learning and log into various services using a digital identity. In education and academia, it offers the best and most comprehensive range of digital services.

Due to constant changes in technology, Arnes is constantly adapting to the needs of its users. Thus, in 2017, it began the four-year Programme for the Further Establishment of ICT Infrastructure in Education, in short, Slovenian Educational Network – 2020 or SIO-2020. The SIO-2020 Programme co-financed the Operational Programme for the Implementation of the EU Cohesion Policy in the Period 2014–2020, under priority axis 10: Knowledge, Skills and Lifelong Learning. The project ran from 2016 to 2020.

The SIO-2020 Programme included three sub-programmes or projects: the first included the purchase of ICT equipment for educational institutions (hereinafter EIs). The second sub-programme included the construction of wireless networks on all Slovenian EIs (WLAN-2020). The third sub-programme included the development of e-services and e-content, through which users acquired new knowledge and competencies necessary for the use of new e-services and technologies. As part of the implementation of the wireless network within WLAN-2020 project, they also established a network infrastructure with the equipment from the technology provider Juniper Networks, namely the EX4600 and EX2300 switches, to which access points and SRX300 routers are connected, and which provide a connection to the Arnes network. **In the public tender the preparation and supply of Juniper Networks active network equipment was entrusted to the company Smart Com d.o.o.**



As part of the SIO-2020 Programme, 875 EIs have implemented modern wireless networks and are now able to provide over 95 percent of learners with access to the internet via a WLAN.

The investment was co-financed by the European Union under the European Regional Development Fund and the Ministry of Education, Science and Sport of the Republic of Slovenia.

REPUBLIC OF SLOVENIA
MINISTRY OF EDUCATION, SCIENCE AND SPORT

EUROPEAN UNION
EUROPEAN REGIONAL DEVELOPMENT FUND

Impact of WLAN-2020 in numbers

875

Wireless networks built at 875 educational institutions locations

2.320

2.320 Juniper Networks EX4600 and EX2300 switches (2 switches on average per educational institution)

193

193 Juniper Networks SRX300 traffic routers

24

24 central wireless controllers (WLC)

19.721

19.721 access points (22 access points on average per educational institution)

667+37

667 km of copper cable and 37 km of optical cable

583

Communication box installed on 583 educational institutions

Juniper Networks Selected Solution – Powerful Network Equipment for Modern Network Services

The type of access equipment follows the recommendations on traffic separation at least to the administrative, pedagogical and eduroam network within the organisation.

> Juniper Networks switches and routers successfully passed all required functionality checks performed in the test environment, including orchestration support (automatic tuning) and security provisioning for IPv4 and IPv6 protocols.

Janko Kersnik
Network Security Solution Architect Manager,
Smart Com d.o.o.

A Modern Wireless Network that Enables Classroom and Remote Learning

Arnes offers support to service users at several different levels, from infrastructure to service work, so that they can be as successful as possible in the field of ICT. Different teams are assigned to provide this support: a network team that covers the lowest infrastructural aspect; a service team that offers support at the programme level and develops services; a customer support team for troubleshooting; and a communications team that provides information on the safe use of the internet.

In just four years, through the implementation of the SIO-2020 Programme, Arnes has equipped EIs with ICT equipment, and since 2018 **built powerful automatically managed wireless networks, and has developed new e-services and e-content in schools, all with the aim of improving the competencies and achievements of young people and raising the level of training of educators in the pedagogical and andragogical process through greater use of modern ICT in teaching and learning.**

The Juniper Networks Switch

- Provides Gigabit connections to access points;
- Supports the powering of devices via the ethernet network, according to the IEE802.3af standard (PoE-Power over Ethernet);
- Provides an adequate level of security at the interfaces for preventing possible attacks;
- Provides support for orchestration (automatic tuning) with applications by supporting APIs for remote access to the switch, insight into the status of the switch and interfaces, and provides configuration and settings to facilitate network troubleshooting and remote management;
- Allows traffic filtering for different protocols;
- Supports IPv4 and IPv6 protocols simultaneously;
- Provides quality of service.

The Juniper Networks Traffic Router

- Enables reliable connection of members' networks to the Arnes network through various connection providers;
- Supports IPv4 and IPv6 protocols simultaneously;
- Provides support for orchestration (automatic tuning) with applications by supporting the API for remote router access, status insight, configuration, and settings to facilitate network troubleshooting and remote management.

> Despite the diverse range of requirements of a large number of users and the extremely challenging conditions due to the coronavirus epidemic, Smart Com's experts prepared and deliver equipment within the agreed deadlines as well as excelled in the collaboration with stakeholders.

Boštjan Mihelič
Project Manager, Smart Com d.o.o.

At the beginning of the project, they faced quite a few challenges. From technical issues involving the preparation of a plan for an architectural solution to build a network of schools, to questions regarding the equipment that teachers and students need, also in terms of services they want to develop in the future. And they also faced with legal challenges (preparation of legal conditions and running the public procurement processes for EIs as well) and organisational challenges (establishment of a new team, cooperation with subcontractors and EIs), so that the programme could run seamlessly and according to the plan. However, as the programme involved a large number of stakeholders, the first step was to reach a common understanding of the desired goal.

Through public tenders, they selected contractors for individual regions—Slovenia was divided into six regions—and providers of active network equipment, e.g. switches, routers and access points. They also appointed a team of consultants who acted as a bridge between the schools and the contractors to facilitate agreement on goals. In mid-2018, once they had defined all the parameters, they started establishing the network itself. Most of the implementation was carried out in the first year, i.e. in 2018, while in October 2020, despite the coronavirus pandemic, the project was successfully completed and the wireless networks at the locations was set up. All EIs who wanted to establish a wireless network got one.

During the programme they also implemented the WIP system for monitoring projects, allowing them to have an overview of each location's current progress. Contractors, suppliers, consultants and schools also had access to this project overview. The WIP system was also integrated with a document management system, which enabled them to digitally sign contracts and control documentation, thus greatly facilitating the course of the project.

The ICT part of the project mainly included the purchase of ICT equipment (computers, monitors, tablets, laptops, projectors), while the WLAN part—the implementation of a wireless network at 952 locations—involved the installation of an appropriate network infrastructure.

One of the basic conditions for setting up a wireless network was that 30 students could watch Full HD (1080p) video content simultaneously through one wireless access point (in one classroom). Switches, however, must support such an infrastructure. First, they need to have connectivity of at least 1 Gb/s on each interface; second, they need to support power supply over PoE and provide enough throughput across 10 Gb/s connections to the rest of the network.

Juniper Networks active equipment has met tender requirements and functionalities, including orchestration support, which was also verified by the Smart Com and Arnes teams during the tender stage.

Positive Effects of the Programme SIO·2020

A unified way of establishing and managing the members' local network

Educational institutions differed greatly in terms of network infrastructure. The schools had very different equipment (not only in terms of computers, but also active network equipment); there was a large range to deal with.

One of the important technical requirements was that the network equipment supports our centralised management of members' local networks and that it enables loading of configurations and debugging remotely, as we do not have external support contractors; instead computer technicians in schools are in charge of this. In this way we can quickly troubleshoot and solve problems together if they arise.

Klemen Križaj
Network Consulting and Supervision Department, Arnes

With the SIO-2020 Programme, a big leap was made to unification of equipment and systems, which is the right path to the digitalisation of education. Meaning that everyone is on the same level in terms of user experience. So end-users, i.e. schools, facing a lack of knowledge and resources, do not need to think about the technical aspects of internet connectivity, since Arnes makes sure that the equipment is appropriate and working properly.

Foto: Aleš Rosa

From the user's point of view we wanted to establish a network where each participant in the class would be able to log in to the network on their device and watch streaming video content from remote platforms (e.g. via the Arnes video portal). This meant that we had to provide enough bandwidth for data to flow smoothly in all directions. We wanted to implement secure and powerful networks with IPv6 support.

Alenka Starc
Head of the SIO-2020 Programme, Advisor to the Director for Coordination of Educational and Research Services, Arnes

We collaborated with Smart Com on the architectural design (ensuring that the equipment actually enables the required functionalities), and we collaborated with the project and logistics teams on a daily basis. Everything worked as it should. Even when challenges arose, mainly due to the epidemic, we successfully solved them on the fly, and that is essential.

Ksenija Furman Jug
Trustee of Framework Agreements with Suppliers of Active Equipment in SIO-2020, Network Consulting and Supervision Department, Arnes

A big step forward was made from the point of view of Arnes, too. Before the implementation of the SIO-2020 Programme, Arnes could only operate routers at the school, but not the local network in the background. It has now extended the management to switches and access points of local school networks. Regardless of centralised and automated management, this means Arnes can provide more support for more users.

There was a lack of competence on the part of teachers since they had not had much need to use digital technology until then. The series of unfortunate circumstances had a positive effect in this case, as teachers discovered that they were able to make use of this technology. Teachers have taken ownership of these services and the ICT infrastructure. It has become part of the pedagogical process and is now used more often in the educational process. This was also confirmed by the report at the end of 2020, which states that the use of ICT was 100%, although the goal of the SIO-2020 Programme was for ICT to be used by 55% of secondary school teachers and 65% of primary school teachers.

Arnes is absolutely indispensable for the computing part of education system. This was true also before the pandemic with the remote teaching. Often there is simply not enough technical knowledge in education institutions to be able to take care of the ICT part, so we turn to Arnes for assistance. With the Arnes Automator tool we are able to manage certain wireless network parameters in a user-friendly way. Therefore, any such solution is very important.

Simon Dražič
Consultant in the SIO-2020 Programme,
Assistant to the Headteacher,
Šmarje pri Kopru Primary School

On the one hand, I am grateful for the coronavirus period. Bistrica Primary School, Tržič, is an innovative school, we use innovative pedagogy, but unfortunately there was no self-confidence in the use of modern technologies by educational staff beforehand. They had a fear and aversion to technology and connectivity, which is understandable. In the beginning we were still getting familiar with it, then we set up two school protocols—online classrooms, a video conferencing system and video rooms—and it worked seamlessly. We set up these two protocols virtually overnight, but we succeeded, and today we are all very proud of it. This is a good example of an innovative school that has done remote teaching very successfully.

Dina Pintarič
Consultant in the SIO-2020 Programme, Headteacher,
Bistrica Primary School, Tržič

A Vision of the School of the Future

At the same time, it turned out that for increased use of digital technology it is important that the technology is 'invisible', i.e. the technical aspect is taken care of so that the user experience can be built on it. Teachers are more confident using it because they know they can use any of the equipment without fear of it not working.

The sudden leap in the use of technology during the COVID-19 pandemy, and above all the loss of fear of the technology, certainly makes for a different future—an innovative digital school. Educational staff in schools will further refine and build on the experience they have gained during this time. Innovative teachers are the foundation of the future, as they will raise students' competencies by preparing them for lifelong learning and equip them with knowledge and skills for the future, all the way through to their profession.

Our desire is to unite all levels, i.e. infrastructural, service and pedagogical-andragogical, so that technology in schools becomes invisible, yet used on a daily basis. When teachers come to class they will be able to use ICT equipment without hesitation. The focus will be on the content and on the interaction with students, not on technical aspects. This is my goal and direction for the future.

Alenka Starc
Head of the SIO-2020 Programme, Advisor to the Director for Coordination of Educational and Research Services, Arnes

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> The numbers are fascinating. That's about 25.000 pieces of active equipment, of which Smart Com has prepared and supplied more than 1.000 switches and traffic routers, and we would not have been able to implement it without remote central management.
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> **Ksenija Furman Jug**
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> Trustee of Framework Agreements with Suppliers of Active Equipment in SIO-2020, Network Consulting and Supervision Department, Arnes

Photo: Aleš Rosa

Although the SIO-2020 Programme has been successfully completed, Smart Com continues to collaborate with Arnes to maintain equipment at educational institutions and to supply Juniper Networks equipment to Arnes members, who will continue to establish local infrastructure and wireless networks in the future.

Smart Com with Juniper Networks modern technological solutions implements networks for tomorrow. The networks that support modern digital services for users are secure, reliable and powerful, and are easy to manage and control.

We are honoured to assist our customers in selecting and implementing a technology solution that is user-friendly, functionally sophisticated and is price performing. In addition to providing consulting services, as well as planning and implementing of the solution and the systems, our team can also manage, maintain and technical support the ICT systems.

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