# UNI•C – A True Internet Pioneer, the Danish Computing Centre for Research and Education

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# UNI•C – a true Internet Pioneer
## The Danish Computing Centre for Research and Education

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**Abstract.** In 1985 it was decided to merge the 3 regional computing centers NEUCC, RECKU and RECAU located respectively at the Technical University of Denmark, the University of Copenhagen and the University of Aarhus.

The background for the merger was the rapid development of computing equipment which meant that small computers could now be purchased for local use by the university departments whereas the need for high performance computing could only be satisfied by a joint national purchase and advanced network access to this central computer facility.

The new center was named UNI-C and succeeded in helping Danish frontline research to use innovative computing techniques and have major breakthroughs using the first massively parallel computer architectures, but the greatest impact of UNI-C on Danish society was the successful early roll out of the Internet to universities with a follow-up of establishing the first Danish Internet service to ordinary PC users. This very first Internet service became a great success and helped to put Denmark on the international map as one of the very early Internet adopters. It also meant that UNI-C was tasked by the Ministry of Education with delivering a number of different groundbreaking services to Danish schools like e.g. the Education Portal EMU, the school intranet SkoleIntra and the single sign on service, Uni-login.

The growth of the service portfolio to schools meant that UNI-C stayed with the Ministry of Education when the universities were moved to a separate new ministry, and today UNI-C only delivers services to schools, whereas the service portfolio for universities is now taken care of by the DeIC, the Danish e-Infrastructure Collaboration.

## 1     Introduction

In this paper I will give some glimpses from the history of UNI•C, one of the innovative public sector IT-organizations in Denmark where I had the privilege to be the Director General for the years 1989-2011. Giving a full history is not possible – for that one would need to write a book – so please be aware that this is by no means an attempt to write the entire history of UNI•C.

UNI•C still exists today, but is on its way to a name change, having been repositioned into an Agency of IT and Learning under the Ministry of Education with a much more traditional bureaucratic role, quite different from the role it was originally founded for.

The historic role, however, profoundly impacted the speed and effectiveness with

which Danish society was able to transform into a true information age society, and so I am happy to have been asked to talk about this at a conference on the History of Nordic Computing.

UNI•C was founded in 1985 as the merger of the three regional computing centers located at the three oldest universities in Denmark. The centers were the Northern Europe University Computing Centre NEUCC at the Technical University of Denmark in Lyngby, the "Regionale EDB-center ved Københavns Universitet" RECKU at the University of Copenhagen and the "Regionale EDB-center ved Aarhus Universitet" RECAU at the University of Aarhus. The decision to merge the three centres was taken after extensive preparatory work done by "EDB-Udredningsudvalget" – loosely translated "The Electronic Data Processing Analysis Committee". The committee's report was published in 1983 and it concluded that in order for Denmark to keep abreast with the fast technological development, time had come for Denmark to invest in supercomputing and networking.

At their conception in 1965 as university computing centers, the regional computing centres had been the only places where researchers could do their advanced computations, where economists could do statistics and modelling for the economic development and where the research libraries could build their big databases.

20 years later smaller computers had arrived and could be bought directly by university departments, by the libraries themselves and the Ministry of Finance and other bodies doing statistics and econometric calculations. At the same time, technological development had led to very advanced "supercomputing" architectures. These could offer computational research areas completely new possibilities, and network protocols were progressing that could offer easy and almost instantaneous access to big computers over long distances.

Hence the new landscape for the use of computing in research pointed to the need for a larger national center with unique facilities like high-performance supercomputers and high-performance networks that could give scientists all over Denmark access to advanced computing power both in Denmark and abroad. At the same time, the viewpoint was that not only university employees and students should have such access, but in fact this should be available to everyone who needed it, also in the private sector, and therefore such services should be accessible for everyone who would pay for them. This was also in harmony with the view held by many university professors that the funding for such services should be allocated to the universities and not directly to the national centre, so that university departments were free to buy whatever machine or service they wanted..

Hence a "commercialization" was foreseen for the services offered by the new merger, as was a possible development towards privatization of the new organization, which was given the name "Danmarks EDB-center for forskning og undervisning", or in English "The Danish Computing Centre for Research and Education".

In line with the acronyms created for the older centers, the new center was at birth given the acronym DECFU. However, it soon became apparent that this new acronym did not really resonate with the users and a competition was held which led to the name UNI•C. This name was very much in line with names of other mergers at the time, e.g., UNISYS and Unibank, where the "UNI" stood for the new unified organi-

zation created from several old ones – and the "C" in this specific case for Center and "Computing". However in the case of "UNI•C" it also associated to the strong ties that the new center had with the universities, and thirdly when read as a single word, it resonated with "unique", thus giving associations to the fact that the new center was soon to purchase unique facilities like the first supercomputer in Denmark, and give unique network connectivity tools to the users, so that they could reach this unique facility and other large computers from all over the country.

The name "Danmarks EDB-center for forskning og uddannelse" was however kept too, and so the full name of the new institution became "UNI•C, Danmarks EDB-Center for forskning og uddannelse".

## 2 The Unique Facilities at UNI•C

### 2.1 The Networks

In networking technology the leading country in the 1970s was the United States with its ARPANET network, the first large-scale data network in the world. The ARPANET was established by ARPA (the Advanced Research Projects Agency) in 1969 to connect universities and institutions with ARPA-funded research. In 1973, Norway was the first country outside the US to be connected to the ARPANET, and in 1977, Norway took part in "internetting" demonstrations in which three networks - the ARPANET, the SATNET and the Packet Radio Net (PRNET) - were interconnected and the TCP protocol was tested. Since this network could only be used by a few Norwegian users, the successful experiment led to pressure for getting a national research network and eventually UNINETT was formed in 1976. In Denmark, the big networking project of the 1970s was to connect the 3 regional computer centers. The project was called "Centernet" and ran through the years 1977-83. Especially RECAU was very active in this project and also established a campus-wide packet-switching network in 1972 with more than 200 terminals. There seems little doubt that the Centernet project made a substantial contribution to research in the field of data net- working in Denmark. However the real breakthrough for the users came in 1988, when the new nationwide Ethernet network DENET went into operation, materializing as the Danish arm of the new Nordic University Network NORDUnet – a truly impressive international multi-protocol net- work realized in cooperation between the five Nordic countries.

At the time of the "birth" of DENET, Denmark, like the rest of the Europe, was on the OSI track, hoping to define a European network protocol that would be better and more secure than the American Internet protocol TCP/IP. Such a European protocol could of course also mean new opportunities for European industry. So when the Nordic Council of Ministers in 1985 decided to invest in a Nordic University Network Development Programme, NORDUNET, the clear intention was to build on the 7-layer OSI model. But even with the extensive networking expertise present in both Denmark, Sweden, Finland and Norway, it was after a long fruitless period of work decided to change the strategy for the Nordic Network and create a multi-protocol network supporting 4 protocols, including TCP/IP. This multi-protocol network is

depicted in the graphic model of "the NORDUnet plug" resembling an electric plug with 4 legs as seen below (borrowed from "The History of NORDUnet" by Kaarina Lehtisalo [1]):
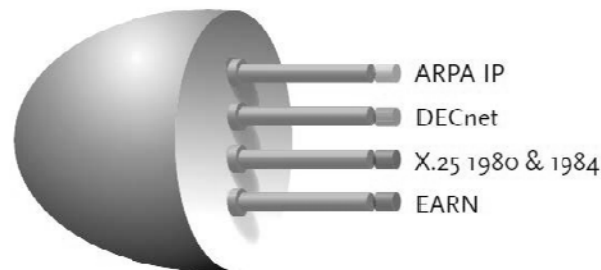


**Fig. 1.** The NORDUnet plug (drawn by Jussi Jokinen, NORDUnet A/S)

This Nordic decision had far-reaching consequences for the development of the Danish university network, and in fact for the whole development of the information society in Denmark. With all the Danish universities connected to the Internet, Danish researchers could now get easy access to day-to-day collaboration with North American colleagues if only a good transatlantic connection could be secured. The National Science Foundation in the US was so delighted to see this development that they strongly supported a transatlantic link to NORDUnet, thus giving the Nordic-North American scientific collaboration a real boost.

In fact, this good connectivity via NORDUnet to other Nordic colleagues, the US and Canada became so important for Danish researchers, that they asked UNI•C whether they could also be connected from home. Working late at night from home was not unusual for university professors, and having an Internet connection at home became desirable. Many researchers had at this time already invested in a small home-computer, and so the need was for a service that allowed them to call up from their home-computer via their normal telephone line. In a sense simple enough – but it was a non-existing service at the time, and it was a real breakthrough when UNI•C launched the new "Internet Service" in January 1993. The researchers had to pay themselves for getting the service established and for the extra cost on their phone bill – and the only reason UNI•C could deliver such a service was that it had become a "state company" with the right to sell services also to private companies and citizens, as long as all the costs and overhead were covered by the income it generated. A business case was developed and launched presupposing that there should be at least 500 customers for the new service already by the end of the first year – which did seem a bit high for a completely new service. But we did not need to worry long about that. The new service quickly became very popular, and the number

of customers far outnumbered our expectations. A number of professionals eagerly seized the opportunity of getting such a service, and reporters both at Computerworld and leading Danish daily newspapers became interested in the perspectives of this new communication channel, and the number of newspaper articles about the Internet exploded. To have such keen and positive interest in the new service and the many new perspectives it opened was quite an experience. It also meant that in the following years, even though UNI•C was a very popular workplace at that time, we actually ended up for a while removing our employees' phone numbers from our website, since they were continuously being disturbed by headhunters during work-hours.

Already in 1991, Denmark had become one of the first countries outside the US to establish a Computer Emergency Response Team – a CERT – called DK•CERT – that helped the universities protect their networks and data. DK•CERT and its close collaboration with CERTs (or CSIRTS) all over the world was a big step forward in the prevention, warning or quick repair of damage from all sorts of cyber-attacks. This service and the security expertise at UNI•C proved tremendously useful for Danish society in the rapid development of the Internet.

When the teleliberalization brought foreign tele-companies (Telcos) into Denmark, the ISP (In- ternet Service Provider) activity at UNI•C had grown to a size that necessitated new substantial investments in international bandwidth. It was difficult for a state company like UNI•C to make such investments at a time when the business model would change and Telcos become competitors rather than suppliers to the service. UNI•C then decided to sell the ISP activity, and in fact all new Telcos bid for the business. It was sold in 1997 with a nice profit for the Danish government, and existed as Uni2 until 2007, most of the time as a daughter company of Tele2.

## 2.2    Supercomputers

The new institution UNI•C almost immediately embarked on the road to the unique facilities and in 1987 acquired the first supercomputer, an Amdahl/Fujitsu Vector Processor with Japanese roots - so a truly international machine, one may say.

Supercomputing at UNI•C had an exciting time in the early years after the purchase of the Amdahl/Fujitsu system.  This supercomputer from 1987 was used by several groups all over Den- mark, however the most exciting very early development was perhaps that a really high-qualified group of numerical analysts gathered around the machine at UNI•C, helping users to optimize their codes and improve their algorithms. This led to groundbreaking results in scientific computing, and the training of a number of exceptionally good PhD-students who helped put Denmark on the world map in scientific computing in spite of the low financial investments put into this expensive front- line research.

In 1991, the Danish Research Councils co-fonded a new "Center for Applied Parallel Computing, CAP", with the aim of getting a massively parallel computer for research in a few selected areas where researchers saw immense possibilities in this special architecture that first came on the market in 1987. A special plea for the pur-

chase of such a system came from one of the frontline research groups at the Laboratory for Technical Physics at DTU. They suggested that a massively parallel supercomputer from the company Thinking Machines should be purchased, since they believed that with this new architecture, they would be able to do atomic scale surface simulations that no one had been able to do before. This "Connection Machine" was not exceedingly expensive, so it gave an opportunity for a small country like Denmark to get an advanced computer, which did in fact help this group and a few other groups to achieve some truly remarkable results. Some of these even made it to the front page of the magazine Nature. After that, the DTU group was offered free computer capacity from big computer vendors in Japan, so Denmark got much more value for money than what we actually paid for the machine. And more importantly, the research done on surface physics at DTU became world leading and also gave new opportunities for Danish industry.

The supercomputing activities at UNI•C were not solely focused on buying and running hard- ware, as mentioned before there was also a very good group of experts supporting new users, optimizing algorithms and co-advising PhD-students together with leading university professors. Today some of those students have very prestigious positions in Denmark and at famous universities abroad, but it did unfortunately also give rise to some jealousy from university departments, even though many departments were happy to get the support from UNI•C.

So when the Ministry after more than 10 years of intense activity in supercomputing decided to reduce the funding for supercomputing with 50%, with the argument being that the original mission had been accomplished and normal computers now had the sufficient capacity for most scientists, the outcome was that support and purchase of high performance computer equipment became de- centralized, and the small group of experts at UNI-C dissolved.
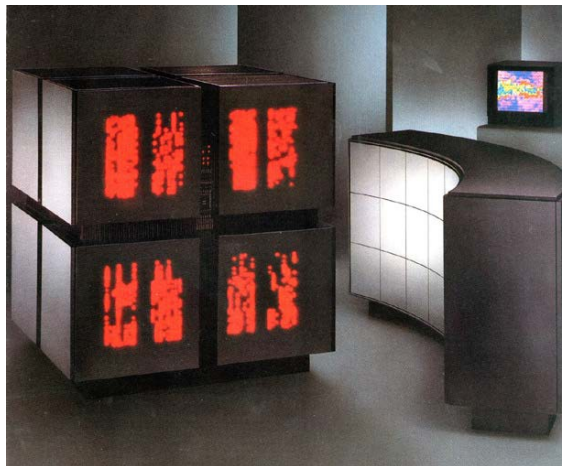


**Fig. 2.** A Connection Machine CM-200 with disk"bar". The UNI•C CM-200 only had one cube, not 8 as depicted here.

The Connection Machine CM-200 at UNI•C was not quite as big as this picture – in fact we only had a single cube, not 8 of them as shown here – but it served its purpose none the less. And the Disc Storage was as "bar"-like as shown here. In fact, the design side of the Connection Machines was special, as was their architecture.

# 3 Computers in Education

## 3.1 The Electronic Classroom

The Computer Centre at the University of Aarhus, RECAU, started in the early 1980s to focus on the use of computers in education. At UNI•C these activities were continued in two rather different areas:

— "The Electronic Classroom" focusing on distance-learning with electronic com- munication be- tween teacher and students.
— "Multimedia learning materials" using the new digital opportunities for having sound, film se- quences and many more pictures than in books plus more interactive learning styles .

"Electronic classrooms" were established at several universities, especially for continuing education, but also, *e.g.*, for business school degrees to adults who were in job. But also other organizations saw the usefulness of electronic classrooms. One example was "Teknisk Landsforbund" which created an impressive and successful continuing education activity for technical assistants, teaching them to use the program AutoCAD. The "Electronic Classroom" was based on the Swedish software PortaCOM, a commercialized development of the original KOM-system, a datacon- ferencing system developed by the Swedish computer scientist Jacob Palme.

## 3.2 SkoDa, SkoleKom, Sektornet and SkoleIntra

In the late 1980s, newspaper databases like PolInfo and databases on social studies and other sub- jects became of interest to Danish schools, but the interfaces were all different and the price of access was high for  schools at all levels.

This led to the Ministry of Education taking an initiative to create a joint interface and joint purchase of access for all Danish schools, and in 1997 the Ministry asked UNI•C to operate and further develop this service. Over the years it became a big success, it actually grew to have 2100 schools as paying customers. It still exists as "Skolernes Databaseservice" or "SkoDa".

Another service that emerged from the Ministry of Education was SkoleKom, a mail and conference system based on the same technical platform as "The Electronic Classroom", PortaCOM. At the peak, it had 350.000 active users, nowadays probably around 200.000.

UNI•C took over SkoleKom as well as the network for schools, Sektornet, in

1997 – right after the sale of Uni2 to Tele2 mentioned above in the networks section.

Already in the early 1990s the Ministry of Education started planning a secure network for all schools in Denmark, the Sektornet. In 1997 Sektornet moved to UNI•C after UNI•C sold its commercial ISP service to Tele2.

With almost all public schools being connected by Sektornet and almost all Danes connected at home at the end of the 1990s, the foundation was laid for teachers to communicate electronically with parents as well as with each other and with the pupils, also after school hours.

Two schoolteachers from Southern Jutland were among the first to develop a system for this and they established a partnership with UNI•C for efficient operation and support. This revolutionized communication between teachers and parents and has influenced school administration as well, making interaction between home and school really easy as compared to the days where all messages had to be carried home on paper deep down in the schoolbag and sometimes took a long time reappearing ...

With more than 1 million users of SkoleIntra, UNI•C here succeeded in creating a unique knowledge sharing and communications platform for the Danish school system.

### 3.3    The Educational Portal EMU

The first Educational Portal was launched by UNI•C in 1997 and was at the planning stage first intended as an Electronic Market Universe, where schools could buy digital learning materials. The name Electronic Market Universe gave rise to the acronym EMU. It soon became clear that time was not ripe for such a market place, and focus was changed to create a portal where teachers and students could find a lot of relevant information. However the acronym EMU was kept, even though some thought it a bit odd to have a portal with the same name as an Australian bird which cannot fly. This portal and its different universes for both very young, young and older students as well as teachers became very popular. For a long time it was on the top20 list for Danish portals. It even got its own mascot, inspired by the name ”EMU” – the Australian bird which stays on the ground but runs exceedingly fast. The EMU mascot became very popular with schoolchildren and even participated in the Galathea3 expedition 2006-2007. During this expedition, an enthusiastic school teacher even made costumes for the EMU, for example for the “EMU over board” drill or diving expeditions, and it made headlines in the newspaper Jyllandsposten – I believe you can say it somehow embodied the enthusiasm with which many Danish schoolteachers and children adopted the new digital era in the two decades 1990-2010. Following the EMU on Galathea3 of course also gave a lot of information about the expedition and its scientific results and the methods used. Together with SkoleIntra, it made the pioneering organization UNI•C known to millions of Danes – notably parents, teachers and schoolchildren.

**Fig. 3.** The EMU toy animal participating in the Galathea3
expedition 2006-2007

## References

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