HISTORY OF THE NORDIC COMPUTER INDUSTRY

Panel Discussion

Christian Gram, Tero Laaksonen, Tomas Ohlin, Harold (Bud) Lawson, Rolf Skår, and Ole Stangegaard

1. *Gram, Panel Chair, Bondehavevej 135, DK-2880 Bagsvaerd, Denmark; chr.gram@ddf.dk*
2. *Laaksonen, Comptel, Finland; tero.laaksonen@comptel.fi*
3. *Ohlin, Linköping University, Sweden; tomas.ohlin@telo.se*
4. *Lawson, Lawson Konsult AB, Stockholm, Sweden; bud@lawson.se*
5. *Skår, Norwegian Spacecenter, Norway; rolf.skaar@spacecentre.no*
6. *Stangegaard, Milestone Systems, SPSS, Denmark; ole@spss.com*

Abstract: In this panel session, people from the four countries – Finland, Sweden, Norway, and Denmark – who participated in the early development of computers and computer industry discuss how the computer industry started and what happened 30 to 40 years ago. We will try to answer questions as follows. How and why did the computer development and industry start in each country? How did it manage the change from research/development into industry? How and why did some of the early companies not succeed? What were main achievements and successes?

Key words: Nordic, computer, industry

1. INTRODUCTION by Christian Gram

In the Nordic countries several initiatives were taken to develop computers, and some of them led to production and marketing of computers from the early 1960s. Many of the companies ran into financial difficulties, went through a number of painful transitions of ownership, and finally stopped or absorbed by larger foreign companies. The following sections shed light on what happened to the attempts to create a Nordic computer

industry. Each co-author describes important events in his country and reasons for why things developed as they did 30 to 40 years ago.

In Finland, the ESKO-project at Helsinki University developed a small computer around 1960, but the lead was soon taken by NOKIA. Tero Laaksonen, now executive officer in COMPTEL, had managed NOKIA's computer operations and he discusses it from a NOKIA point of view.

In Sweden, early players were FACIT and DataSAAB, and through the 1960s and 1970s they manufactured computers and related equipment with some success. Harold Lawson, who was a consultant to DataSAAB and CPU architect of their last mainframe, mentions some key points in their development process, while Tomas Ohlin discusses whether a better IT policy in Sweden could have led to a viable computer industry.

In Norway, some defense researchers started a computer development already in the late 1950s. Out of this grew the computer company Norsk Data, where Rolf Skår was among the founders and became the general manager.

In Denmark, the story starts with the research institute Regnecentralen, which transformed into a commercial company producing computers and operating as a service bureau. Ole Stangegaard, who worked for the government's service bureau, describes what he sees as lost and gained opportunities. Christian Gram adds a few remarks on two other Danish computer companies.

2. FINNISH COMPUTER INDUSTRY by Tero Laaksonen

My experience begins in the early 1970s and mainly in Nokia's computer division, later Nokia Data, and then ICL. Overall, I think that there was a lot pioneering in the Nordic countries not only in application software, but also in hardware, operating system design, and other research. This applies also in Finland. There were a few initiatives in the country that resulted in industrial scale production, the foremost being Nokia.

The results of the local R&D were quite good and attained quite a success, though mainly locally. What went right was perhaps the swift execution of ideas, true entrepreneurship, and good quality of products. In Finland's case, even commercial results were quite good as long as a preference for "Made in Finland" existed. However, as soon as de facto standards emerged along with the IBM PC, difficulties started to accumulate. Standards invited to mass-production, and the players with risk taking capability could swiftly gain strong market position.

Nokia introduced some wonderful examples of early technologies such as local area network long before Ethernet became commercially accepted, black and white screen on the PC, and others. Specialized solutions for retail POS as well as for retail banking were extremely successful as long as more "standard" products could not erode the prices.

In the aftermath, one could say that Finland created products as good as any other country did; even in the era of de facto standards there existed swift adaptation to the technology. However, the sales and delivery networks were lacking. Even if this was clearly understood, there was not enough willingness and daring to invest in this. In Finland, the thinking was that the country could not expect to excel in such high technologies. A prominent Finnish industrialist put this into words saying, "In Finland it is possible to make products that are at least of the size of a horse". There was common agreement with this sentiment.

The government tried to create a strategy that would consolidate the industry. In this way, the consolidation would make it stronger. However, the initiative never materialized into a working model, and one could say in hindsight that failure in this trial was lucky for the country because in all aspects it would have resulted in a subsidized, bureaucratic, and inefficient structure. On the other hand, Finland did successfully develop education. With current skills in hi-tech engineering, even marketing areas have experienced a true turn around, thanks to the pioneering work and the accumulated knowledge from those times.

What would happen if history had taken alternative paths? From the Finnish industry point of view, there were only very weak opportunities to manufacture large volumes of commodity products and to distribute them. The sources of the key technologies were elsewhere and the accessible market was simply too small. On the software side, there was ground for development and they grasped that. Much depends on credibility and since the country as part of the Nordic community can boast of many achievements, the world-class paper industry for example; even other competencies such as the Finnish IT development have attained a greater degree of respect.

3. EARLY DREAMS ABOUT A SWEDISH MAINFRAME COMPUTER INDUSTRY
by Tomas Ohlin

The Swedish ICT market appearance in the sixties was very different from that of today. IBM was an extremely dominant market part, and Televerket was the only telecom provider. The market was biased.

It seemed impossible to introduce competition on the computer market. The dependence on one provider was almost total back up. It unified and streamlined systems service to a degree that would show to be unhealthy, at least in a crisis. The thought of national technological dependence was a view considered unhealthy for a country like Sweden.

Could a small country develop market alternatives by itself? What type of ICT policy would then be relevant? A natural thought was to ask for state support of some kind.

What type of systems would then be of concern? Would hardware and software services have application? At the time, computer systems for many analysers conceptually were hardware oriented. They considered relevant to count and compare speed and memory sizes. Telecommunication connectiveness was also relevant, but not crucial. We should remember that the 1960s was the era before time-sharing and multiprogramming. The systems structures were star shaped, software systems were block oriented, with fixed-type operating systems, well-defined compilers, and application packages that were only beginning to show structural similarities. With regard to developing computer services, these were relevant for ICT policy making only to an astonishingly limited extent.

So, what was Sweden's capacity as a computer developer and provider? Moreover, which was its market strength? It was relevant to develop further the position of SAAB. Its computer division, DataSAAB, had been successful with model D21, and D23 was in the mind of some planners. FACIT was developing certain types of office systems. On the software side, many Nordic computer users accepted Algol as an able competitor to FORTRAN and COBOL; DataSAAB had active software development in this domain. Algol Genius was a Swedish invention, with the impressive Norwegian Simula development nearby (1967). What could Sweden do to support all this?

Swedish public ICT policy just came into being, but there was already a strong tradition of state support to other industrial branches. It was not difficult for leading industrial politicians to extrapolate into the computer field. They formed a broad public committee, *Dataindustriutredningen*, in 1971. Harry Brynielsson was the chair and this author took part in the work.

The committee mapped the computer system development and market situations, and asked itself about possible public measures. Naturally, they expected some type of DataSAAB support, but how would they formulate this? Moreover, what would this look like as seen from a political perspective? Certain general public reforms were suggested, with educational measures, general research expansion, usage related measures, standardization and structural support. They invented a new form called the "national projects". This would include large projects of social importance, with national equipment and software suppliers. The added additional

research support aimed directly toward the Swedish computer manufacturers by certain committee members.

Government showed thoughtfulness when it received these proposals for public support proposals in 1974. Would such measures be effective? IBM was eager to ensure that they would not. After public consideration, only few of the proposals materialized. In retrospect, those proposals for public ICT support now seem fair and relevant. However, it turned out to be a difficult task to develop a national alternative to the computer market situation of that time. The international forces turned out to be much stronger than expected.

Yet, the almost total IBM market dominance of that time later met with successful challenges. IBM abandoned the de facto monopoly strategy with its dependence. Did this relate to certain measures outside of the market? Did public policy play a role? To some extent, it is true. We must remember, though, that IBM made a mistake by not realizing the phenomenal force in the expansion of the personal computer. Nevertheless, this was fifteen years later. The Swedish public ICT measures of the1970s were not directly successful. However, they did establish a foundation. Can we do all this again? Perhaps we can.

4. COMPUTER ARCHITECTURE DEVELOPMENT IN DATASAAB
by Harold (Bud) Lawson

Note: A more comprehensive presentation on this point appears in a separate paper in the proceedings; namely, Panel contribution: The Datasaab FCPU (Flexible central processing unit).

The goal is to place into perspective of general computer industry developments some computer architecture developments around the late 1960s and early 1970s, in particular, the DataSAAB FCPU. I have written several articles that are relevant in this regard. See the references.

The announcement of the IBM 360 was a critical turning point in the computer industry. Here we saw a mismatch between processor architecture and system software, see the *Mythical Man Month*, and the *March into the Black Hole of Complexity*. This resulted in unstable platforms of hardware and software. The source of these problems is function distribution in computer system architectures where a model from 1976 showed the dramatic affects of complexity. The DataSAAB Flexible Central Processing Unit (FCPU), building upon ideas from the Standard Computer MLP-900, was a 64 bit asynchronously controlled microprogammable processor. It

included the ability to implement multiple instruction repertoires and raised the semantic level and can be compared to the Burroughs B5000, 5500, 6500 and some of the Soviet Machines.

Many things could have happened. For instance, cooperation with Regnecentralen – RC4000 was a possibility. Others include cooperation with Burroughs, cooperation with Motorola, and the Styrelsen för Tekniska Utveckling (Project P). What did happen was something different. First, the arrival of microprocessors changed hardware economics and in the end, as well now observed, has proved to be a catastrophe for software economics. What could happen in the future? We can expect further catastrophes, more stable and secure platforms, and would probably reinvent what others have already done. There is a big market out there for the right products that include platforms and applications.

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5. HISTORY OF NORDIC COMPUTER INDUSTRY AS SEEN FROM NORWAY
by Rolf Skår

NDRE (FFI, Forsvarets Forskningsinstitutt) scientists visiting MIT in the period 1957-1969 developed the knowledge to design state-of-the-art computer systems in Norway. The pioneer was Yngvar Lundh visiting MIT during the TX-0 period. MIT developed the TX-0 by a team led by Ken Olsen, founder of Digital Equipment. Many regard the TX-0 as the "mother" of all modern computer architectures leading the way to today's microprocessors.

5.1 Choices

Computer design architecture included several choices. The first of these included the choice of word length (24, 16, or 32 bit), electronics (germanium or silicon, TTL), and memory technology (ferrite core and the switching to solid state RAM). Choices in architecture also involve the

inclusion of virtual memory (paging) in hardware or not, the use of hardwired or microprogrammed logic, floating point arithmetic and its speed, and whether to use RISC or CISC instruction sets.

Software choices also played a part - principally the choice of operating system. Options include real time processing, time-sharing, transaction processing, multi-mode processing, combination processing, and network access. For languages, we needed to choose FORTRAN and/or COBOL, ALGOL, Pascal, SIMULA, and proprietary system language development. We even had choices of applications process control such as scientific general purpose for universities and research institutes, commercial transactions, and other processing applications.

5.2 Rivalries

Of course, rivalries existed. The rivalry between Norsk Data and Digital Equipment (PDP-8, PDP-11, and the VAX) as seen from a Norwegian perspective is interesting. The complete split between the IBM total dominance in commercial computing and the modern minicomputer as seen from the mini- or the supermini-computer side is interesting. It included the almost total lack of communication and transfer of people between these two dominant camps. IBM was still selling and promoting punched cards when Norsk Data was working from online display terminals. Later, IBM was promoting word processing running from central mainframes. The financial challenges faced Norsk Data. It became a public company through listings on London Stock Exchange and NASDAQ in New York. Finally, we have witnessed the long historic trends from the TX-0 to WINTEL (Windows and Intel microprocessors) machines and with it the downfall and disappearance of both mainframe and minicomputer architecture.

6. EARLY DEVELOPMENTS IN DENMARK by Ole Stangegaard

6.1 Personal background

Trained as line officer in the Danish Army, Ole Stangegaard received a leave of absence in August 1960 to join the first ten employees at 'I/S Datacentralen af 1959' (DC). Initially responsible for computer operations and later for computer programming, he became vice president in April 1964 with direct reference to the Board of Directors of DC. On leave from this position, he transferred to the Ministry of Finance in 1966 serving as head of

the department responsible for the Danish government's computer planning and acquisitions, maintaining responsibility for computer acquisitions at DC.

Stangegaard left the Danish governmental area of computing in October 1967 and founded the computing subsidiary ØK Data of the East Asiatic Company (EAC), then a major Danish shipping, trading and industrial conglomerate with activities on all five continents. ØK Data did not only provide computing resources to the EAC companies in Denmark and abroad, but also actively pursued business with Danish and international customers outside the EAC group. In 1979, ØK Data acquired the service bureau activities of Regnecentralen (RC). In 1985, Stangegaard joined Price Waterhouse (PW) as partner in their at that time infant consultancy practice in Denmark. When he eventually retired in 1994, that practice had grown to more than two hundred consultants. Today he serves as chair of a small number of Danish IT and telecom businesses.

6.2 Historical background

Two organizations, Regnecentralen (RC) and DC, dominated the Danish computing scene in the early 1960s. RC came into existence in October 1956 under the auspices of the Danish Academy for Technical Science (ATV). It had built the first Danish computer, the DASK, in 1957. RC's business ideas were two-fold: To develop, produce, and market computers (GIER, RC 4000), and to operate a computer service bureau initially based on RC produced equipment but eventually using mainframe computers from CDC. The dichotomy between these two business ideas proved to be fatal for RC forcing a division of the two activities into separate companies in 1979.

For better and worse, the academic origin dominated RC creating an innovative environment with respect to both hardware, software, and application development, but failing to establish commercial skills e.g. in marketing and strategic partnering and RC suffered from a chronic lack of working capital. The Danish government and the Danish municipalities in December 1959 had founded DC and funded it handsomely through the Ministry of Finance with the specific objective of improving efficiency of the public administration through computerization. DC's virtual monopoly in the public sector and IBM's role as preferred vendor to DC created a rapid growth and certain technically innovative applications (OCR, telex based remote access to databases) but also a bureaucratic and self-sufficient approach to the Danish computing scene. Subsequent to privatization in 1990, they sold DC to CSC Inc in 1995. Today, it remains one of the largest computer service organizations in Denmark.

6.3 Opportunities lost

It seems evident that the scenario with two important and early players as RC and DC in spite of – or because of – different backgrounds, both financed by public funds, if properly managed could have become a dominating IT enterprise in Denmark or even on a Nordic scale. Clearly, this did not happen. RC and DC have now both disappeared and/or been acquired by international IT enterprises.

So, what was the reason for this opportunity missed? In my view, it was as often as many times before and after, the lack of true management talent and political foresight. It would have taken a major management effort to bridge the gap between the mainly academic origin and atmosphere at RC and the public sector origin and attitude at DC. The charismatic manager of RC, Niels Ivar Bech, viewed with disdain the IBM trained and overcautious managing director of DC, Willy Olsen. With deep mutual suspicion, they actively discouraged attempts to establish contacts or cooperation by the staff of the two enterprises, which gradually developed into direct competition. In this way, one great opportunity for harvesting the benefits of the early start of computing in Denmark was lost. Had the management talents and personalities been different, the outcome might have developed in the creation of a productive 'centre of gravity' for the early IT development in Denmark.

6.4 Opportunities gained

The rationale in 1959 for establishing a central government data processing facility, DC, was the political decision to change the Danish income tax system from paying in arrears to a 'pay as you earn' system (kildeskat). This required a central registration of all income earners. They consequently decided to centralize the up-till-then municipal population registers established in 1924 into a nationwide central population register (CPR) and simultaneously to computerize it. In the process, all Danes received a ten-digit personal identification number (CPR-nummer). This created much political apprehension about the potential for a 'Big Brother watches you' society. However, common sense prevailed and since then the wide usage of precise personal identification has changed the way – both the public and the private sector – of running the Danish society.

Following the successful and universally accepted implementation of the CPR, DC centralized and computerized other decentralized registers. Administrative registers like the Central Motor Vehicle Register (CMR), the Register of Housing (BBR) are good examples of important computer applications during the early 1960s in Denmark. In each case, the

introduction had to overcome much political and organizational resistance; but in each case, they reaped considerable advantages – primary as well as secondary ones.

6.5 Summary

In summary, it is fair to say that during those years, the pioneers built the infrastructure of the 'information society' as we know it today. Those of us who were then active in this process may not have been aware of the full impact of our efforts. However, in retrospect, we were instrumental in changing the way our society functions. It has been a privilege to take an active part in such a revolutionary undertaking.

7. THREE DANISH COMPUTER COMPANIES by Christian Gram

7.1 Personal Background

From 1958 to 1973, Christian Gram was employed by the Danish company Regnecentralen, first part-time and later full-time. Because of his mathematical background, he mainly worked with software development, consulting, and teaching. However, he also participated a little in hardware development. Since 1973, he has taught computer science at the Technical University of Denmark, from which he retired in 2000.

7.2 Regnecentralen

At Regnecentralen (RC), established 1955 by the Danish Academy of Technical Sciences, a group of clever people worked enthusiastically to develop, produce, and sell computers and computer services. From 1957 up through the 1980s, they developed several computers and peripheral units and sold them with some success in Denmark and in Europe. In 1988 – after several financial crises – the British ICL bought RC resulting in a loss of its independent status.

The technological standard of both hardware and software was high, with several unique contributions in different areas such as paper tape readers, memory addressing, storage allocation, compiler structure, multiprogramming operating system, process control, and standard systems for bookkeeping. Nevertheless, RC failed to manage the change from a pioneer company, with emphasis on technical development, into an industrial oriented company driven by the hard reality of marketing factors.

7.3 A/S Chr. Rovsing

In 1963, Christian Rovsing (CR) started his company, and CR quickly grew into a successful computer industry until its financial collapse in 1984. CR specialized in process control for airplane and space technology and developed a 16-bit minicomputer used in several advanced communication systems.

The failure in 1984 seems related to the fact that the company expanded very rapidly and continued to invest in new development projects paid by expected sales – sales that never came to fruition.

7.4 Dansk Data Elektronik

In the early 1970s at the Technical University of Denmark, a group of electronic engineers worked with the new concept of microprocessors. In 1975, they decided to start a new company, Dansk Data Elektronik (DDE) where they developed several smaller and larger computers, the most successful of which were Unix-servers with multiple processors. DDE also developed design automation systems and advanced real-time application systems for industry such as for newspaper production. Through the 1980s, DDE expanded considerably and established subsidiaries in several European countries. Later DDE stopped computer production and development because of hard competition internationally. DDE tried to survive as a software company, but after financial difficulties around 2000 the company was sold and totally reorganized in 2001.

7.5 Failure or Success

At least three times, technically very capable people have started computer development and production and run it successfully for some twenty years. However, the rapid technical international development and the rapid growth of the international computer industry never left the Danish companies the time to consolidate. Therefore, they failed to establish a firm platform and a steady market from which they could finance further development.

The Danish computer industry has had at least two major impacts in Denmark. First, a large number of young people developed deep insight into computer technology and computer science. Later, many of them taught computing at universities and other schools where they helped educate the next generation. Secondly, the Danish society and Danish business life has benefited from early stimuli to introduce and use computers, often in advanced applications.

8. CONTRIBUTIONS FROM THE AUDIENCE by Christian Gram

Below is a short list of statements from the audience about the importance of the early Nordic computer industry.

Military significance: "The computer development had success in many military and quasi-military applications, in Sweden through DataSAAB, in Norway through NorskDATA, and in Denmark through A/S Rovsing."

Programming languages: "Scandinavian software developers have contributed very significantly. There were very early works on compilers for Algol (RC in Denmark and Facit in Sweden). Norsk Regnecentral developed Simula, the forerunner of all object-oriented programming."

Scientific cooperation: "The Nordic computer congresses started already in 1959, the internationally recognized scientific journal BIT was founded in 1960, and in 1971 the Nordic IT societies started the journal DATA. All in all we had fine opportunities for exchanging ideas."

Process control: "In all the four countries we were pretty early using computers for process control and in embedded systems."

Last words: "All the good ideas were around – and they *could* have led to a much better IT-world!"