Why Dansk Datamatik Center?

1960s: Simple programming courses $\rightarrow$ Big systems + lots of errors

NATO 1968: SOFTWARE ENGINEERING

Report on a conference sponsored by the NATO SCIENCE COMMITTEE
Garmisch, Germany, 7th to 11th October 1968

Peter Naur + Brian Randell +
many others

IBM Vienna: VDM = Vienna Development Method aiming at
"systematically developing a compiler from a language definition"

Dines Bjørner + H. Bekic + Cliff Jones + many others
**VDM**: - Specification language VDM-SL (also called META-IV)
- Methods/rules for deriving + manipulating specifications

```
AccNum = token; CustNum = token;
Balance = int; Overdraft = nat;
AccData :: owner : CustNum
            balance : Balance
state Bank of
    accountMap : map AccNum to AccData
    overdraftMap : map CustNum to Overdraft

inv mk_Bank(accountMap,overdraftMap) ==
    for all a in set rng accountMap &
        a.owner in set dom overdraftMap &
        a.balance >= -overdraftMap(a.owner)
```

```
pre cust in set dom overdraftMap
post r not in set dom accountMap~ and
    accountMap = accountMap~ ++{r|-> mk_AccData(cust,0)}
```
Short story of **DDC**:

1968: NATO-conference on problems with SW. New term: **Software**

1970s: Still many big datasystems delayed, with errors and shortcomings.


**DDC created**: ATV society with 10 members: Private + public IT companies (no banks)

**Ambition**: Learn companies better SW development practice.

1980-84: **DDC Growth**: from 2 to 40 people

from 1 mio.DKK to 13 mio.DKK

Main Projects: **Compiler development** for Ada and CHILL.

1985: **DDC International** (now DDC-I Inc.): Develop + market + sale Ada systems.

1985-89: Many SW development projects together with member companies.

Courses, seminars, publications

VDM developed into **RAISE** = Rigorous Approach to Industrial **Software** Engineering.

1989: **DDC closed**. Some projects + staff transferred to CRI Inc.
ADA Project:

1980: US DoD wanted a *cure-it-all* language: Ada

   French/German consortium ready to get EU-money.


1984: Ada completed + US-DoD validated

   First Customers:

   Nokia, 2 * Honeywell, Beijing Inst. of System Engin., NEC (Japan)

1985: Subsidiary *DDC-International Inc.*: Ada, later C, C++, Safety

   (Now in Phoenix, USA.)

1984-87: EU-contract: *Formal Definition of Ada.* 4 volumes

   DDC + Italy.

   Alas! - No real interest in Denmark.
ADA Project:

VDM Specification of Ada compiler

Domain Engineering

Requirements Engineering

Software Design

Ada compiler First to be US-DoD validated in Europe

On schedule, <20% budget excess.
CHILL = CCITT High Level Language
Formal description + Compiler

⇒ Public property ⇒ No lasting income.

Revision of VDM ⇒ Rigorous Approach to Industrial Software Engineering

RAISE = Language + Methods + Tools for

- Requirements Analysis
- Specification
- Design + Development

of general software

⇒ EU Development contract ⇒ No lasting income.

Office Automation Projects: Cooperation with Member Companies on:

- Taxonomy + Terminology
- Generic Office Automation System.
DDC closed after 10 years, because:

- DDC’s major SW products had **no interest** for the Danish IT-companies.

- DDC **failed to convince** Danish IT-companies of the usability of Formal Methods.

- EU and Government **funding** not enough to run DDC.

- ADA didn’t get the expected **worldwide spreading**.

- and we failed to cultivate and utilize **Nordic know-how**.
DDC Achievements:

- **Awareness** of modern SW techniques among Danish IT users + producers.

- The ADA system basis for **DDC-I Inc., USA**.

- The RAISE methods + tools + people continued in SW company CRI Inc.

- 50-100 young candidates got experience with advanced SW technology ➔ new SW companies.

- Many publications and international contacts.

- Many projects better performance + quality than common in 1980s.

- with thanks to my co-authors

  Dines Bjørner, Ole Oest, Leif Rystrom