The DIPS story - a Long and Winding Road

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My agenda

- The DIPS story
- What happened?
- Where are we today?
- Where do we go on?

- Please do ask questions!
The story about DIPS
1982
Hospital-IT in the 80’s

- Characterized by large, expensive and proprietary computer systems
- IBM, Datapoint, Norwegian Data, Data General +++
- Hospitals used ØMI (Economic Medical information system), later AMI, run on Data Central
- Departments registered ØMI forms
- Information about admissions and diagnoses were punched on floppy disks
- Then driven by truck to local data central
- In return trucks carrying reports of very variable quality!
- But the basis for the revenue to the hospital
The work routines for physicians, nurses etc.

- **Post Cabinet Information System**
- A lot of walking for the employees
- Lab orders to be delivered at 0400 latest
- Lab results produced during the day were delivered in the cabinet
- Referrals put in the cabinet for the physician
- Paper records were written on typewriters with numbered pages
- **Very work consuming!**
The IT Committee decided that an online computer system was needed.

Many visits to larger hospitals in Sweden and Norway.

A pilot using Datapoint equipment and software developed by Scanvest Ring was tested in 1986.

Handling admissions, transfers and discharges, and diagnoses/procedures could be registered.

Early 1987, the hospital decided not to continue the use of the Datapoint system.

Primary reason was lack of market impact for this system.
• All systems available were proprietary hardware/software running on expensive large/mini computers

On the other hand...

• PC’s with high capacity were available at a low cost
• Novell Netware Network system was available and working well
• Development software was available
• Why not develop a new system on PC/Network?
DIPS Development - 1987

- One more software engineer employed
- We were using Dataflex with database files
- During some busy months we produced software to replace the Datapoint system
- Coax cables were distributed to all offices, wards and reception
- PC’s (cheap ones) were bought and distributed
- We used Novell Netware 386A server with dual disks and controllers (2 x 186 MB) with RAID
- On the 18th of September 1987, DIPS was put into use – and it worked!
- Distributed Information Patient System
1987 - 1992

- New modules developed
- EHR was developed integrated with the PAS
- LAB and RIS systems were developed
- News about DIPS spread
- Several new hospitals signed agreement to use DIPS
- A kind of joint venture – sharing development cost
The years 1995 - 1999

- EEA/EU-agreement went into force in 1994
- Requiring the hospitals to invite tenders
- The joint venture cooperation around DIPS was not the future
- High demands were waiting, DIPS for Windows in development
- We struggled with a Y2K bug!
- DIPS became a private limited company in 1987
- Owned by the employees (51%) and the old customers (49%)
• The first workflow system
• Integrated scanning (bulk and single)
• The first “Paperless Hospital” in Norway
• Arendal Sykehus
• Relevant parts of the paper records were scanned into the DIPS EHR
  – And shredded!
• Physicians started with our electronical workflow system
• The paper based records went out of use
The benefits and effects

- The Patient Records available in the whole hospital at once
- Quicker response to patient requests
- Quicker and easier clerical routines
- Writing queues gone, lesser stress
- Some physician work easier, some heavier
- The clerical staff ran less and gained weight, 3-5 kg
Before DIPS

They had 6 of those shelves, several months queue
After DIPS...

No writing queue!

Dictation Tapes not needed!
News story

NHS challenged to go paperless by 2018

The NHS should go paperless by 2018 to save billions, improve services and help meet the challenges of an ageing population, Health Secretary Jeremy Hunt will say today.

In a speech to the Policy Exchange this evening, the Health Secretary will say that patients should have compatible digital records so their health information can follow them around the health and social care system.

This means that in the vast majority of cases, whether a patient needs a GP, hospital or a care home, the professionals involved in their care can see their history at the touch of a button and share crucial information.

His speech comes as 2 reports are also published which demonstrate the
But did the physicians use the EHR System?

Research work at NTNU
Questionnaire developed by dr. med. Halvard Lærum
23 important work tasks
Supplied with interviews
Lærum et al 2006: DIPS at Arendal 2002-2005

Retrieve information
- 23 Check and sign typed dictations
- 22 Collect patient information for discharge reports
- 4 Obtain results from new tests or investigations
- 10 Obtain results from clinical biochemical laboratory analyses
- 12 Obtain results from x ray, ultrasound or CT investigations
- 14 Obtain results from other suplemental investigations
- 3 Follow results of a test or investigation over time
  - 1 Review the patient’s problems
  - 2 Seek out specific information from patient records
  - 19 Collect patient data for various medical declarations
  - 8 Produce data review for specific patient groups

Generate and store information
- 11 Order x ray, ultrasound or CT investigations
  - 5 Enter daily notes
  - 9 Order clinical biochemical laboratory analyses
  - 15 Refer patient to other departments or specialists
  - 20 Give written specific information to patients
  - 17 Write prescriptions
  - 24 Register codes for diagnoses or performed procedures
  - 18 Write sick leave notes
  - 21 Give written general information to patients
Lærum et al 2006: Hospitals not using DIPS

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Legend:
- Never/almost never
- Seldom
- About half of the occasions
- Most of the occasions
- Always/almost always
The Norwegian Hospital Reform
2003: The Norwegian Hospital Reform

- From 74 hospital customers to 5 very large Health trusts
- The Eastern Regional Health Authority was the first to announce a tender
- Very exciting and scary for us!
- Would the large (60,000 employees, 60 Mrd NOK) trust put the responsibility for the core PAS and EHR system into the hands of the small DIPS Company (30 employees)?
- Not very good odds, we were the underdogs in this competition!
- We made an strategic alliance with Deloitte Consulting
- Bids came from WM-data, Tietoenator and Siemens
- DIPS, Tietoenator and Siemens in the final round
2003 – bid for Eastern Regional Health Authority

- A lot of requirements (2300)
- Demonstrations for a large group of clinicians
- We made a good impression
- And won the tender!
- Probably the most important contract for DIPS ever
- The start of a very important period of deliveries of DIPS
How did we deliver?

- As a part of the contract, every hospital went through a pre-project planning and estimating the main project
- We (Deloitte and DIPS) made a thorough study of the work routines
- How could these routines be more efficient and leaner with DIPS?
- Flowcharts were made and studied
- New routines were written and put into a large education program
DIPS Digital EPJ med Arbeidsflyt

- Ekspedisjon, poståpner
  - Henvisninger (Elektr.)
  - Henvisninger (Papir)
    - Dokumentet skannes
      - Settes på arbeidslista for vurderende lege
        - Vurderende lege åpner arbeidsliste, skriver diagnose, hastegrader etc og sender henvisningen til arbeidslista for skrivestua
          - Skrivestua åpner arbeidslista, gir pasienten time til innleggelse, skriver brev til pasienten.
  - Prøvesvar (papir)
    - Dokumentet skannes
      - Settes på arbeidslista til behandlende lege
  - Prøvesvar (Elektr.)
Our delivery projects were successful

- We went through many large delivery projects.
- Old databases with EPH and PAS information were converted into the DIPS Database.
- Integration with 3rd party systems were produced.
- DIPS was put into servers and clients.
- Using Oracle high availability software (Real Application Clusters + Dataguard).
- Usually the old system was put into read only Thursday, data was extracted and converted and tested Sunday, and DIPS went live on Monday.
Technology success from North Norway

- The largest EHR/PAS vendor in Norway
- 200 employees later this year
- Outsourcing (Belarus)
- Revenue 250 MNOK
- Main office in Bodø
- Offices in Tromsø, Trondheim and Oslo
Owned by the employees

- Vest Agder County: 8%
- Diakonhjemmet Hospital: 11%
- Nordland County: 19%
- Employees: 62%
DIPS and research

- We contribute in several projects, both with financing and active participating

<table>
<thead>
<tr>
<th>Project Owner</th>
<th>Participants</th>
<th>Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tromsø Telemedicine Lab</td>
<td>Many</td>
<td>Process-support</td>
</tr>
<tr>
<td>SINTEF</td>
<td>DIPS, University Hospital of North Norway</td>
<td>ACTIV Project, optimization</td>
</tr>
<tr>
<td>The Innlandet Health Trust</td>
<td>National Knowledge Center /NTNU/DIPS</td>
<td>EVICARE: «Evidence-Based Medicine» (EBM) at the point of care, integrated with an electronic health record (EHR)</td>
</tr>
<tr>
<td>Halogen</td>
<td>Sintef, Linköpings Universitet, Hafslund Strøm, Finn, DIPS</td>
<td>To develop a visual language for service design</td>
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</tbody>
</table>
Todays Market Situation

Region Mid-Norway

Oslo University Hospital
Norway and penetration of EHR

- Almost complete
Norway does not have a common EHR

- A very restricting legal framework
- “EHR only available within each legal entity”
- Message based communication since early 90’s
  - Lab/X-ray results
  - Discharge notes
  - Referrals
- Electronic Prescriptions for the Patient is rolling out
- Message based communication with the elderly care/nursing homes
Healthcare Challenges

- We are getting older and older, and the elderly getting sicker
- The growth in healthcare to be able to handle the future needs the next ten years is scary
- We must focus on preventing diseases instead of repairing
- Obesity is becoming a major health issue

And this was supposed to be fun???

The Hoola Hoop does not fit into the lifestyle of modern children

Lets go down to Kentucky Fried Chicken!
EHR challenges

• Most physicians still use the dictation machine
• It is always very challenging to change work routines
  – But very necessary to get benefits
  – All implementations are large projects for organizational development
• The patient must still repeat a lot in her journey through the health care system
• Many specialist systems live within their silos
• Many physicians wants better interfaces, more functionallity, more process support etc.etc.
• How can we address these needs?
DIPS Arena – Our next generation EHR
Our new EHR: DIPS Arena

- In 2006, we started rebuilding our EHR/PAS on SOA
- Building on the knowledge from 25 years of development in Norway
- Developed in close collaboration with our customers
  - Workgroups with clinicians from all customers
  - Monthly reviews of new functionality
- This year we are piloting the first parts of DIPS Arena
We must do it smart

- DIPS Arena will not be a copy of DIPS Classic
- We try to think smart and find better ways to handle the needs and requirements
- Making it a better solution for clinicians
  - Better overview
  - Process support
  - Decision support through guidelines
- The capacity to develop (and maintain) software is limited
- At the same time the requirements and complexity is growing
- We must find more sustainable ways of developing DIPS
- One initiative is to do “Model Driven Engineering”
Model Driven Engineering (MDE)

- In order to do MDE we searched for a domain model
- We had great belief in the archetype concept
- EN ISO 13606 standard presented archetypes for healthcare
- Had a reference model and clinical information represented in archetypes
- These concepts were taken further by the OpenEHR initiative
- Developing open source software and information models
We have committed to the OpenEHR platform

- Using both the OpenEHR reference model and the archetype formalism
- Not for the purpose of standardization, but as a tool for «Modell driven development»
- We have adapted specialized component types (Observation, Evaluation, Instruction and Action)
- Dividing our development into a core part and a MDE part
Model driven development

A stable well defined core
Services and interfaces
Referencemodels
Standards
Database schemas

Date content
User Interface
Work processes
Security

Variables, archetypes and terminology
Templates
Process templates and clinical pathways
Authorization templates and mandates

Users
Domain experts
Team

OpenEHR – Two-level Modelling

Templates

Creater

Instanciate and use

modellerer

Core development
Towards more structure

- Today, most of the EHR is unstructured, free text
- And it is repeated many times
- Can we give the clinicians a flexible and easy to use tool for structuring more of the EHR?
- Using “floating” archetypes and autocomplete?
- Can we enable parts of the EHR to be persistent?
• In Denmark, the G-EHR project (2002)
• Every single observation, plan and result was to be registered structured based on Snomed-CT nomenclature
• This initiative was cancelled in 2007
• Many reasons, one major was the increased workload
How does DIPS Arena look like?
Aktuelt kontakt

Tidligere sykdommer
1994 Appendicit (Tykke)
1996 Paraksiol Scholethri
2001 Diabetes Mellitus I

Familie / sosialt
Pasienten bor alene i kommunal bolig, ufører, 85 år. Hvis vandt x 2 daglig. Ingen nær familie.

Legemidler forordnet
Ampesilor Perifin 100/50 (I/O) (Insulinskæringsvæske Insulin (human))
Vid bekr. 0,03 ml (0,3 I) - Int 2 / 4-dage - Max. 3-dagevis 5,5 E
Risperdal 2 mg Tabl (Risperdal)
Rostemidetopisk: Faste rundt 2 = 0 = 0 = 0 (mg)
Insulinskæringsvæske Perifin 100 E/ml (Insulinskæringsvæske, suspensjon Insulin (human))
Rostemidetopisk: Faste rundt 0 = 0 = 0 = 0 (mg)

Medisinsk koding

Hoveddiagnose
E10,1 Diabetes mellitus type 1 med ketoacidose
ICD-10

Notat

Anamnese:

Status Presens ved inkomst kl. 23:30:
Mann i godt hold, nedsatt bevissthed, gjør ikke rese for seg, ikke orientert for tid og sted. Klam og blek i hudens. Ingen cyanose.

Puls: 105 rpm
Blodtrykk: 140/95
Temperature: 28, overblandt
Regul.: 2,7 (normalt)

Cor: Regellemessig hjertetakt, klare hjertetoner, blyd - systolik, ejeksjonspreget gr 2.
Example: Using structure/archetypes
Example: Enterprise Search

- How do we enable search as a technology, without losing patient information security?
- Can a word cloud based on medical key words in documents be useful?
- We can use MeSH (Medical Subject Headings) as tags
- To be usable, search must be immediate
- We implemented Apache SolR as an open source enterprise search platform
- This gave necessary speed, both for word clouds and free text search in the EHR
HANSEN, Arne
15.12.36°03.23 - 76 år - Mann

Dokumenter

Abscess anemi bloddning blatt cyanose endringer feber hånd
høy hypokaliemi nyresvikt pancytopeni respiratorisk sepsis smert stabel
status sykrommer utgangspunkt vurdering

Ingen dokumenter valgt
Better decision support

- Evicare: Research study: How can we integrate evidence based knowledge into the EHR?
- Establish link between structure (problem/diagnosis) and guidelines
- GRADE is an initiative to establish a common, sensible and transparent approach to grading quality of evidence and strength of recommendations
- MAGIC provide guideline organizations with digital tools so that they can develop, adapters, publish and update reliable guidelines based on the GRADE system.
- We integrate MAGIC into the DIPS Arena
  (Interested? Contact Linn Brandt, brandtlinn@gmail.com)
Integrating MAGIC

26.10.11 – Poliklinisk notat, Reumatisme
Reumatologisk poliklinisk tjeneste Arne Hansen Jørgensen

Anamnese
Udredning av forhået SR - reumatisk sykdom?
Relevante bakgrunnsopplysnings
Enkel, bor alene i eget hus. En datter bosatt i Larvik.

Aktuelle sykdomshistorie

Nose smerte i nakken etter etterfall før vinter. Behandlet med Prednison. Hun har god effekt av prednikson og ble utsett på lungved hver fæt trækket.

Observasjoner

Resultater fra supplerende undersøkelser

Bildeanalyse og PET-scan: Infiltrasjoner i fingrene og i begge hofter forent med artritis.

Resultat: Inconclusive.

3.10.11 – Poliklinisk notat, Reumatisme
Reumatologisk poliklinisk tjeneste Arne Hansen Jørgensen

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Resultat: Inconclusive. Hvis det er stor utvikling, kan det være en reumatisk sykdom.
Integrating clinical guidelines
Why did we succeed?
Why did we succeed?

- All we did was bottom up
- In close cooperation with the users
- Picking low hanging fruit, one at a time
- We were able to build trust from the customers
- Many of our employees have clinical background (nurses, lab technicians, a few physicians)
- Our employees find it encouraging to make software for a better healthcare
Why did we succeed?

- We are very proud over our achievements these 25 years
- Probably the best explanation is a lot of stubborn long time commitment
- It is tempting to cite Churchill

Continuous effort, not strength or intelligence, is the key to unlocking our potential
Thank you!

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