

Business Intelligence in the Home Care Sector

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15. December, 2008

Layout

- 1 Business Intelligence for Home Care
 - Introduction
 - Rambøll Care
 - Questions
- 2 Source Data and ETL Process
 - Source Data
 - Extract-Transform-Load
- 3 OLAP Cube and BI Application
 - Creating the OLAP Cube
 - BI Application Tool
 - Examples
- 4 Future Work and Conclusion
 - Future Work
 - Conclusion
 - Questions

Introduction

Collaborator: Herning Municipality

- Home care department.
- Business intelligence solution.

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Existing technology

Operational home care system: Rambøll Care

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Operational home care system: Rambøll Care

What is missing?

Analytic capabilities

Rambøll Care

Klient Visitationsvurdering (Krum, Kit (id:476))

996677-0013  Krum, Kit (id:476) Oprettet: 20-02-2007
 Krumflappen 28, 7400 Herning 99 22 55 44

Evalueringsdato: 1 23-11-2008
 Klodde

Fælles vurdering | Uden fare

	1	2	3	4	Bemærkninger
1. Personlig pleje					
1. Personlig hygiejne	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
2. Af- og påklædning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
3. Toiletbesøg	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
2. Spise og drikke					
1. Morgenmad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
2. Middagsmad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
3. Aftensmad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
4. Drikkevarer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
3. Mobilitet					
1. Færdes inde	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
2. Færdes ude	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
4. Daglig husførelse					
1. Rengøring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
2. Tøjvask	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
3. Indkøb	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
4. Økonomi	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
5. Aktivitet					
Aktivitet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
6. Social samvær/Ensomhed/Netværk					
Social samvær/Ensomhed/Netværk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
7. Mental og psykisk tilstand					
1. Psykisk tilstand	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
2. Hukommelse	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
3. Kommunikation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
8. Akut/Kronisk sygdom/handicap					
Akut/Kronisk sygdom/Handicap	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
9. Boligens indflydelse	Egnet	2	3	4	
Boligens indflydelse	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

Questions (1 of 2)

- 1 Has there been a **change in the functional level** between 2003 and today?

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- 2 Are there areas with equal functional levels that differ significantly regarding inspected and actual provided assistance to a citizen?

Questions (1 of 2)

- 1 Has there been a **change in the functional level** between 2003 and today?
- 2 Are there areas with equal functional levels that differ significantly regarding inspected and actual provided assistance to a citizen?
- 3 Are there **differences in the inspector's grants**, i.e., are two comparable citizens granted different services based on the functional evaluation?

Questions (2 of 2)

- ④ Are there special correlations between the functional evaluation and the granted service package, i.e., is there for example a **subparameter** in the functional evaluation that is **decisive for a change in the granted service package**?

Questions (2 of 2)

- 4 Are there special correlations between the functional evaluation and the granted service package, i.e., is there for example a **subparameter** in the functional evaluation that is **decisive for a change in the granted service package**?
- 5 Has there been a **change** in the **inspected time** and the **granted time** for citizens with similar characteristics based on the functional evaluation?

Questions (2 of 2)

- 4 Are there special correlations between the functional evaluation and the granted service package, i.e., is there for example a **subparameter** in the functional evaluation that is **decisive for a change in the granted service package**?
- 5 Has there been a **change** in the **inspected time** and the **granted time** for citizens with similar characteristics based on the functional evaluation?
- 6 Are there **geographic conditions** regarding both grants and functional levels?

Our Focus

Question 1

Has there been a change in the functional level between 2003 and today?

Our Focus

Question 1

Has there been a change in the functional level between 2003 and today?

Question 3

Are there differences in the inspector's grants, i.e., are two comparable citizens granted different services based on the functional evaluation?

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Databases

Oracle - 9.5 GB

Production DB for the Rambøll Care System.

- More than 100 tables
- More than 100 views

SQL Server - 9 GB

Data Warehouse for Focus Care

- 98 Dimension tables
- 27 Fact tables

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Documentation

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Documentation

NONE!!!

Oracle Database Design

Tables

- Both danish and english named tables, i.e. Client and Klient
- Some tables are referenced all over the place, especially MODULE_TYPE
- Standard system extended with things as an afterthought
- Tables can contain completely different things

Oracle Database Design

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Constraints

- Mostly consists of only null checks
- Few foreign keys used

Example from table EVALUATION_HISTORY

Example from table EVALUATION_HISTORY

Column Name	Data Type	Nullable	Data Default	COLUMN ID	Primary Key	COMMENTS
C_CPR_NO	CHAR(10 BYTE)	No	(null)	1	1	+The clients personal CPR-number (Centrale Person Register).
EVALUATION_NO	NUMBER(3,0)	No	(null)	2	2	+key
MODULE_TYPE_NO	NUMBER	No	0	6	3	+Unique number of the module types
EVALUATION_DATE	DATE	Yes	(null)	3		(null) +date
EXPERT_JUDGEMENT	VARCHAR2(4000 B...	Yes	(null)	4		(null) +expert judgement
EVAL_VALUE	NUMBER(6,2)	Yes	(null)	5		(null) +value
CREATED_INI	VARCHAR2(10 BYTE)	Yes	(null)	7		(null) +Ini of the person that created the evaluation
DRAFT	VARCHAR2(1 BYTE)	Yes	'n'	8		(null) +indicates a draft

Example from table EVALUATION_HISTORY

Oracle EVALUATION_HISTORY

Columns Data Constraints Grants Statistics Column Statistics Triggers Dependencies Details Partitions Indexes SQL

Actions...

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EVALUATION_DATE	DATE	Yes	(null)	3		(null)+date
EXPERT_JUDGEMENT	VARCHAR2(4000 B...	Yes	(null)	4		(null)+expert judgement
EVAL_VALUE	NUMBER(6,2)	Yes	(null)	5		(null)+value
CREATED_INI	VARCHAR2(10 BYTE)	Yes	(null)	7		(null)+Ini of the person that created the evaluation
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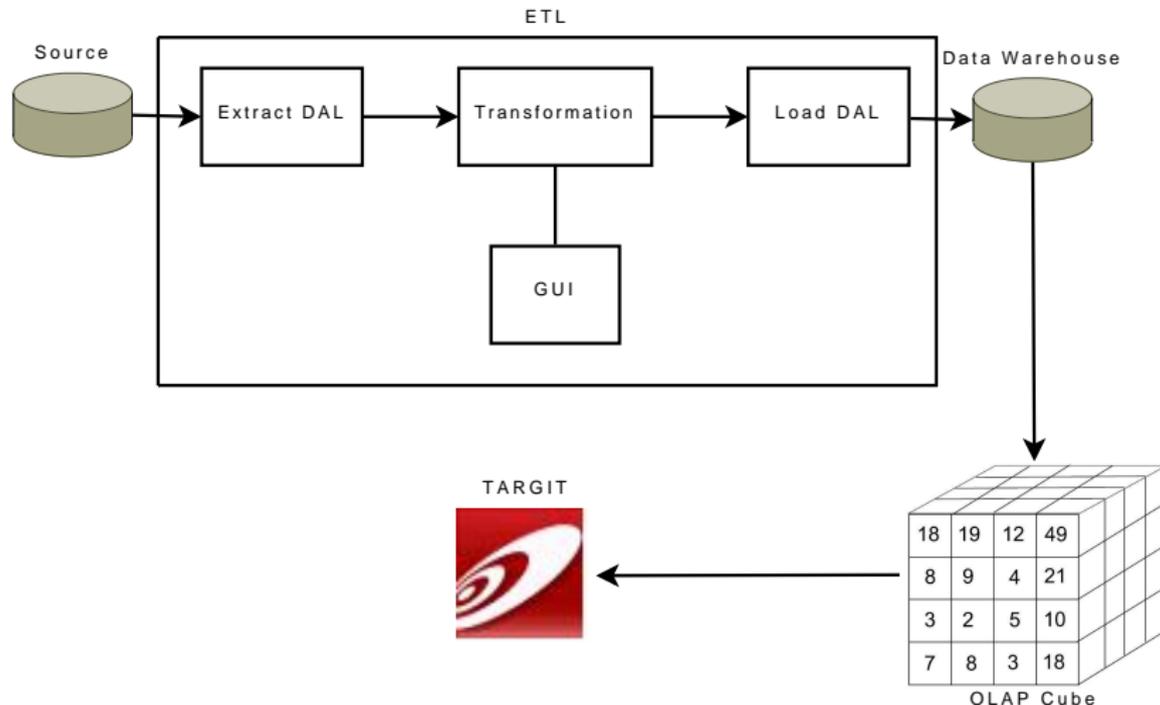
Oracle EVALUATION_HISTORY

Columns Data Constraints Grants Statistics Column Statistics Triggers Dependencies Details Partitions Indexes SQL

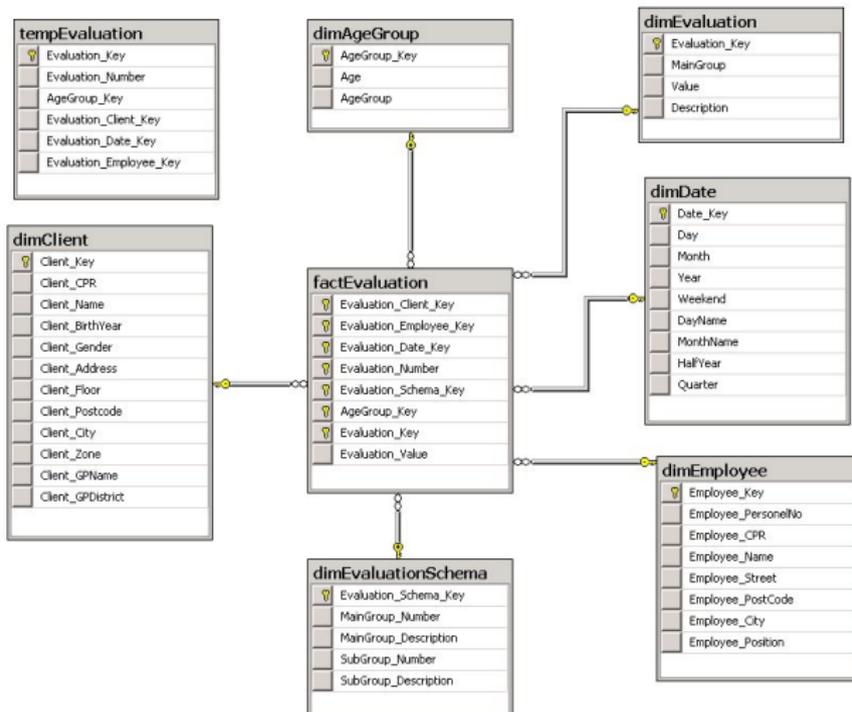
Actions...

Constraint Name	Constraint Type	Search Condition	Reference Owner	Referenced Table	Reference Constraint Name
FK\$CLIENT#EVALUATION_HISTORY	Foreign_Key	(null)	OMSORG	CLIENT	XPKCLIENT
SYS_C0010021	Check	"C_CPR_NO" IS NOT NULL	(null)	(null)	(null)
SYS_C0010022	Check	"EVALUATION_NO" IS NOT NULL	(null)	(null)	(null)
SYS_C0010023	Check	"MODULE_TYPE_NO" IS NOT NULL	(null)	(null)	(null)
XPKEVALUATION_HISTORY	Primary_Key	(null)	(null)	(null)	(null)

Architecture



Design of the Data Warehouse



Extract Employee

Source Table

- PERSONNEL
- Contains 2919 entries
- Where about 600 entries are not employees, but more like functions, i.e. Week-end rute 5

Extract Employee

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What is extracted?

- PersonelNo (ini)
- CPR
- Name
- Address
- Position

Transform And Load Employee

Transform

- Remove all employees without a CPR
- Set PostCode to 0, if it does not exist

Transform And Load Employee

Transform

- Remove all employees without a CPR
- Set PostCode to 0, if it does not exist

Load

- Create the Employee table
- Create a DataTable with all records
- Use SqlBulkCopy to add the DataTable to the DW

Fact Table

Temporary Table

- One entry for each evaluation
- Contains the evaluation number
- Contains keys for Citizens, Employee, Date and AgeGroup

Fact Table

Temporary Table

- One entry for each evaluation
- Contains the evaluation number
- Contains keys for Citizens, Employee, Date and AgeGroup

Fact Table

- For each evaluation, get the 20 rows with the actual evaluations from the source DB (MainGroup, SubGroup and Value)
- Add the information from the temporary table to the fact
- If any values are 0 or null, disregard the entire evaluation
- For each 50.000 facts, add them to the DW.

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Creating the Dimensions

The screenshot displays a BI tool interface with three main panels: Attributes, Hierarchies, and Data Source View.

- Attributes:** A tree view under 'Dim Date' containing 'Date Key', 'Day', 'Day Name', 'Half Year', 'Month', 'Month Name', 'Quarter', 'Weekend', and 'Year'.
- Hierarchies:** A 'Hierarchy' dropdown is set to 'Date Key'. Below it, a list shows levels: 'Year', 'Half Year', 'Quarter', 'Month', and 'Day', each with a double arrow icon. A '<new level>' option is at the bottom. A tooltip reads: 'To create a new hierarchy, drag an attribute here.'
- Data Source View:** A yellow panel showing a 'dimDate' dimension with a list of attributes: 'Date_Key', 'Day', 'Month', 'Year', 'Weekend', 'DayName', 'MonthName', 'HalfYear', and 'Quarter'.

Creating the Dimensions

The screenshot displays a BI tool interface with three main panels:

- Attributes:** A list of attributes under the dimension 'Dim Date', including Date Key, Day, Day Name, Half Year, Month, Month Name, Quarter, Weekend, and Year.
- Hierarchies:** A panel for defining a hierarchy. It shows a 'Hierarchy' dropdown, a list of levels (Year, Half Year, Quarter, Month, Day) with expand/collapse icons, and a '<new level>' button. A tooltip reads: 'To create a new hierarchy, drag an attribute here.'
- Data Source View:** A panel showing a preview of the 'dimDate' dimension with its attributes: Date_Key, Day, Month, Year, Weekend, DayName, MonthName, HalfYear, and Quarter.

Creating the Hierarchy

- Date Hierarchy
- Age-Group Hierarchy

Creating Calculated Measures

Calculated Measures

- Count
- Average

Creating Calculated Measures

Calculated Measures

- Count
- Average

The screenshot displays the configuration interface for a calculated measure. On the left, the 'Script Organizer' shows a tree structure with 'Command', '1 CALCULATE', and '2 Average'. Below it, the 'Calculation Tools' section includes 'Metadata', 'Functions', and 'Templates'. The 'Measure Group' is set to '<All>', and a list of dimensions is visible: 'D520A DW', 'Measures', 'Dim Age Group', 'Dim Client', 'Dim Date', and 'Dim Employee'.

The main configuration area on the right includes the following fields:

- Name:** Average
- Parent Properties:**
 - Parent hierarchy: Measures (dropdown)
 - Parent member: (empty field) [Change]
- Expression:** `[Measures].[Evaluation Value] / [Measures].[Fact Evaluation Count]`
- Additional Properties:**
 - Format string: "#.##0,00;-#.##0,00"
 - Visible: True (dropdown)
 - Non-empty behavior: (dropdown)
 - Associated measure group: (Undefined) (dropdown)
 - Display folder: (empty field)

Browsing the OLAP Cube

The screenshot shows an OLAP cube browser interface. On the left, a tree view displays the cube structure under 'D520A DW'. The main area is divided into sections for dimension selection and data display.

Dimension Selection:

Dimension	Hierarchy	Operator	Filter Expression
<Select dimension>			

Data Table:

Drop Filter Fields Here				
Drop Column Fields Here				
Age Group	Age	Evaluation Value	Fact.Evaluation Count	Average
0-20	772	320		2.41250
21-50	21740	12520		1.73642
51-65	47958	28120		1.70548
66-75	69012	41940		1.64549
76-85	143474	88260		1.62558
86-95	94822	55400		1.71159
96-100	8060	4320		1.86574
101-105	772	340		2.27059
Grand Total	386610	231220		1.67204

TARGIT

Input

- OLAP Cube.

TARGET

Input

- OLAP Cube.

Options

- Select measure:
- Grouped by <Attribute>
- ... with <Attribute> on the criteria line
- ... selected on the following criteria:

TARGET

Input

- OLAP Cube.

Options

- Select measure:
- Grouped by <Attribute>
- ... with <Attribute> on the criteria line
- ... selected on the following criteria:

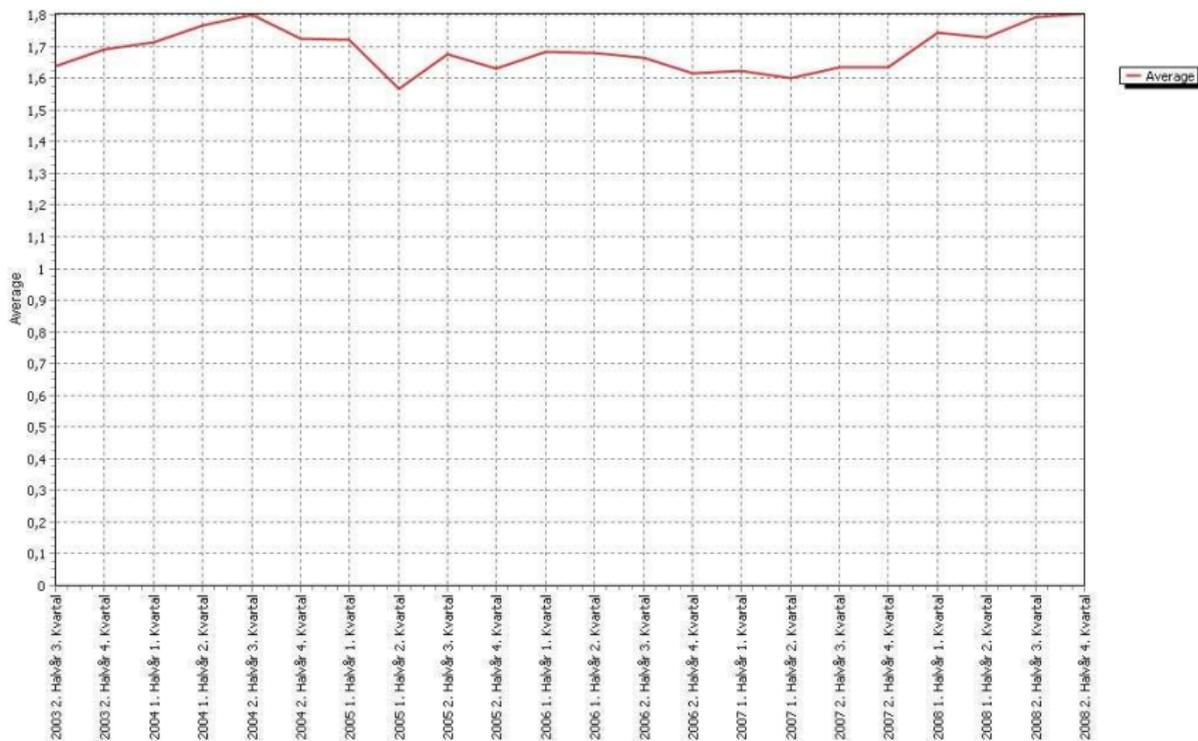
Output

- Different Graphs
- Tables

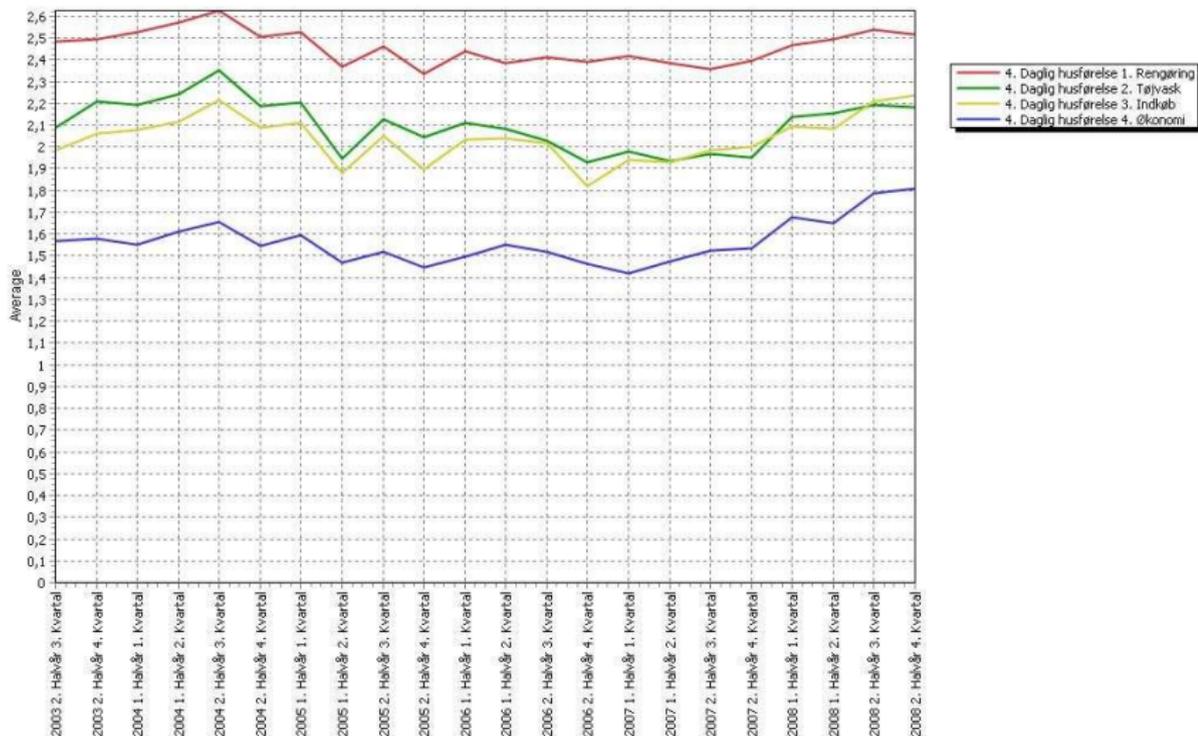
Questions

- Did any development happen, over time, in general?
- Did any development happen, over time, in the main group category "Husføring"?
- How is the distribution, of females over age, of the evaluation values.

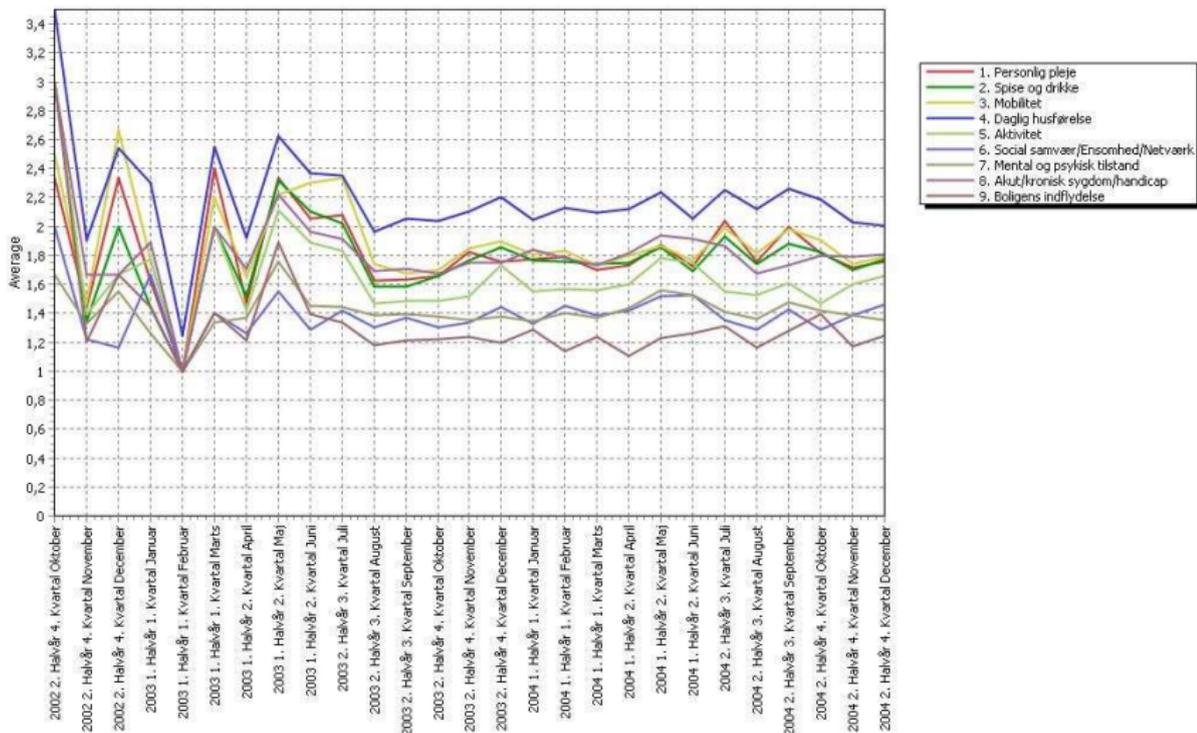
General Development over Time



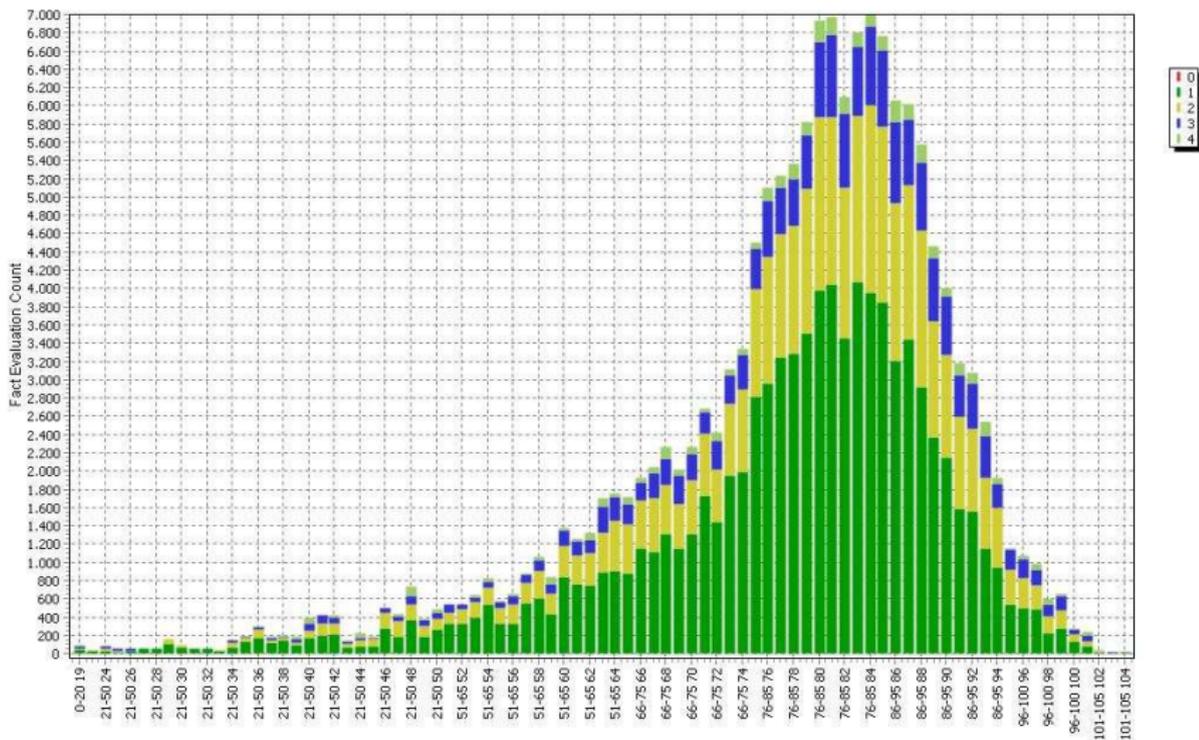
Daily House Keeping Development over Time



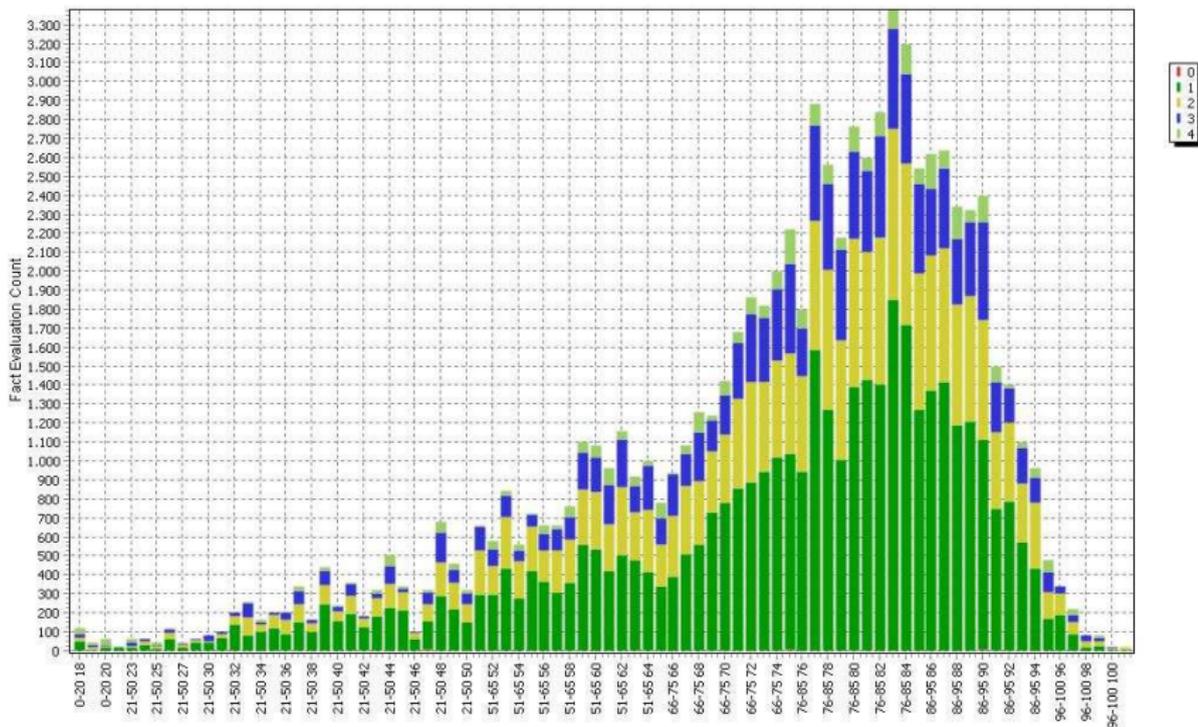
Main Group Development from 2002 to 2005



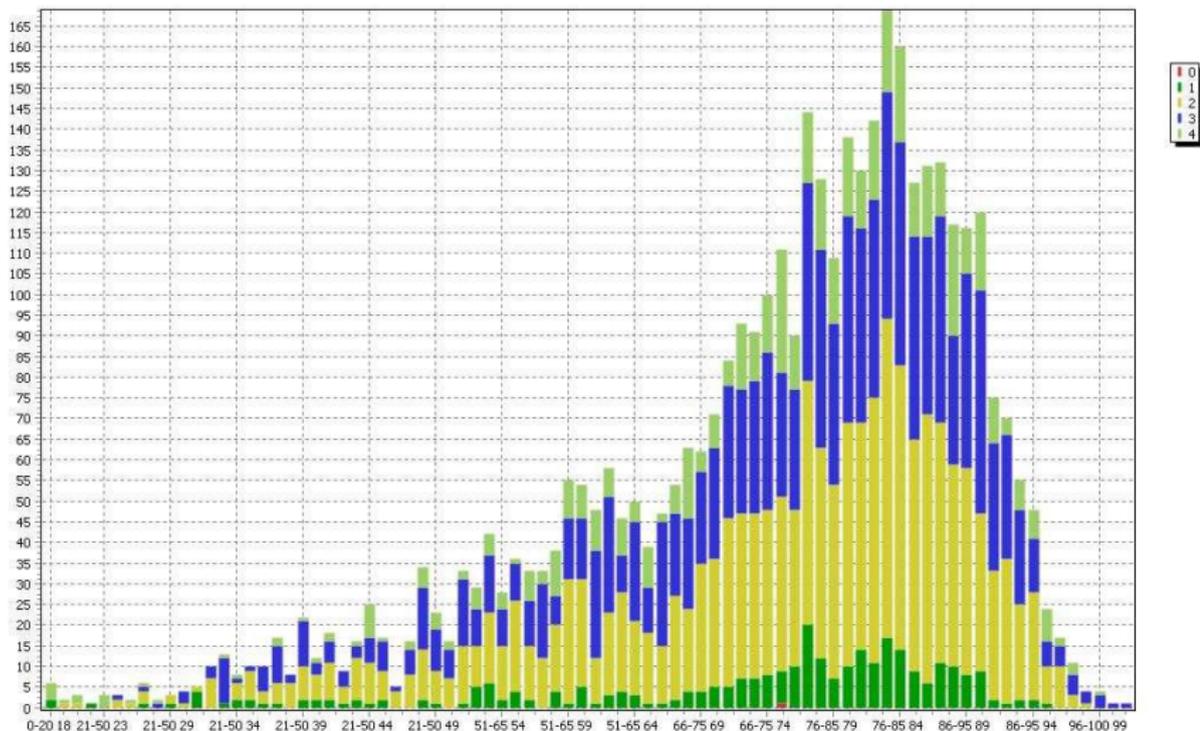
Evaluation Value Distribution over age for females



Evaluation Value Distribution over age for males



Evaluation Value Distribution over age for males, cleaning



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Future Work

- More Requirements, Working on Requirement 3
- More Attributes, more analysis possibilities
- More Calculated Measures
- Find a way to use the comments for analysis purposes

Conclusion

- Designed a Data Warehouse
- Implemented the ETL
- Created the OLAP Cube
- End User Analysis on the OLAP Cube

Questions

- What can be done to make the process more time optimal? At the university? In Herning?
- How could the comments attached to each evaluation form, or row, be used to improve the analytic possibilities of the data warehouse?
- How to implement a weights for overall analysis?