Data Warehousing in a Call Center Environment

MEDIA WAREHOUSE / Telenor Media

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Introduction

Telenor Media is a subsidiary of Telenor responsible for value-added services in the area of call centre services and “Yellow pages” products. The present focus on Media Warehouse is the operations of “directory inquiries” call centres.

Telenor

Telenor is the Norwegian state owned Telecom operator. It is a SAS customer since many years with traditional use of SAS software on “everything” from mainframes and servers to PC’s and workstations.

The change from traditional use of moving and reporting data has now started in favour of more business focused data warehousing solutions.

Telenor Media in numbers:

<table>
<thead>
<tr>
<th>Total number of employees: apx. 2700</th>
<th>Number of employees within Personal teleservices: 200</th>
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</thead>
<tbody>
<tr>
<td>Turnover in 1997: 1.9 billion NOK</td>
<td>8.7 mill. directories is distributed yearly</td>
</tr>
<tr>
<td>Result in 1997: apx. 303 mill NOK</td>
<td>90 % of the directory market</td>
</tr>
<tr>
<td>Number of employees within sales: 400</td>
<td>10.7 % of the media market</td>
</tr>
<tr>
<td>Number of employees within Directory assistance: 1150.</td>
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The Development Process

In 1995 Telenor Media decided to start a project with objectives to improve the quality of and functionality to the Production Infrastructure handling the national directory inquiries in Norway. This included also development of new Administrative Supporting Systems.

The main objective of the Administrative Supporting Systems is to obtain effective administration to support the core services of the call centers according to Telenor Media’s business strategies, through automated data collection, forecasting, forcing and skill-set scheduling of the human resources.

As told earlier the Administrative Supporting Systems should primarily handle the national Directory Assistance Services. However, it should be possible for the user organisation to implement other Telenor Media services and let the system handle call centers where the operator handles different type of services from one or more queues.
The basic requirements are functions for Workforce Management, including Data Collection & Warehousing. Data should primarily be collected from Directory Assistance, Telephony Systems or other systems supporting Telenor Media services.

A supplementary objective is to ensure an effective Data Warehouse supporting marketing analysis, budgeting & result reporting including network operator invoicing. In addition to this it should utilise appropriate Planning, Reporting, Query & Analysis tools for long-term business planning and general management purposes.

**The Workforce Management Problem**

In this document I will not go into details regarding the Workforce Management Problem. Anyway it is important to mention this concept briefly because this takes care of the payback part for the whole project.

The single largest operating expense for most inbound call centres is personnel expense. Almost 70% of the total operating costs for a typical call center are directly related to personnel.

Overstaffing results in unnecessary payroll expense as agents sit idle.

Conversely, understaffing reduces the quality of the service provided to the caller. It also increases agent occupancy, which in turn, can lower agent morale and increase the rate of staff turnover. Therefore, the efficient use of personnel resources is critical to a centre’s success.

The figure to the right illustrates the overall challenge in Workforce Management:

Optimising or balancing the Customer- and Employee satisfaction.

How well we accomplish this will be decided through the summary of the customer-employee relations during all the calls in a year.
National Directory Inquiries.

This service have the following key figures:

- 65 mill offered calls pr. year
- 250,000 offered calls during the busiest day of in the busiest period of year
- 25,000 offered calls during the busiest hour of day
- 7 offered calls pr. second.

This service is a 24-hour service and this high telephony-based traffic demands high quality in the technical infrastructure, to give the customer using the service the right service and to have high reliability in the communication between the customer and the agent in the call center.

The Production Infrastructure (technical concept).

The main components in the technical infrastructure are:

- The telephony system (transaction systems)
- The Directory Assistance System (DAS)
- The Data Warehouse (MediaWareHouse)
- The Workforce Management System (TCS)

The Production Infrastructure and the main components are presented in the figure below.
The telephony system (transaction systems)

The system is IN-based, comprising central functions (by the IN) and local functions (by the Local Computer Telephony System). Together the two systems constitutes full call center functionality.

The Telephony System have a central queuing, accounting, call completion and billing facility in the IN net.

IN functionality includes nation- wide ACD functionality (to 12 sites). In addition IN includes queues and voice system related to central queuing.

The main objective of the Telephony System is to obtain the following:

- *Audio information of new number using the IVR system part.*
- *Call Completion which could free the user from remembering the given number and make a new call.*
- *Flexibility to integrate new services e.g. call center applications and operator services.*
- *Produce reliable data to the Administrative Supporting Systems (Media Warehouse)*

The Local Computer Telephony System (LCTS) represent a combined PABX, ACD, IVR and CTI functionality.
LCTS connects the calls to the operators telephones. It also manages the local operators, extensions, call scripts, IVR functionality and operator voice files. LCTS sends call alert transactions to DAS, maintains local statistics and produce high frequently status reporting to the Media Warehouse for Traffic Monitoring & Control.

**DAS (Directory Assistance System)**

The Directory Assistance is a business area based upon accessing and distributing of number and address information, supplemented by possible additional services for value adding of the basic information.

**Workforce Management System (Tele Center System, TCS).**

This is the main system handling resource administration for the people (agents) in the call centers. The main objective of this system is:

- Generate accurate forecasts of call volumes and patterns and determine the optimal staffing and trunking required to meet desired service levels.

- Automatically creates detailed employee schedules based on forecasted demand and the call center’s rules so there are right number of people available at the right times.

- Assign employees to schedules, record exception to schedules as they become known, and track call center performance throughout the day

**MWH Data Warehouse, functionally demands**

Why did we got into a pregnancy of thoughts of using Data Warehousing in a Call center Environment ?

It is very important to have the right type of data and reliable data at the right time when you are in the business of taking care of resource administration in a high volume Call center business.

When we looked into what the ACD- vendors could deliver regarding data/ statistics we soon realised that we had to go into our “creative” room and think in new ways to handle this. We discussed this problem with other departments (marketing, economics) of the company. They told us that they also needed information that could be created from the data coming from the telephony systems.

We then decided to start the development of a Data Warehousing concept with the main functionality:
• Collect statistical information on call and DAS operations, monitor online information, and consolidate and store historical information for forecasting, other statistical processing or data distributing to other interfaced systems.

• The “Warehousing” functionality shall ensure an effective and structured storage of corporate data to be used for consolidated planning, reporting, query & analysis through appropriate tools.

• Support data collection from each Local Computer Telephony System (LCTS) of online traffic information to be used for monitoring and control purposes, calculating average 5 minutes values. This level of information shall be used as “online” information to be used for monitoring the actual traffic and performance in the network of call centers.

• Support data collection from the central IN system.

• Support data collection of customer revenue information based upon charge transactions.

• Support data processing and reporting for the Workforce Management System with calculated average 30 minutes values.

• Comprise appropriate tools to support corporate long-range business planning and general management and reporting purposes

MWH Data Warehouse, the solution

To enable a smooth operation, a semi powerful HP server is used. The server reads flat files from call centres every 5’th minute (ref. figure above). The number of flat files is large: Two files every 5 minutes, additionally files every 15’th minute. That means that the MediaWareHouse contains almost real time data.

Synchronisation of data collection and updating the MediaWareHouse is done by a base SAS Unix- session called the Collect job. The collect job also controls the exporting of data to the Work Force Management system (TCS).

SAS is performing FTP reads from files located at 12 call centers all across Norway. Synchronisation of the time at every call center against the central server is essential to obtain accurate statistics.

Technical problems might be difficult to handle if or when ftp file transfer is ”hanging”. The system is capable of recover files within 4 days back in time. The system keeps track of the last read file from every call center, and must be able to handle a server ”fall out” at any time, and restart collecting data from the next 5 min interval before the break. It is important that all files are collected to obtain accurate totals for all analysis variables. An error log containing missing files is maintained.
The collect job is a Base SAS process. Data is read into SAS data sets. The amount of data is not for the time being too large: The whole MediaWareHouse contains about 3-4 Gb. That is because the files are aggregated to a great extent before they are read by the system.

The MediaWareHouse is updated continuously. Exploitation applications may therefore access the MediaWareHouse data at the same time as updating is performed. SAS/Share is used to ensure safe concurred Access to data.

Each night a batch is run to do various tasks like regenerating data for a given number of days back, reading data from Work force management that is delivered once a day, and so on.

Currently plans for using the MediaWareHouse administrator (1.3) is considered to manage, facilitate further development, and management of the MediaWareHouse. New 1.3 features are important, especially extended attributes, enhanced treatment of user exits, transformation libraries, and the new data table making it possible to graphically represent every step in the data flow from the ODD’s to the detail level tables, with greater flexibility in modelling the flow, thus enhancing the documentation and maintenance capabilities in WA.

Given that WA is applied on existing installations, the job will be to restructure some of the code (user exists), breaking it into smaller pieces, and so on, so that each steps can be represented in the process window. By this, the processes will be better documented, and we will obtain greater flexibility and easier management regarding user exits.

If we succeed in restructuring the collect job using WA as an interface to the whole process, we might have come a long way towards a REPEATABLE solution for call centers.

Exploitation application

An application is built to provide the facilities for monitoring, standard reporting, ad-hoc reporting, and maintenance of the exploitation application.

A distributed client server architecture is used. There is a client component (MWH client) and a server component (MWH server) in the system. An partly object oriented approach is used to develop the application.

Each user and the monitoring screens is accessing a connect server on the central UNIX machine.

Security is ensured mainly by the central UNIX HP server. To start a monitor report session or a regular reporting session, the user has to log on. Each user has to have a UNIX user id. In addition, each user has to be registered in an application specific table of users allowed to log on to the system.

Monitoring

The monitor reports are built using SAS/AF. The AF application is signon on to the compute server automatically, and is running continuously. It waits 5 minutes for one monitor report or 15 minutes for another until it refreshes its contents by fetching new data from the server. The application uses SAS/AF graphics objects and data table objects.
The thick client solution has had memory problems while running continuously, problems that is reported to be fixed in v7. In the meantime a thin client solution is considered.

The monitor reports would then be displayed in a WEB page. By using the META tag in the heading section in the HTML page, the WEB page can refresh itself say every 30 seconds. The server would then produce the WEB page using SAS/IntrNet software at regular intervals, (5 and 15 minutes). Since we use a UNIX server, no problem with file locking should occur.

**Standard Reports**

Standard reports are built using SAS/AF. After logging on to the server, each user belongs to a user group. Each user group has a given set of functions available, for instance the functions to run a specific report. The functions not available is either greyed out or is hidden. Thus function control of the various application components is obtained.

The standard reports are displayed in SAWS/EIS multidimensional reports.

**Ad-hoc Reports**

Ad-hoc reports are prepared in a sub-system using SAS/AF. Each report is programmed, then registered in a central metadata table in the MediaWareHouse. Then the report is distributed to other users.

The distribution is performed by registering a new function for every ad-hoc report. Each user will then have the ad-hoc reports selectively available according to user group. The source and SCL lists to control the reports is copied to the central server. When a new report is distributed, the client application detects it, and copies the necessary components down to its client side. The report is then ready to be run.

The Ad-hoc reports may be displayed in SAS/EIS or any other product.

**Maintenance**

There is a separate general system for maintaining the metadata for controlling the client server relationship and application specific tables in the MediaWareHouse.

The metadata for function access control, user management, user access control, data access control, and automatic distribution of application components (SAS/EIS components, ad-hoc reports), SAS formats, or data tables is controlled by a general Set-up application.

The distribution mechanism detects when a new component is defined, and distributes it out to the client installation or out to single workstations according to where the set-up application has defined the client environment.

The application uses SAS formats heavily. There is one "world" of formats on both the server and clients. Every time the system detects that a new format definition is given, the formats are redistributed to every client installation.

Data tables that are needed in the client environment is registered for download at start-up at a session. When the user then logs on to the system, the table is downloaded to the proper
location if the creation or modification date of the table located on the server is different from the one located on the client side, or if the client table does not exist.

**Future Development**

At present Telenor Media is looking into expanding the use of the Media Warehouse (MWH). The following areas can be interesting to look into:

- Implementing all the other call center services handled by Telenor Media into the MWH.
- Use the MWH to serve marketing oriented areas
- Use the MWH to improve the economic analyses regarding the production
- Use the MWH in conjunction with other SAS modules to improve the quality of forecasting the customer behaviour using the services offered by Telenor Media.
- Use the SAS Warehouse Administrator in the process of expanding the MWH and documenting future development.

\[\text{\textsuperscript{\textdagger}}\text{The connection to the DAS system is not yet implemented.}\]