INTRODUCTION OF A FULLY INTEGRATED WORKFORCE MANAGEMENT

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ABSTRACT

In today's regulated market, grid operators are under constant pressure to improve consumer service while reducing costs. In field operation, this drives a necessity for an IT-based Work Force Management (WFM).

In the context of this paper, WFM describes the assignment of appropriate resources with the required qualifications in due course at the right location. A further step is an integrated WFM, starting with the project planning, an individual order-generation, the dispatching of the field engineer and the performance-related charging and billing of the work performed. Additionally, a system-based assessment of the condition of the technical equipment could be implemented.

This paper presents an integrated WFM tool explaining the motivation and expectations, describing its system integration and giving a detailed description of its main-functions. Beside its IT-applications, the key factors of success are described, e.g. the integration of and the open communication with affected employees.

INTRODUCTION

The KELAG Netz GmbH (KNG) is the local power- and gas-grid operator in Carinthia, Austria. With a peak load of 751 MW, the KNG operates a high-, medium- and low-voltage network of 18.400 kilometres in length. 46 substations at a 110-kV voltage level and 7.100 MV/LV transformer stations provide energy for more than 290.000 consumer installations. Furthermore, 770 km distribution system of natural gas with 34 pressure reduction stations delivers energy to 10.200 consumers.

In these grids, the range of activities varies from planning, building, commissioning and servicing to maintenance of the grid-assets. To optimize the work force management process within the KNG, an area-wide implementation of an integrated workforce solution using existing economical, technical and human-resource based data was established.

PROJECT AIMS

In 2008, the KNG launched this ambitious project to optimize the workflow from the planning to the constructing and billing stage. After a test-run of two months, WFM was started in January 2010. The aim of the new approach was an improvement in the following areas:

- overview of all work orders
- overview of the workforce
- support for crew assignment
- availability of on-line status information
- automatic work time registration
- reduction of paper
- collection of project-relevant on-site information
- continuous electronic workflow from job planning to implementation and order settlement

The new system should be successfully implemented for the following activities:

1. Maintenance and construction of
   - substations and transformer stations
   - overhead lines and cables (0.4/20/110-kV)
   - fiberoptic infrastructure
2. Troubleshooting
   - all grid-assets at 0.4/20/110-kV
   - natural gas
3. Replacement of meters

SYSTEM INTERFACES

An IT-workforce management requires a high level of data density and quality. In this project, existing databases were extended and new software applications developed. Further, customized interfaces were designed to transfer and/or exchange information.

Figure 1 shows the way of a work order and the interaction between the different software modules. The Field Force Automation (FFA) software [1], the core-component of the dispatch units, can be fed with work orders from two systems – SAP/PM or SCADA. All adaptations within FFA were done by GRINTEC, an Austrian software company.

Before 2010, all maintenance and construction activities were planned with a customized in-house software. This application was replaced by SAP/CU in January 2011. There, the work orders are planned in great details, e.g. working hours, material, external services, costs for transportation, costs for equipment and costs for switching procedures.

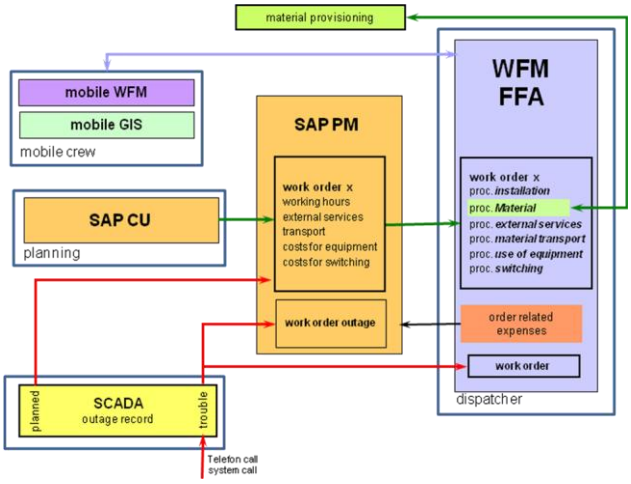

Figure 1: Way of a work order

These data are forwarded to SAP/PM where all investments and expenses are allocated. In a next step, the work orders are transferred to FFA onto the dispatch board, where a material provisioning takes place. After a work order is completed, the costs are finally activated and billed in SAP.

During failures and outages in the grid, an outage record is generated in the SCADA-system of the centralized control centre [2], which automatically triggers a workflow in FFA. This can be done as a direct assignment to the field engineer or, if available, through a dispatcher.

DISPATCH BOARD

Every operational department has the responsibility to dispatch its assigned field engineers. Depending on the number of field engineers and areas of work, one or more operators are in charge. These dispatchers monitor and edit schedules, check the status of work orders, view and allocate unscheduled orders and update technician/crew profiles and availability.

The dispatch board can be seen in Figure 2. Each operator has an individual view for his designated field engineers. However, the configuration of a dispatch board is always the same. All work orders can be seen on the bottom of the page. They are organized according to predefined work-classifications, e.g. voltage level, cable, overhead-line, etc. The crew can be seen on the left hand side. For the crew assignment an integration of SAP/HR was carried out to use the existing data regarding availability and qualification of each crew member.

The current job assignments are shown in the middle of the page as a Gantt chart. Thus, each job is displayed according its time and duration and contains data of its location, required resources, plans, switching procedures, and so on. A special colour-coding identifies the status of each work order. For emergency situations, the location of each team-vehicle is regularly transferred to the dispatching station. An emergency button in every vehicle guaranties, when activated, an immediate action of the dispatcher.

During planning of a work, the duration is calculated in SAP/CU in hours. When assigned to a crew within WFM, the duration changes according to the number of crew-members. Furthermore, the driving time is considered by FFA, using the vehicle position and the embedded routing system.

To supply the dispatcher as well as the management with further information about the work orders, a reporting system is integrated. Here, the work orders can be separated into fields of activity, geographical locations, a daily overview, alarms of missed deadlines, and so on. Further, a general survey of ongoing and planned activities and all investments is available.

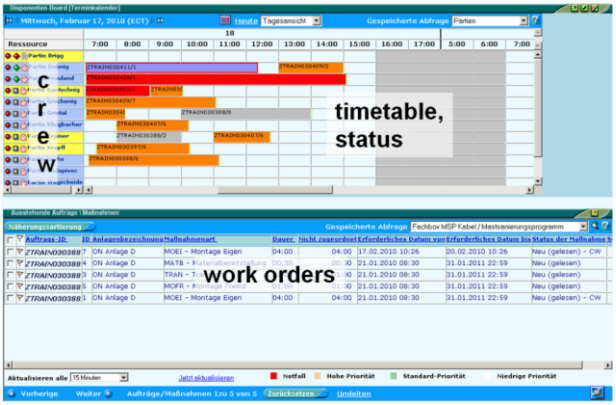

Figure 2: Dispatch board

Monitors are installed at a central place, where field engineers need to pass by before and after work. On this screens, an overview of the work orders including the crew assembling and the crew assignments for the current and the next day is display. That information, in this quality not available before WFM, was an additional benefit for the field engineers and therefore a further step towards acceptance of the new system.

TEAM BUILDING

In contrast to most other grid companies, the in-house services at KNG are very high. Therefore, special installations are done exclusively by the own stuff. These tasks result in daily changing and varying crew-sizes from one up to five field engineers.

Within the KNG, 15 dispatchers are responsible for 364 field workers, up to 135 possible crews and 40 trucks, excavators, mobile aggregates, etc. The designed software tool includes full support for multi-person crews and special task assignments, adapted to the company's unique requirements.

MOBILE SOLUTION

In the next step, a mobile solution was integrated in each crew-vehicle. The aim was to provide the field engineers on-line with all project-relevant information for the daily work and to enable a bi-directional communication with the responsible dispatcher.

To guarantee a data exchange between the mobile devices and the dispatch units, the data transfer can be achieved in three different ways:

- mobile network UMTS/3G
- W-LAN
- LAN

The advantage of the UMTS/3G network is the high accessibility even in rural areas. For a higher bandwidth, a W-LAN is available at all local operation units. It is used for regular updates and data exchanges before leaving a operation unit and after returning to it. If a higher data transfer is necessary, e.g. for a whole update of the Geographical Information System (GIS), the local LAN can be used. The change from one kind of communication to another is done automatically – there are no further user-adjustments necessary.

For security and availability reasons, the KNG runs its own radio network. As communication is always the key for any grid operation, this network is used for the secure voice communication between the centralized operation centre and the field engineers, e.g. during switching operations for a planned work or for fault localizations during power failures. Because of the limited bandwidth, it is not used for the WFM-data transfer but only for the GPS-localization of the vehicles.

All data are continuously synchronised with the central data base to guarantee up-to-date data on the mobile devices and an up-to-the-minute overview of the work in progress on the dispatch boards. Field engineers can receive and acknowledge work orders pushed to them, provide field status back to the dispatcher, and download images, documents and other information over their rugged wireless laptop.

Depending on the mobile network, the accessibility might not be available in all areas and at all time. Thus, the mobile FFA software supports a storage and forward functionality on the notebook. This means queuing data when devices are without coverage until the signal is restored. This allows mobile users to work on-line and off-line. Further, other data and software applications, e.g. a routing system or GIS, are available on this notebook.

In the KNG, all asset-relevant data are stored in GIS. This system provides a detailed mapping of the high-, medium- and low-voltage system as well as of the gas grid. Due to the centralization of the operation of the medium-voltage grid, the data in GIS need to be up-to-date and are transferred once a week into SCADA/DMS [2, 3]. The advantage of this method is that both – the operator in the operation centre and the field engineer – use the same database with information about the grid and its assets.

A routing system, which is combined with the local GIS on the notebook, supports the field engineers in the localization of the assigned working places. To use these function, the GPS-data have to be attached to each work order already in the planning stage.

Maintenance and construction activities in the grid often require switching procedures. This can be done by specialists from a maintenance crew or by other qualified engineers. Every HV/MV switching is planned and finally authorized by technicians in the operation centre. To give the field engineer an overview of his daily switching activities, a copy of the switching assignments from SCADA/DMS is send onto his mobile notebook.

The laptop is situated on an own rack in the vehicle, depending on the car type in the front or in the back of the car. Every vehicle has an in-dash touchscreen monitor to access notebook-functionalities like the routing system or the status check from the driving seat.

Geo-referenced coordinates of the vehicles are transmitted on a regular basis to the dispatch stations to localize the vehicles and crews. These data are very useful during power failures. Considering the location and the qualification of the crew members as well as the availability (status of the current work order and work classification), the appropriate crew can be assigned for the urgent task.

ON-LINE MATERIAL SHOP

The standard material within the KNG for building and maintenance of the MV/LV grid assets is listed in an own catalogue. In the past, this list was mainly used by technicians in the planning stage.

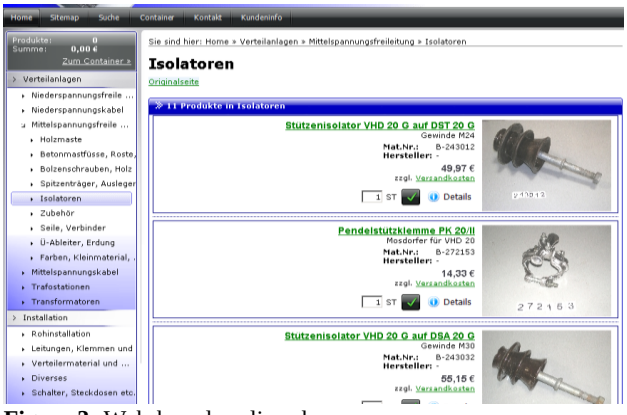

Figure 3: Web-based on-line shop

To make this list more user-friendly and widely accessible, an "on-line material shop" using the HTML-technology was developed, as seen in Figure 3. The information displayed contains a picture of the component, the part number, the price and if available further manufacturing specifications and drawings.

The application can be accessed from any PC as well as from the mobile devices. It enables the field engineers to place repeat orders already in an early stage or to return material if not needed. These orders can be sent directly from the laptop to the central depot. There, the material will be prepared for the following pickup.

ORDER AND TIME SETTLEMENT

In addition to the planning and dispatching functionalities, the automatic order settlement is a further application implemented in the WFM-process. In the planning stage, all activities were related to pre-defined prices. After an order is technically completed, all job-related expenses like driven kilometres, machine hours, external services, etc. are immediately available. Therefore, after released by the dispatcher, all activities are forwarded to SAP and billed automatically.

For the time registration of the field engineers a new FFA functionality was developed. As every engineer is assigned to a crew and every crew to a work order, the working-hours, the possible extra-payments and the expenses can be calculated automatically from the status information of each job, which is done on a daily basis. These data are used to pre-fill the timesheets of each field engineer, which are forwarded to the dispatcher and finally transferred to SAP-PM and SAP-HR.

CRITICAL FACTORS OF SUCCESS

The impacts of a serious change in a well-known and functional workflow practiced over decades were known to KNG before launching this project. Therefore, the integration of the staff, which is directly affected, was a major concern. Field engineers played a key-roll during the course of the project and they were, from the beginning of the project, integrated in project teams. Further, a periodical feedback to all affected employees was carried out with an open communication about ongoing changes.

From the organizational point of view a separation of the work-order planning and work-order execution as well as a strong commitment to a standardization of all processes was a key factor for the successful project implementation.

FURTHER PROSPECTS

The next step in this project will be the optimization of the customized hard- and software applications. Here, the main focus lies on the user-friendliness of the dispatch board and the software-tools on the mobile devices.

A further implementation in this system will be the mobile inspection and planning tool. This application enables a preliminary planning already at an early stage in the field. The final planning is done afterwards in the office with SAP/CU.

One of the ongoing projects is the further reduction of paper. This is achieved by the implementation of plans, orders, commissioning papers, etc. in an electronic form to the work orders. Thus, the field engineer should finally be able to access all documents from his mobile device.

With regard to the huge amount of meter replacements due to smart metering, the integration of the replacement process of meters will be the final aim in this project. For this task, an own scheduler function is developed, to optimize the path selection for the multitude of work orders.

CONCLUSION

This paper presents the steps towards an integrated Workforce Management, explains the efforts and benefits and describes its further prospects. The technical cornerstones as well as the critical factors during the implementation are presented. Furthermore, details about the system interfaces and the various applications are given.

The base for this project was a high digital data density and quality in an unified IT landscape as well as the standardization of all involved processes. The integrated WFM finally concentrates and edits these data for its special purpose. Therefore, a data-set, once fed into the system, is used throughout the IT-system.

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