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Implementation of Ericsson's Workforce Management

Rakesh Binny Dasari
M.Tech (Industrial Engineering) Student
Department of Mechanical Engineering
Sanketika Vidya Parishad College of Engineering, Visakhapatnam.

Mr R. Surya Kiran, M.Tech, (Ph.D)
Associate Professor & HoD
Dept. of Mechanical Engineering,
Sanketika Vidya Parishad College of Engineering, Visakhapatnam.

ABSTRACT

The purpose of this master thesis is to examine the domain of workforce management of mobile workforces. A market inventory of workforce management systems and case studies of how workforce management is practiced have been made. The observations from these studies have been used to develop a number of design implications for the workforce management module in the Ericsson Trouble Management solution. A subset of the design implications have been implemented in the Ericsson workforce management module. A key function in a workforce management system should be to relieve the pressure of the workforce manager. The case study shows that the prerequisite for well functioning mobile workforce management is a good technical infrastructure for both the workforce manager and members of the workforce. Essential functions of a workforce management system are to support the mobile workforce and the workforce administrator in two way communication. This will make reporting of accomplished tasks directly to the system possible instead of via the workforce administrator. In addition to these aspects the market inventory points out a number of features that exists in other workforce management systems. Some of the features presented are; automatic scheduling, future planning, schedule optimization, mobility support and technician workload presentation.

1 INTRODUCTION

The conditions of mobile work in different settings have been examined in a number of studies for example Bellotti & Bly, Kristoffersen, Ljungberg. In the first study the focus is collaboration between mobile workers. The second study focus on the special requirements associated with mobile field work in physically challenging surroundings.

Other aspects of collaboration in mobile work appears when one of the co-workers sits in a stationary work situation with access to printers, faxes and supporting computer system and the other is a mobile worker with little or no access to these systems. This is often the situation in what is called workforce management. However, workforce management often denotes the task of controlling a workforce in terms of working hours, location of work etc. The communication in that situation is of secondary interest. Studies of workforce management therefore often concern how to predict workload and allocate staff. No consideration has to be made to special demands on certain competence in the

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workforce. There is no need for two way communication between workforce manager and workforce. A typical setting for this kind of workforce management is a call center where a workforce manager allocates staff according to predicted workload.

A different type of workforce management is where the workforce manager administers a workforce handling tasks that demand special skills. Yet another aspect is administering of mobile workforces. Also, this kind of workers often needs to have access to information during the assignments. This kind of workforce management takes place for example in activities where staffs of field technicians maintain technical equipment geographically distributed.

2 ERICSSON'S WORKFORCE MANAGER

The cause behind the making of this thesis was that Ericsson needed help to improve their workforce management system.

The workforce management module is part of a larger system called the trouble management (TM) solution. The main uses of the TM system are to gather information about telecommunication and computer networks and to react on events caused by failure in these networks. The workforce manager deals with the dispatching and assignment of work orders to technicians. When a failure occurs in the network a trouble ticket (TT) is created. A work order is later created with the information from the trouble ticket. A work order includes information about the problem and site information.

In order to solve the problem in the most efficient way it is imported that the work order is assigned to the most suitable technician. The workforce management system helps an administrator to find the most suitable technician based on certain information about the technicians.

The purpose of this thesis from Ericsson's point of view was to gain knowledge about workforce management systems in general and how these are used in practice. One desire that was expressed by Ericsson was to get design implications to improve their current version of the workforce manager.

2.1 Description of Ericsson's workforce manager

In order for the workforce administrator to select the best suited technician for a particular work order he or she search a database where the technicians' personal and work related information such as telephone numbers and skill are stored. Search parameters also include the geographical area within which the technician works. The technicians availability is presented by an on/off duty state.

The solution has a web interface that makes the system accessible for technicians when they're on location. The field technicians can connect to the internet and view assigned work orders or report a finished work order directly to the system. The web interface is however not adapted with small screen devices such as hand held computers. Ericsson's workforce management solution is implemented in Action Request System (ARS) from Remedy.

3 RELATED WORKS

3.1 COMMERCIAL WORKFORCE MANAGEMENT SYSTEMS

An area that is closely related to workforce coordination and this thesis work is the work in call centers. Call centers can be found in a number of various domains such as telemarketing and alarm centers. Where there is a multitude of telephone calls that need to be addressed individually there is often a centre of coordination to handle this work. Many studies have been made on call centers to support the work with IT-technology.

The difference between the work at a call centre and the workforce administrator's work is that the administrator has to deal with issues like scheduling and dispatching of

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work orders to the most suitable person. The work at call centers often is more a matter of dispatching the call to a person within the call centre itself. In those cases where call centers actually dispatches and coordinates work to a mobile workforce the main issue is not to find the most suitable person but to make sure that a call is taken care of quickly.

An example of a study made at a call centre that handles this issue is the study on Andhra Pradesh Emergency system. EMRI is a company that is responsible for managing telephone calls made to the emergency telephone number 108 in Andhra Pradesh. The Emergency operators receive, categorize, document, dispatch and monitor the incoming cases. The purpose of the study was to observe how the EMERGENCY operators work; how they coordinate the information and tasks between them; how the technology supports that work.

When a call to Emergency is made the operator tries to find out what has happened and from the given information tries to prioritize the event. All information is stored in the CoordCom system that is used by the operators in the call centre. The next step in the Emergency process is to find an available ambulance and to dispatch it. CoordCom gives the operator a list of available ambulances with additional information about its status and current position. The operators often collaborate when dealing with a high priority case. At these situations one of the operators tries to talk to the caller and find out as much as possible about the incident while the other operator acts like the dispatcher. The dispatcher in this case "listens in" on the conversation via the CoordCom system and dispatches the resource according to the given information.

This study shows that the largest problem in the operators works are the difficulty to interpret the caller's information; this is a problem that is not apparent in the workforce administrator's work. The CoordCom system should be seen as a communication and information storing system. It should not be designed to actively do categorization and analysis of the case. This is something that distinguishes CoordCom from workforce management systems. In workforce management system a prominent feature is to automate and give support to the administrator. This may have something to do with the nature of the tasks being handled. One might not trust a system to make decisions in a life and death matter.

In this report a comparative study is made over different workforce management systems on the market. Kumar has made a similar study on workforce management systems at several call centers. Whereas this thesis only studies what features different management systems has to offer, he makes an effort to find out how these features work and whether they are as efficient as the companies that develops management systems wants you to believe. He concludes that "workforce management systems are a mixed bag, working well for scheduling and as an assist to the entire call centre management process, but limited in modeling and forecasting capability and in the ability to deal accurately with advancing technologies such as skill-based routing". This conclusion is important to bear in mind in order to get a balanced picture when studying commercial workforce management systems.

3.2 TECHNICAL WORKFORCE MANAGEMENT SYSTEMS

Another example study was made in Everest engineering Pvt limited company located in Visakhapatnam.
Everest Engineering Equipment Pvt Ltd is a prominent service provider of Tower Cranes, Passenger hoist & Mast climbers. We are an ISO 9000 certified service provider, MSME certified from Directorate of Industry.

Pressure vessel is defined as a container with a pressure differential between inside and outside. The inside pressure is usually higher than the outside, except for

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some isolated situations. The fluid inside the vessel may undergo a change in state as in the case of steam boilers, or may combine with other reagents as in the case of a chemical reactor. Pressure vessels often have a combination of high pressures together with high temperatures, and in some cases flammable fluids or highly radioactive materials. Because of such hazards it is imperative that the design be such that no leakage can occur. In addition these vessels have to be designed carefully to cope with the operating temperature and pressure. It should be borne in mind that the rupture of a pressure vessel has a potential to cause extensive physical injury and property damage. Plant safety and integrity are of fundamental concern in pressure vessel design and these of course depend on the adequacy of design codes. When discussing pressure vessels we must also consider tanks. Pressure vessels and tanks are significantly different in both design and construction: tanks, unlike pressure vessels, are limited to atmospheric pressure; and pressure vessels often have internals while most tanks do not (and those that do are limited to heating coils or mixers). Pressure vessels are used in a number of industries; for example, the power generation industry for fossil and nuclear power, the petrochemical industry for storing and processing crude petroleum oil in tank farms as well as storing gasoline in service stations, and the chemical industry (in chemical reactors) to name but a few. Their use has expanded throughout the world. Pressure vessels and tanks are, in fact, essential to the chemical, petroleum, petrochemical and nuclear industries. It is in this class of equipment that the reactions, separations, and storage of raw materials occur. Generally speaking, pressurized equipment is required for a wide range of industrial plant for storage and manufacturing purposes.

The design of a pressure vessel is more of a selection procedure, selection of its components to be more precise rather designing each and every component. Regarding storage of fluid for a pressure vessel system should be preferred due to its simplicity, better sensitivity, higher reliability, low maintenance, compactness for the same capacity. The storage of fluid at high pressure in the pressure vessel is at the heart of its performance and is the first step towards the Design. The pressure vessel components are merely selected, but the selection is very critical, a slight change in selection will lead to a different pressure vessel altogether from what is aimed to be designed. It is observed that all the pressure vessel components are selected on basis of available ASME standards and the manufactures also follow the ASME standards while manufacturing the components. So that leaves the designer free from designing the components. This aspect of Design greatly reduces the Development Time for a new pressure vessel. It also allows the designer the freedom to play with multiple prototypes for the pressure vessel before finalizing the decision. The pressure vessel Selection Procedure after determining the inputs is a simplified process and can be automated to shorten the design cycle.

Selection of pressure vessel components should be according to standards rather than customizing the design. As abiding by the standards lead to:

- A universal approach
- Less time consumption.
- Easy replacement
- So less overall cost

Everest engineering, have done a vessel with larger diameter having thin wall thickness by using fabrication process. Pressure vessels, depending on requirements, can be made of a variety of materials including polymers (plastic), fiberglass, carbon steel and stainless steel, with both carbon steel and stainless steel the most common for industrial applications. They have a done a pressure vessel by using stainless steel. The fabrication process was held due to low skilled labour. This triggered the immediate introduction of work force management system to overcome the issues.

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The concept of work force management system was used to identify and recruit the required skilled worker on a contract for the construction of the pressure vessel. This was the immediate help to meet project standards. Initially there were some issues as the workers don't know each other very well, they fail to work as a team and that resulted in minor misunderstanding and disputes on the workers. The administrator also faced the problems.

At the end of every day the workforce manager used to check the daily report and noticed the delay in constructing the vessel. He talked with the workers and came to know that there were some issues. As the main feature of workforce management system is to give support to the administrator, The workforce manager held a meeting and settled the issues in between the workers. Due to less time the workers have done overtime to complete the construction. So daily as usual work force manager check on the report. In case if he was unable to come to work site he made a phone call to make sure that they were going according to the schedule. Error Analysis as RED – Critical(Find the error) , Amber - (solve the type of known defect) , Green – Fair job/work. This study shows that workforce management system is not only a system, it also provides suitable technician.

4 CASE STUDIES

In order to see how workforce management is applied at companies working with mobile workforces two case studies have been made. For the first case study, at a support service company, presented in section 7.1 a number of interviews with the staff and observations of the workforce administrators were made. The second case study, accounted for in section 7.2, was made through Error Analysis.

4.1 The support service company and the technical company

In the following section the result of the observations and interviews made at both support service company and technical company are presented. The studied organization and the workforce management software used today are described. Focus lays on what the work orders in the workforce management software look like and how they are used.

4.2 Task processing

A large telecommunications company is one of the clients. When an error occurs in the clients network that requires a field technician to correct it, the support service company is engaged.

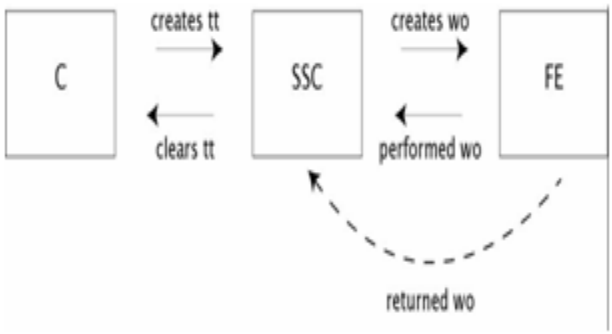
Similarly, when the technical company faced an issue, the workforce manager got involved to solve it.

4.3 Two types of commissions

The commissions handled are urgent error handling, so called service commissions, and installation jobs. Service commissions will be handled within 24 hours and installation commissions within 96 hours.

Communication between customer, administration central and field technician.

The picture below shows the flow of a commission through the organizations. The focus of this report is on the communication between the support service company (SSC) and the field engineering (FE).



C – owner of the network, NOC
SSC – support service company administration central
FE – field technicians

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An error occurs in a telecom or data network of an operator (C). The network operation central (NOC) at the client's (C) is informed either by a customer reporting it or by an automatic alarm from the network.

A trouble ticket (tt) is sent to the administration central at the support service company (SSC). The workforce administrator at the administration central receives the trouble ticket and creates a work order (wo). The workforce administrator assigns the work order to a field technician (FE). The field technician performs the assignment if possible. If the technician cannot perform the assignment it is returned to the workforce administrator. When the assignment is completed the field technician reports the job done to the workforce administrator at the administration central (SSC), normally over the phone. The workforce administrator clears the trouble ticket in the system, i.e. reports the cause of the matter, what was done to correct it and the time the error was corrected. The client (C) can then log on to the system to see what was done.

4.4 System

The major client and the company studied use a joint system that mediates communication regarding commissions. The client's NOC personnel create trouble tickets in the system. The support service company workforce administrators receive it, create work orders and assign the work orders to the field technicians.

4.5 The system work order

A work order consists of the information from the trouble ticket and possibly additional information about infrastructure, site information etc. Due to this extra information a work order may contain several pages of information. One of the field technicians says "We often need a lot more information about the equipment than the client provides. workforce administrators normally looks up this info for us and enclose it in the work order or we do it ourselves. This is one of the reasons why it's best to have a work order in print, because of the amount of information. PDA's, mobile phones, all those portable things aren't any good to display all that data."

4.6 How a work order is handled

When a work order is created it is assigned to the field technician appointed to perform the task. Since the system is not used by the field technicians on location, the work orders are mediated to the field technicians either by phone or by distribution of a printed copy of the work order. one of the workforce administrator says "I phone the guys when I have a new job for them and we agree on how to get the work order to them. If they are here in the office I just give the work order to them".

4.7 How to assign a field technician for a task

The following section describes the different criteria used when assigning a task to a specific field technician. Since this is an important task for the workforce administrator the descriptions are relatively detailed.

4.8 Choice of field technician based on geographic location

Each week two field technicians per expert group work with service commissions and the rest of the group work with installation commissions. Since there are only two field technicians working with service commissions, the workforce administrator assigns the field technician currently available and does not consider where in the district he or she is located. This implies that the field technicians sometimes must drive a long way to perform a job. If a field technician currently working with installation commissions is in the area of a service commission, this field technician may get assigned to perform the task instead if he or she is available. The indication to where a field technician is currently located is by the latest performed assignment. Installation commissions are if possible assigned to field technicians living nearby in order to avoid long driving distances.

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4.9 If a problem occurs on a commission

The workforce administrator is responsible for seeing to that a commission is completed within the agreed time. If a task assigned to a field technician risks not being completed in time the workforce administrator must find out why the task is not completed. In that case the workforce administrator calls the field technician to see if he or she needs help from another field technician and why the assignment does not proceed as planned.

"Normally, I don't have to worry about that because they call me or some of the other guys before there is a risk of passing the deadline. Still, I have the responsibility if something after all should go wrong."

4.10 Communication from the workforce administrator to the field technician

Distribution of work orders

Installation commissions are, as mentioned earlier, scheduled in advance by a workforce administrator. Field technicians working with installation commissions can thus themselves print out work orders for scheduled assignments whenever they are in the office. Service commissions demand immediate action. Since the field technicians mostly are not in the office during the work day the workforce administrator normally phones the field technician to give the work order information orally.

4.11 Future support

The new system that will be introduced during autumn 2003 replacing the current system does not support a handheld solution either. A possibility considered is to develop such a solution. Developing a web interface to the system has also been considered. This would make it possible to receive work order information and give reports on completed assignments directly in the field. According to the supervisor, a web interface to the new system has high priority but has to, like everything else be compared to other needs in the company. The problem of what technical equipment to use also remains.

5 DISCUSSION

In the following section the results of the analysis is discussed.

5.1 Technical infrastructure

The support service company and the technical company

The staff at the support service company suffered from poor technical infrastructure. This is the cause of most of the problems and breakdowns in the workflow in the everyday work. The problems concern for example the possibility to print a work order, access information directly via a system, give reports on performed assignments etc. The major cause of the problems is the infrastructure and can thus not be solved by a better system.

The workers at the technical company lacked team work initially and had their differences. This caused delay in the work. The problem is that they don't know each other good enough.

5.2 The paper as information carrier

The field technicians want to have the work order printed on paper. A piece of paper is the most practical information carrier for work on location. Both for information from the system, for example the work order, site specific information, as well as for information to the system, such as report on action taken on a site or new site specific information collected by the field technician on location. Handling papers is however difficult. To print information in the field is a problem but also to file information written down by the field technicians on paper. A solution to the latter problem would be to find routines in the daily administratively work to file notes written on the paper work order.

Another would be to find an acceptable solution where the field technician can take notes digitally on location and that way store the information directly in the system.

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5.3 Two way communication

This could be obtained by extending the functionality of the system. That way the field technicians could for example handle the closing of trouble tickets. This measure would also take some of the work load of the workforce administrators on busy days. Again, the problem of infrastructure appears. A solution would be to make the system handling the work orders accessible from a number of easily accessible spots, field stations for example. In this way the field technician can choose whether to download the information to a PDA, a laptop or print the info.

5.4 Reliable routines in the daily work

Many of the things considered a problem in every day work, for example the lack of finding a field technician by competence, problems in filing new information about sites etc is due to the lack of routines in the daily work. Thus, changes to the organization of work would probably solve some of the problems.

5.5 The workforce administrator workload

The workforce administrator has to keep track of a number of things concerning the field technician workforce such as current location, skill, previous site experience. This increases the workload on the workforce administrator potentially causing breakdowns in the workflow. This information could be mediated through systems for assignments scheduling, GPS modules or be delegated to a person in the field technician workforce. It may however in a small organization not be economically or organizationally possible to distribute responsibility differently or to introduce system support for these tasks.

Few of the staff members would directly benefit from such an investment why it may be difficult to justify it. Unfortunately, if such investments are not made it may hinder a small organization from becoming more effective, growing or handle changes of staff.

5.6 Needs

Below, a list of features that would facilitate the work of workforce administrators and field technicians at the support service company.

Infrastructure.

Technical infrastructure that enhances communication both ways.

Guidelines for categorizing of competence.

System access.

Access to the system on location for example in the car or at a field station.

System support.

Support in the system for information about a field technician's work load, current location etc.

Routines.

Routines in the administrative work for filing new location specific information or support in the system for filing this information on location.

5.7 Method Discussion

The difference in the findings from the two case studies may to some extent be caused by the different methods of gathering the data. It was however not possible to conduct the studies differently because of the geographic distance to the persons and offices in the second case study. In order to compensate for the lack of observations at the telecommunications company, more follow up interviews were made to get as good view as possible of the work.

6 DESIGN IMPLICATIONS FOR ERICSSON'S WORKFORCE MANAGER

In this section the design implications for how to develop the Ericsson workforce management module is discussed. Based on the findings from the market inventory and the case studies a number of suggestions of future development are proposed. The findings from the case studies, particularly the one made at the support service company, revealed a lot of problems and situations causing insecurities in the everyday work. However, these problems and situations mainly had to do with

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organizational issues and for which a computer system would not be a solution. The design implications are also developed with the existing workforce management system in Ericsson's trouble management solution in mind. Therefore, the design implications are made considering what is available today and what can actually be implemented in the future considering the platform. That is why some of the findings having a major importance in the analysis of the case studies may not have been taken into account in this section

6.1 Implemented design implications

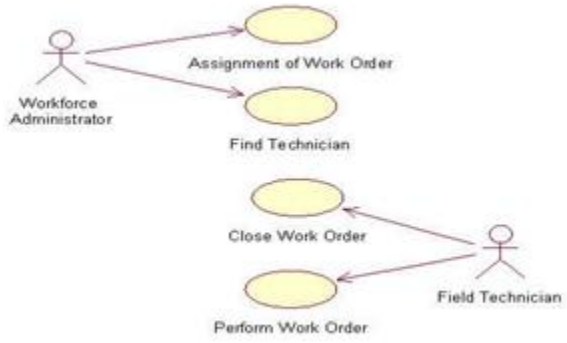
A prototype has been developed to improve Ericsson's current workforce management system. This section presents the features that were implemented for the prototype.

6.1.1 Calendar function/Technician Workload

Based on the findings in the market inventory this feature was implemented because it is a prerequisite to other features that may be implemented in the future and for the administrator to be able to pick the right technician for a certain task. For the administrator to control and to create an efficient schedule the information about the technicians availability is crucial. The technicians current status as well as future workload is the base of every schedule. Prior to the development of the prototype, Ericsson's solution did only represent the technicians current availability with an on/off duty status, thus leaving the administrator with very limited information. The obvious design implication is therefore to implement a tool that lets the administrator view the technicians assigned work orders, working hours and other appointments. Although this update of the solution is not nearly as complex as an automatic scheduler it can improve the administrators work considerably.

6.2 IMPLEMENTATION OF A PROTOTYPE

This chapter explains and illustrates the functions that have been implemented according to the design implications. These functions are integrated with Ericsson's trouble manager solution but they are still under evaluation and should be consider as prototypes. To have a better understanding of how the system works a short description of its users and their activities follows. The design of the prototype has the UML [9] framework. The two main users of the workforce management system are the workforce administrator and the field technician. The administrator's main activity is to find the right technician for the right job and to assign the work order to him (see UC1 and UC2). The field technicians' interaction with the system involves performing the work order and finishing it by sending it back to the system (see UC3 and UC4).



Assign Technicia

The main activity of the workforce manager is to assign a work order to the most suitable technician. In order to find the right technician the administrator must search the workforce database using the workforce manager. The complete workflow from creation of a work order to dispatching it to a technician is illustrated in Collaboration Diagram 2. The prototype offers a more detailed list as a result from a search. This list now includes information about a technician's workload and secondary skill. A secondary skill has been added to refine a technician's area of expertise and to make distinction between different technicians easier.

By clicking the button Select Field Technician in the

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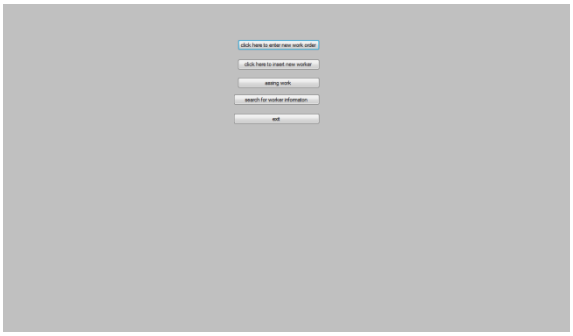
work order form the administrator is given the opportunity to search for a technician with specific attributes such as skill and working region.

Clicking this button will display the User Details form.

1. Search
2. Search Results
3. View Calendar
4. Save



1. View Workload

By selecting a date on the left part of the form you will be able to view the workload of the current field technician in the appointment table.

2. Appointment Table

This table displays information about appointments and work orders that has already been assigned to the technician. The information includes start and end time of the appointment, description and specific details about the work order such as site information.

3. New/Modify/Delete

To create, modify or delete an appointment click the appropriate button in the top right corner of the form. When the New or Modify button is clicked the schedule dialog will appear (see New Assignment).

NEW ASSIGNMENT

Appointments are created by clicking the New button in the Calendar form. This displays the Schedule form.

1. Create new appointment
2. Modify an appointment

VIEW ASSIGNED DETAILS

By clicking on the button Assigned Details the user can view the selected Technicians' details, such as full name, telephone numbers, skills, which work orders that already are assigned to him etc.

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