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# Computerized Maintenance Management System at Maritime University's Department of Physical Plant

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## INTRODUCTION

The Department of Physical Plant, Maritime University, Canada, is deciding to upgrade its maintenance information system. The manager of Physical Plant, Ms. Lisa Johnson, wishes to identify some of the key technical, managerial, and organizational issues for implementing the new system and to decide the best way to maintain the new system.

### Background

Maritime University is one of top ten comprehensive universities in Canada serving over 15,000 students. The Physical Plant Department of Maritime University is mainly responsible for the maintenance of the buildings as well as repairs done to the property within the university. The fundamental mission of Physical Plant is to provide cost effective facilities and services that support and promote excellent teaching and research, which in turn promote the university's reputation. With the anticipated growth and development of Maritime University, Physical Plant department is required to enhance its maintenance management. The management of maintenance focuses on activities to maximize throughput by managing materials and manpower and skills involved in the maintenance program. It is still relative new in the business arena. Moreover, sound maintenance management requires excellent management information management and business planning. Therefore, the Physical Plant department is in an urgent need of computerized maintenance management systems.

Physical Plant is currently using Maximo® ADvantage to manage its maintenance function. Physical Plant used the software for its daily maintenance management. Maximo® ADvantage is a simple maintenance management system, which was first released by MRO Software, Inc. in 1992. It includes three modules (estates help desk, call logging, and planned maintenance) and six functions (planning and scheduling, purchasing, work request/service management, component management, quick PM list, and usage-based planned maintenance). Microsoft Access® is the database management system that supports the Maximo® ADvantage. All users of Maximo® ADvantage share the Access database stored in a common disk drive. Some important information cannot be computerized and stored in Maximo® ADvantage and data sharing among users is not convenient. As a result, well-defined reports cannot be generated automatically. Meanwhile, since Maximo® ADvantage is not accessed widely within the office area and the workshop, job duplications often happen. For example, team leaders in the workshop cannot generate the purchase order themselves. They have to fill out a purchase request then pass the request to the Finance Assistant, who then creates a purchase order and sends it to the supplier. The same things happen to the billing. Because most of the data have to be processed twice, the incidence of data entry errors, error processing costs, and data inconsistency are inevitable. It is also impossible for the current system to provide all the information that management needs for the enhanced managerial purpose.

There are five problems relating to Maximo® ADvantage.

#### 1. Documentation management

Maintenance documentation is an asset for the Department of Physical Plant. There are two types of useful documentation: historical information and technical documentation. The historical information records previous job details and equipment repairs and failure history, while technical documentation consists of instructions, drawings and manuals of the equipment. Making these available on computer will increase information availability and allows for quicker and more efficient searches. But at present, the specifications are computerized in an inconsistent way, which make the information incomplete. In addition, the equipment spare parts are not associated with the equipment. All these problems prevent the work orders from being created properly, which results in difficult work planning and the history reports of cost and equipment replacement impossible.

#### 2. Inventory management

Inventory surplus, inactive inventory, missing parts, reordering are the major problems for the inventory management facing by Physical Plant. Inevitably, high inventory occupies too much unnecessary financial and space resources. The restocking procedures are computerized based on the experience of the storekeeper, therefore the reliability may be doubtful. The preventive program is not computerized and the maintenance staffs know the program by heart and execute it when required, which also is not very accurate. Computerizing non inventoried purchases and special orders will facilitate the entry of new acquisitions. Linking spare parts to equipment in the inventory will enable the users to search by maintenance employees, validate the recorder values and advise the replacement parts to keep in the store. A just-in-time (JIT) inventory system will be the managerial target.

#### 3. Purchasing management

Three purchase order systems exist in Physical Plant and various types of purchase orders are used. Purchaser has to copy the purchase request sheets one by one, since the purchase application is not accessible to everyone but some assigned employees. The drawbacks of the existing purchasing procedures are obvious: increase unnecessary workload, slow and undermine supply procedures for the storeroom. Due to different purchase order system, it is quite difficult for the management to fully manage the purchasing activities and control the purchasing cost.

**4. Labour management**

Punch card is the normal means to manage the labour time. But punch card only records the time that workers punch in and out, it does not contain the details what workers do during their work shift. It is therefore hard for management to compare the actual finished workload to the plan. In addition, punch card will not provide complete information for each employee's attendance, vacation, sick, and non-productive work time and track working history.

**5. Billing**

Since Maximo® ADvantage cannot create bills automatically, the staffs in Physical Plant have to write the bill manually after summarizing the bill information. There are eight billable buildings at the University, which results in a lot of paper work.

Besides the aforementioned deficiencies of Maximo® ADvantage, Physical Plant's dependency on the Department of Computer and Communication Service (CCS) is another concern. Like other departments within the University, Physical Plant receives the umbrella service from CCS, which includes computer and network technical support. CCS assigns certain disk storage space and network capacity to Physical Plant, which are sometimes not enough. Downtime was experienced now and then due to the full disk storage space, slow network or the entire network shut down. Maintenance Control Center (MCC) will not be impacted seriously, since the requests can be recorded manually. However, work orders, stock entries, and purchase orders cannot be processed, which can result in maintenance delay. The worst is that no one in Physical Plant can guarantee the clients when the maintenance can be done since they have no idea when the system will come back. As a result, customer's satisfactory level of their service is impaired.

## THE ACQUISITION

In order to reduce the unnecessary workload and increase the efficiency, the management of Physical Plant decides to acquire a new version, Maximo® 4i Release into the daily operation. The one time software acquisition costs the department $200,000. The management of Physical Department made the purchasing decision. The acquisition expense was allocated through the department annual budget and was approved by vice present of the university. The department of CCS was informed only after the purchase was made.

Maximo® 4i Release is a Window-based maintenance system. It contains modules with technical and historical data on the equipment, work order planning, inventory control and reporting facilities. Compared to the legacy system, Maximo® 4i Release is user-friendlier and better tuned. Maximo® 4i Release provides a robust and scalable solution for small to mid-size physical plants, facilities, and process or discrete manufacturers. The product runs on popular databases such as Microsoft SQL Server® and Oracle®. The estimated benefits that Maximo® 4i Release can bring are:

**1. Enhance the business process in the Department of Physical Plant**

After Maximo® 4i Release is installed, shop staff and team leaders can access the system directly. Therefore, they can enter the purchase order to the system by themselves, which reduces the job duplication and the process time. Orders can be processed immediately and the maintenance can be done without unnecessary delay. Meanwhile, the decision maker can be more productive since better operational planning and maintenance scheduling are available.

**2. Faster access to new and better information**

With the help of better database, such as MS SQL Server® or Oracle®, Maximo® 4i provides an advanced data-capturing system. The database is very accessible and allows for efficient search. The management can use the retrieved data to decide the most proper maintenance policy.

**3. Reduce maintenance cost**

The optimum maintenance policy makes the excessive wear for equipment or buildings due to bad maintenance planning avoidable.

**4. Lower inventory level**

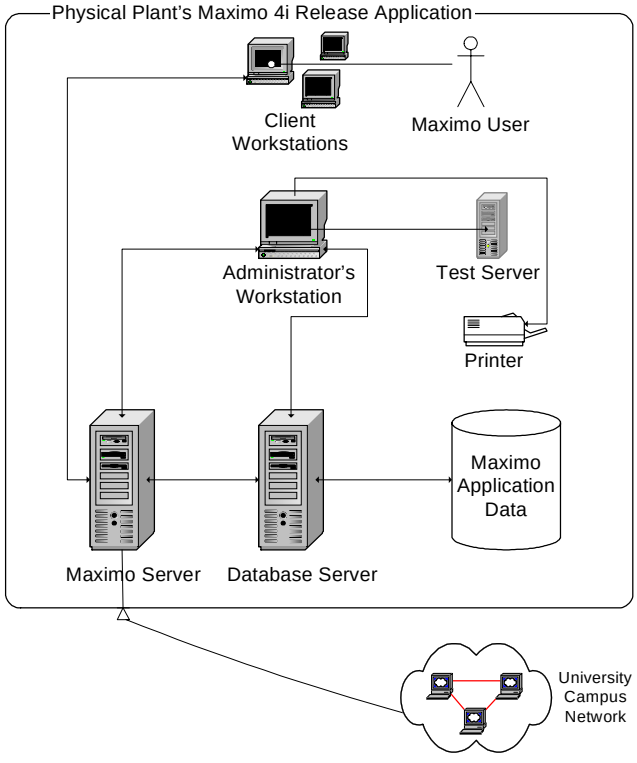
Maximo® 4i has the capability to provide detailed and accurate information about the inventory level, since just-in-time methodologies is employed to control the inventory.

**5. Improve data consistency and accuracy**

The data processing errors due to the job duplication can be reduced greatly. The automatically generated reports and bills are more reliable than those created manually. Maximo® 4i has been successfully implemented in several Canadian universities such as McGill University and Concordia University in Montreal, Quebec and University of Ottawa in Ottawa, Ontario. Since Maximo® 4i Release is a very powerful maintenance management technology application, Physical Plant wishes to take full advantage of the application. Meanwhile, the management of Physical Plant also wishes to take this opportunity to develop a proper information management strategy to enable Maximo® 4i Release to integrate with its own business and management process and provide the best service to the University.

Maximo® 4i Release employs a three-tier architecture, consisting of database server, application server, and workstations (See Figure 1). The database server provides a common, central repository of all organizational data, supports a variety of relational back-end databases. Application server supplies a suitable containment environment for the business logic components to run in. It also manages these components efficiently. The workstation provides desktop graphical user interfaces (GUI) running on clients, user validation, makes data requests to the database server, and presents formatted data returned from the database server. Database and database server maintenance are the major components of the new system. Therefore, where to put the database server and who should take care of database and database server are the two concerns of the management of Physical Plant. Physical plant is considering the possibility of maintaining the new system by its own IT staff and placing the database server in its own office area.

*Figure 1: Physical Plant's Maximo® 4i Release System Architecture*



## THE CHALLENGE

The decision to purchase and implement Maximo® 4i Release has created some tensions between Physical Plant and some departments within the university. In particular, the Department of Computer and Communication service (CCS) is not happy about the fact that the Physical Plant went ahead and purchased the software without being consulted first. There are two main concerns to CCS: 1) new system will add more network traffic to already congested campus network; 2) more support and service will be required.

In anticipation to the need of new system, the Department of Physical Plant hired a full time IT person who is responsible for the implementation and management of Maximo® 4i Release application. The new Maximo® 4i Release is a great challenge for both newly hired IT person and the information management of the department. Specifically, the management wants to know: 1) what are the main cost factors for implementing such a system? 2) How to manage the transition between the old and the new system? 3) What are the potential technical, managerial, and organizational difficulties for implementing such a system?

## THE OPTION

After discussing with Maximo® 4i consultant, the implementation committee within the Department of Physical Plant finds that there are four implementation alternatives available. They are:

- Option 1: Keep the existing service relationship with CCS and outsource the whole system maintenance to CCS. That is, CCS will maintain the database and application servers and provide network support.
- Option 2: CCS provides hardware, network, and telecommunica tion support; Physical Plant manages system maintenance which compromises network security and data management.
- Option 3: CCS provides network support including security management; Physical Plant manages database server and data management.
- Option 4: Physical Plant takes full control of the new system. The IT staff of the department supports both the database server and the network.

## THE PROPOSAL

It's a typical winter day in Canada, cold and snow. Ms. Lisa Johnson is thinking about the proposal and recommendation she should make to the University's senior management as she was looking through her office's windows. Although she knows maintenance and asset management business well, she does not know IT very much, especially when it comes to such things as network, security, and databases. She was wondering if she could find someone to help her to prepare the proposal and recommendation.