SYSTEM REQUIREMENTS

SPECIFICATION

for the

Equipment, Maintenance, User Tracking System

(EMU)

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CSCI8700 – Software Specification and Design

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# 1 Introduction

### 1.1 Purpose

The purpose of this document is to provide the specifications for the Equipment, Maintenance, and User Tracking System (EMU). It contains a description of the basic system functions, system requirements, constraints, and interfaces.

### 1.2 Scope

The scope of this document is to describe the overall function of the EMU. EMU is designed to track computer equipment, software, and maintenance reports for the Information Science and Technology department at the University of Nebraska at Omaha.

### 1.3 Definitions

Authorized User: Anyone who has been given a valid username and password by the system administrator and uses these credentials to authenticate themselves to the system.

Inventory Subsystem: The portion of the EMU system used by support staff to organize, monitor, and track IS&T technology assets. The inventory subsystem tracks both hardware and software assets.

Maintenance Request Control Center: The part of the system accessible by support staff that allows them to view and handle maintenance requests submitted to the system.

Maintenance Request Priority: Describes the urgency with which a request must be addressed. Requests can be classified as routine, urgent, or critical.

Maintenance Subsystem: The portion of the EMU system used by support staff to organize, prioritize, and process maintenance requests.

Network Sensor: A sensor that monitors network traffic and sends a signal when the network is behaving abnormally.

Point of Contact: The person who should be contacted by support staff regarding a maintenance request.

Software License Type: Describes the type of license issued by the software vendor. Licenses may vary depending on the vendor. Typically, software can be categorized as being a site license or a traditional license limiting installation to a specific computer.

### 1.4 Acronyms

EMU - Equipment, Maintenance, and User Tracking System

IEEE - Institute of Electrical and Electronics Engineers

IS&T - Information Science and Technology  
PDA - Personal Data Assistant  
SSL - Secure Sockets Layer

SysRS - System Requirement Specification (this document)

### 1.5 References

The following documents were used in the development of this System Requirements Specification:

* Fall 2007 Term Project Requirements, Dr. Mansour Zand, September 2007
* IEEE Std 1233, 1998 Edition – Developing System Requirements Specifications
* Fall 2007 System Requirements Specification Example, Dr. Mansour Zand, September 2007

### 1.6 Overview

The remainder of the system requirements specification is organized into the following sections:

2. General System Description

3. System Capabilities, Conditions, and Constraints

4. Interfaces

# 2 General System Description

### 2.1 System Context

The EMU system will be responsible for tracking the computer hardware items, software, licenses, and maintenance history for the IS&T department of the University of Nebraska at Omaha.

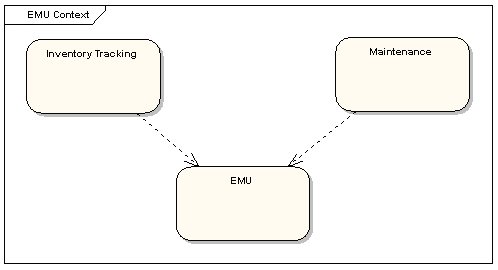


Figure 2-1 – EMU System Context Diagram

### 2.1.1 Inventory Tracking

The inventory tracking subsystem will provide IS&T personnel with the ability to track all hardware equipment and software. The system will be able to track all inventory by bar code. Bar code labels can be generated and printed from the system for new inventory and read by the system from a bar code scanner. The system will be capable of providing a variety of information about the inventory and capturing that information in various reports.

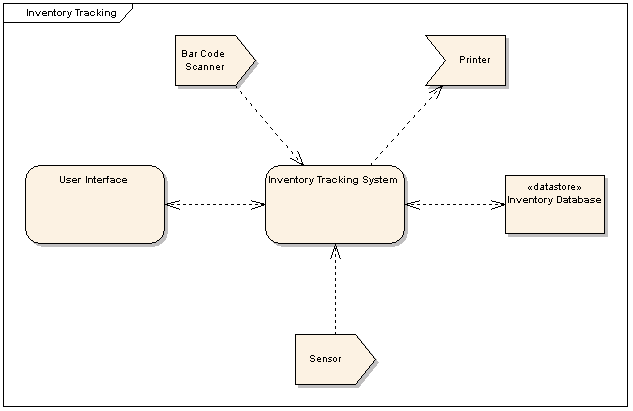


Figure 2-2 – Inventory Tracking Subsystem Context Diagram

### 2.1.1.1 Equipment

The equipment portion of the inventory tracking system will be used to track various types of hardware equipment including different types of computers, projectors, and networking equipment. The system will store some basic information about the equipment including a general description, type of equipment, and warranty information. The equipment tracking will also include the ability to track the history of replacement parts installed in the equipment.

### 2.1.1.2 Software

The software portion of the inventory tracking system will be used to track software owned by IS&T. The system will store basic information about the software including the title and a general description. The system will also provide the capability to track licensing information including not just the license model and number of licenses owned but also linking installed licenses to particular hardware items also in the inventory tracking system.

### 2.1.2 Maintenance

The maintenance portion of the system will allow for the user to input work orders for new problems with equipment maintained by the IS&T department. The maintenance portion of the system will also provide the ability to manage existing work orders by allowing the appropriate users to modify them and push them through the system. The maintenance portion of the system will also allow staff to view all previous maintenance actions for a given piece of equipment.

### 2.1.3 Interface

The system will provide a text-based interface, to allow the user to enter, view, and edit data as needed. The interface will allow the user to perform all interactive actions necessary to complete entry of maintenance requests as well as for staff users to manage and work existing maintenance requests.

### 2.2 System Modes and States

### 2.2.1 User Mode

In user mode, the system will allow viewing and addition of data. Users will still be restricted according to their user characteristics (section 2.6). See the user characteristics section for more information on the different types of user roles and what parts of the system each role will be able to access.

### 2.2.2 Admin Mode

In admin mode, the system will allow for full modification of the data, and the design of the system. This mode will be restricted to designers, and lifecycle maintenance personnel.

### 2.3 Major System Capabilities

The main capability of the system is to provide an online solution to report, process, and track maintenance requests. Authorized users can submit maintenance requests from any Internet enabled device. Support staff receives these requests and can use the system to prioritize and track the requests. Additionally, the system also allows staff to track parts inventory and equipment. Finally, the system maintains an archive of maintenance requests and an inventory of assets that the system can use to generate reports.

As part of the requirements elicitation session held with the customer it was determined that the customer required a web interface as the primary interface to the system. This was to permit easy access by any staff or faculty member from any internet enabled computer without the need for special software. The details of the requirements elicitation are contained in appendix A-1 at the end of this document.

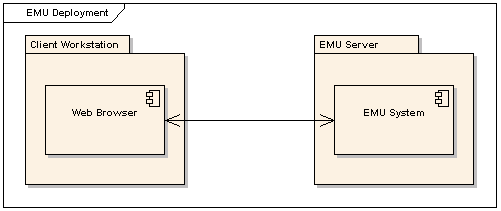


Figure 2-3 – EMU System Deployment Diagram

### 2.3.1 Track Inventory

1. The system shall track an inventory of hardware equipment and software.
2. The system shall be able to accept bar code input from a bar code scanner.
3. The system shall be able to print bar codes for tracked equipment and software.
4. The system shall be capable of tracking a minimum of 5000 individual assets.

### 2.3.1.1 Equipment Inventory

1. The system shall track equipment inventory by room number, type, serial number, and bar code.
2. The system shall include server, workstation, projector, monitor, laptop, printer, PDA, and network as available hardware types.
3. The system shall track warranty information for each piece of hardware to include type of coverage, contact information, and response information.
4. The system shall be capable of generating a report on any hardware asset to include the general hardware information, installed software, warranty information, and parts replacement history.
5. The system shall track all parts replaced in tracked equipment.
6. The system shall track the date a part is installed, a general description of the part, and the equipment that the part was installed in.
7. The system shall track the maintenance ticket associated with each part installed in tracked equipment.

### 2.3.1.2 Software Inventory

1. The system shall track software license and maintenance agreement information for each piece of software asset to include type, key, number of licenses and expiration date.
2. The system shall track how many licenses of a particular software asset are owned and how many are available.
3. The system shall track what software is installed on each piece of equipment.
4. The system shall be capable of generating a report on any software asset to include the general software description, license and maintenance information, and equipment the software is installed on.

### 2.3.2 Maintenance Subsystem

The maintenance request subsystem will provide IS&T personnel with the ability review, prioritize, track, and respond to maintenance requests. Users can communicate in real time with support staff using online chat or they can file a formal maintenance request using online forms provided by the system. The system will also submit automated maintenance requests when software licenses or hardware warranties are near expiration. The status of each maintenance request can be updated by support staff as the reported problem is resolved.

1. The system shall provide an online interactive chat where authorized users can report problems and request help from on duty support staff.
2. The system shall provide online forms that allow authorized users to submit maintenance requests.
3. Maintenance request forms shall allow the user to classify the request as emergency/non-emergency, report the device type, give a description of the problem, provide a serial number, and report the location of the device.
4. Maintenance requests should be time stamped at the time of their submission and whenever staff updates them.
5. The system shall automatically submit a maintenance request for a piece of software when its license expires in 30 days.
6. The system shall automatically submit a maintenance request for a piece of hardware when its warranty expires in 30 days.
7. The system shall allow persistent maintenance requests to be submitted by support staff that are generated automatically at regular intervals. (e.g. install software updates weekly)
8. The system shall automatically submit a maintenance request when a sensor is triggered and signals a specific problem.
9. The system interface shall distinguish between automatic and manual maintenance requests.
10. The system shall allow support staff to prioritize maintenance requests.
11. The system shall allow support staff to update the status of a maintenance request.
12. The system shall allow support staff to reclassify a request as emergency/non-emergency.
13. The system shall keep an archive of all maintenance requests and allow support staff to generate reports including all maintenance requests for a particular device and all maintenance requests reported by a particular user.
14. The system shall be capable of generating reports filtered by timeframe.
15. The system shall keep an inventory of parts tracked using a barcode and barcode reader.
16. The system shall provide support staff with maintenance records that have the following information available: Timestamp of submission, user who submitted the request, user’s description of the problem, devices affected, any warranty information pertaining to the device(s), current status of the request, priority of the request, list of staff assigned to the request and their comments about any work that has been done, and a list of any replacement parts that have been used to resolve the problem.

### 2.4 Major System Conditions

1. Users are authenticated by the system based on usernames and passwords.
2. Users are added to the system manually by the system administrator.
3. The Inventory Tracking subsystem must share a common database with the Maintenance subsystem.
4. The system shall monitor network conditions and keep records of network maintenance.

### 2.5 Major System Constraints

1. The system is dependent on users having Internet access and electricity.
2. The system requires that somebody be able to access the web interface in order to create a maintenance request. The system provides the ability for a staff user to enter a maintenance request on behalf of somebody else in the event that a maintenance request must be phoned in by the affected user when the problem affects the user’s ability to submit the request themselves. (Such as when there are network issues or operational issues with the computer from which the user would normally submit the maintenance request).

### 2.6 User Characteristics

### 2.6.1 Administrator

System Administrators will have full capability to view and modify records in the database. They can update the system, and perform required maintenance on it. They can change the status of maintenance reports to reflect archived conditions. They cannot remove records or delete information from records through the system interface. The administrator is also responsible for providing usernames and passwords to faculty authorized to use the system.

### 2.6.2 Faculty

Faculty will use the online maintenance request forms and online chat utility to report problems to support staff. This is the primary focus and the only functionality accessed by the faculty role.

### 2.6.3 Support Staff

The support staff consists of those employed by the college of IS&T to maintain and solve problems relating to onsite technology equipment and assets. These users have access to the maintenance records, equipment tracking system, and inventory system.  They can read, update, and modify records but cannot delete them. Unlike the administrator, they cannot change the status of maintenance reports to reflect archived conditions.

### 2.7 Assumptions and Dependencies

### 2.7.1 Assumptions relating to the user

1. All users of the system can read and speak English.
2. The user can follow any instructions given by the system.
3. The user will follow all policies regarding usage of the system.
4. The user must have a browser capable of running a chat program.

### 2.7.2 Assumptions relating to the system

1. This system assumes that internet service is available 100% of the time.
2. The external monitoring system, maintained by IS&T staff, is fully functional 100% of the time.
3. Virus protection of the system will be provided by outside sources, and is not covered by this SysRS.

### 2.7.3 Dependencies in the system

1. The system is dependent on having a stable and reliable Internet connection.
2. The system is dependent on the integrity of the main database.

### 2.8 Operational Scenarios

The system is capable of performing a number of major capabilities during normal operation. Those capabilities include the following:

* Adding new items to the inventory database
* Querying the inventory database
* Adding a new maintenance request
* Performing work on an existing maintenance request
* Holding a chat session
* Generating a report based on the inventory database, maintenance requests, or both

The system can operate in any of the states detailed in the following sections. Each operational scenario exists for specific reasons detailed in the corresponding paragraph. In some cases the system can be in more than one operational scenario at the same time. Specifically when the system is operating in the diagnostics state it could be doing so while in the on-line state or while in the off-line state.

### 2.8.1 On-line

The system is fully capable and operational. The system is available on the network for users and administrators to access. All major system capabilities described previously can be accomplished. This will be the state of the system during normal operation.

### 2.8.1 Off-line

The system is not available on the public network, but is still accessible to help desk technicians accessing the system from the EMU server. The technicians can still perform all major system capabilities described previously but without the concern of any other user accessing the system at the same time. This state will be used primarily for troubleshooting the system when problems occur or for administrators to perform maintenance that can be accomplished without requiring the system to be in the disabled state.

### 2.8.2 Disabled

The system is disabled. No user interface is possible in this state. This state will primarily be used for administrators to perform maintenance on the EMU system that requires scheduled downtime.

### 2.8.3 Diagnostics

The system is fully capable and operational, but is pointing to a secondary database for testing purposes. All of the major system capabilities described previously can be accomplished in this state but only against the secondary diagnostics database. This state will primarily be used for administrators to troubleshoot the system when problems occur or when a sample database is being used to perform user training.

# 3 System Capabilities, Conditions and Constraints

### 3.1 Physical

The following sections describe the physical characteristics, conditions, and constraints of the EMU system. The majority of these characteristics and constraints are imposed by the hardware that will run the EMU software. The following sections will describe the amount of space required to install the system, the power necessary to operate the system, and the environmental constraints of the system, among others.

### 3.1.1 Physical Characteristics

The system will be installed on a Commercial Off-The-Shelf (COTS) server procured from a commercial vendor. The system will require 2U of rack space and will be approximately 30” deep by 17.5” wide by 3.4” high. The system will weigh approximately 50 lbs. as configured.

### 3.1.2 Power Consumption

The system will include redundant 750 Watt hot-pluggable universal 110V AC power supplies. It is assumed that the necessary Uninterruptible Power Supply (UPS) for the system will be provided.

### 3.1.3 Environmental Conditions

The system has an operational temperature range of 10 degrees Celsius to 35 degrees Celsius, (50 degrees Fahrenheit to 95 degrees Fahrenheit) and a storage temperature range of -40 degrees Celsius to 65 degrees Celsius, (-40 degrees Fahrenheit to 149 degrees Fahrenheit). The system has an operational relative humidity range of 20% to 80% non-condensing. The operational altitude of the system is from -50 feet to 10,000 feet.

### 3.2 System Performance Characteristics

The system is required to be on-line and available for usage 99.9% of the time. The system should also be able to handle maintenance requests simultaneously submitted by no less than 10 users.

### 3.3 System Security

The system will not allow users access at a greater level than assigned to them by administrators. Network communications will be protected by SSL encryption. Users will be required to enter a user name and password for access to the system. User names and passwords will be maintained in the system, and encrypted for protection.

### 3.5 System Operations

### 3.5.1 Human Factors

* Users will be properly trained to do the functions that they are authorized to perform, and will be required to follow the policies for those procedures.
* Training to use the system must be able to be completed in less than 10 minutes for standard users, and 30 minutes for administrators.
* There is no time limit for training of system lifecycle maintenance personnel.
* Users are expected to understand how to navigate using a web browser.
* Support staff must manually update the status of each maintenance request.
* Web forms shall be design in a matter consistent with the Americans with Disability Act to provide access to the blind.
* Faculty should be provided with guidelines describing the kind of information they should include when reporting a maintenance problem.
* System staff should be provided guidelines about how maintenance requests should be prioritized.

### 3.5.2 Maintainability

* The system will be documented with inline comments to assist with future upgrades and maintenance.
* The system shall be accompanied by maintenance instructions which need to be detailed, understandable, easy to read and should also contain the information such as descriptions about all the parts of the system along with their manufacturer and local supplier of the items.
* Installation of the all the components needs to be well documented, so that it could be easier to replace any component with the help of the manual instead of waiting for the engineer to repair the faulty component which avoids the unavailability of the system.
* A set of basic troubleshooting instructions will be provided to cover common issues that may result during maintenance operations.
* Maintenance activities should be conducted during non-peak hours.
* Incremental database backups should be carried out daily and before any potentially damaging maintenance operations are conducted.

### 3.5.3 Reliability

* The system will be fully functional 99.9% of the time.
* The system shall provide a mechanism for backup without requiring the system to be taken offline or shut down.
* Monthly visual inspections of hardware such as sensors must be conducted to preemptively discover potential and address potential component failure.
* All data submitted by users must be accurately recorded in the database.
* After submitting a maintenance request, the system should provide some confirmation to the user that the request was received.

### 3.6 Policy and Regulation

IS&T personnel will be responsible for writing organizational policy for usage of the system, and for posting the policy. In addition, it is expect that the users of the system sign an agreement acknowledging the policy and agreeing to the usage terms. The system must conform to all existing University policy governing student/faculty privacy and equipment usage. The system administrator will be responsible for enforcing policies relevant to the EMU system.

### 3.7 System Life Cycle Sustainability

The system will be designed modularly, to allow for the addition and removal of subsystems, without degradation of system operation. Life cycle maintenance personnel will maintain all documentation necessary for long-term maintenance of the system. All components must be thoroughly documented and tested before being integrated with the EMU system. Finally, the EMU system should provide some capability for minor software updates without the need for significant down time. Ideally, these updates could be distributed and installed remotely by the system administrator with minimal effort.

# 4 Interfaces

### 4.1 System Interfaces

### 4.1.1 Inventory Tracking

The inventory tracking subsystem will have a bi-directional interface with the maintenance subsystem. The maintenance subsystem will retrieve information about equipment in the inventory subsystem when working with a maintenance ticket involving a piece of tracked equipment. The inventory tracking subsystem will interface with the maintenance subsystem to provide a link to the maintenance ticket associated with a particular replacement part tracked in the equipment inventory. The inventory subsystem will also interface with hand scanners which allow users to scan and verify pieces of equipment, and to add equipment into the database.

### 4.1.2 Maintenance

The maintenance subsystem interface will be text-based. Users will have the capability to access this subsystem from in-place stations, even when connectivity is degraded. Hand-held scanners will allow users to view maintenance history for a given piece of equipment.

### 4.1.3 External Fault Tracking

The system will generate any messages required by the in-place external fault-tracking system.

### 4.2 User Interfaces

The EMU user interfaces are broken down into two major categories, one for each of the two main subsystems. The inventory tracking user interface is a relatively straight-forward user interface and is described in greater detail in the following section. The maintenance subsystem is composed of several different user interfaces needed to accomplish the variety of different tasks from both the viewpoint of the faculty requesting maintenance and the staff providing the maintenance. Each of the various maintenance user interfaces is described in greater detail in the following sections.

### 4.2.1 Inventory Tracking

The inventory tracking human-machine interface will be web-based. Users will be able to access this system from any internet-connected computer with a standard web browser, provided they have the proper username and password. The inventory tracking web interface will allow users to interact with the system using a mouse and keyboard. The main interface will be mostly a text-based interface allowing the user to input the required information about each item in the inventory.

### 4.2.2 Maintenance

There are four distinct user interfaces for the maintenance subsystem. The users of the system have an interface for interactive chat and online form submission of a maintenance request. The support staff has an interface for interactive chat and an interface that allows them to view, prioritize, and update submitted maintenance requests. These interfaces should be able to be viewed by any modern PC with Internet capabilities.

### 4.2.2.1 User Chat

The system will provide the user with a simple browser-based chat window available at a web address. The user can type text into a chat box and view some identifying characteristic of the support staff representative with whom they are chatting.

### 4.2.2.2 Maintenance Request Forms

Authorized users will have access to online forms that have textboxes for reporting the device type, giving a description of the problem, providing a serial number, and reporting the location of the device. A radio button should be displayed to allow the user to classify the request as emergency or non-emergency.

### 4.2.2.3 Support Chat

The system will provide support staff with a browser-based chat window similar to the one provided to the user. An alert should be made once a user attempts to initiate chat. The alert disappears one the request is accepted by one of the on duty support staff members. The support member who accepted the chat may then begin typing and viewing messages in a traditional textbox messaging system.

### 4.2.2.4 Maintenance Request Control Center

The Maintenance Request Control Center is accessible only by support staff and provides them with a record of all maintenance requests. Through this interface, support staff can generate reports, view new maintenance requests, and update maintenance requests. This interface is complex yet must be as intuitively easy to understand as possible. The interface must display reports, accept input from staff, and organize maintenance record displays according to key fields such as date, priority, and status. Additionally, manual and automatic maintenance requests should be clearly differentiated.

### 4.3 Hardware Interfaces

The maintenance subsystem must be able to interface with existing network sensors used by college of IS&T to detect problems within the network. These sensors must interface with the subsystem in order to generate the automated maintenance requests documented in the maintenance subsystem requirements.

The system must also interface with barcode readers used during inventory and maintenance. It is desired that the barcode reader used would have the capability to connect to a computer using a standard USB connection.

# 5 Traceability Matrix

The following requirements traceability matrix identifies system requirements from the system description provided in class. These requirements are then mapped to the system requirements contained in this document.

|  |  |  |
| --- | --- | --- |
| ***Capability*** | ***Requirement Description*** | ***SyRS Reqs.*** |
| **1** | **Equipment Tracking** |  |
| i | Physical characteristics of equipment and its ID# | 2.3.1; 2.3.1.1 |
| ii | Equipment location, user(s), and usage category | 2.3.1.1 |
| iii | Software available on the equipment | 2.3.1.2 |
|  |  |  |
| **2** | **Maintenance System** |  |
| i | Maintenance Record | 2.3.2 |
| ii | Maintenance Schedule – routine periodically | 2.3.2 |
| iii | Prioritizing requests, ask assignment, status of request | 2.3.2 |
| iv | Request for maintenance – manually or simulated by sensors | 2.3.2 |
|  |  |  |
| **3** | **Parts Inventory** |  |
|  | Generate barcode for all physical parts and use barcode reader during inventory and maintenance. | 2.3.1; 2.3.1.1, 4.2.1 |
|  |  |  |
| **4** | **Software Inventory** |  |
| i | Software description | 2.3.1.2 |
| ii | Software usage | 2.3.1.2 |
| iii | Software license | 2.3.1.2 |
|  |  |  |
| **5** | **Network System** |  |
| i | Network characteristics | 2.4 |
| ii | Record of maintenance and trouble shooting on the network | 2.4 |
|  |  |  |
| **6** | **On-line forms and chat** |  |
|  | Process troubleshooting and maintenance requests | 2.3.2; 4.2.2 |

**A-1 Requirements Elicitation**

This appendix contains the results of a requirements elicitation session held with the IS&T staff on Wednesday, September 12, 2007. The IS&T staff provided a high level description of the system that was desired and the major capabilities it would provide. A series of questions were developed and posed to the IS&T staff at the elicitation session. The following informal notes detail what was learned from this session and is broken down into the sections from the provided project description.

**Equipment Tracking**

Equipment references by room number, type, and possibly serial number (as well as bar code)

No I/O aside from bar code scanner and printer

Report generation – time frame important, (all activity in a given time), sortable and queryable by user, equipment, time, etc.

Equipment types to be tracked includes server, PCs, projector, monitor, laptops, printers, PDAs, network equipment (switches / routers / WAPs)

Computers should be separated by type (server, PC, mac, etc.)

Roughly 2500 individual items in current inventory

Include warranty information, coverage, type, contact information, response info (free text?)

Expiration notice on warranties as well as licenses

**Parts Inventory**

Parts inventory to track what replacement / upgrades parts were installed in what system when

**Software Inventory**

Software inventory installed per device, license key, license model, expiration date

Notify when nearing expiration

Software tracking is for every piece of software owned, whether it is installed or not

Software should act as a piece of equipment, in the equipment tracking system

**Maintenance System**

Prioritization of issues only needed at emergency / non-emergency level

-would be helpful to understand severity of the problem (is the system unusable, can the person perform their job, etc.)

-admin can change / update priority if needed

Staff members (users) perform maintenance

Request items to track - timestamp of when a request is submitted, name of requestor, location, emergency or not, description of problem, what type of device (pc, printer, pda, etc.), can you function or not with the given condition / does a work around exist, serial number if possible

Should be able to lookup history of maintenance records by piece of equipment or by user requesting

Maintenance records should be kept indefinitely but a status of decommissioned should exist for hardware no longer in the building

Auto-generation of tickets based on expiration (distinguishable, by category), better than email notification, (auto generation also goes for scheduled maintenance)

Staff will pick off a queue as needed, each record should have a status (new, open, pending approval, close)

Sys admin should be able to open a record (over the phone) for a user who cannot access the request page

Display should be limited by category of user, users should not be able to change submission time, requestor, etc. only new comments

User request submission separate from sys admin side, but still requires a logon

There should be an indication of who is on duty, who would you like to chat with, who is available

Monitor connectivity with other systems and auto-generate a record when a system goes down

**General**

Focus is blend of both tracking and maintenance system

Users will be sys admins, student workers, and also faculty and staff issuing support requests

Does not have to be interactive

Standalone system, no integration with blackboard, etc.

Administrative and read only user groups

Prefers mainly a text interface, a little bit of guidance, (not full wizards)

No reason to be fancy

System for local IS only

Acceptable downtime (99.9% uptime, example 2 hours per month)

Would like browser based client interaction including chat

Would likely go into test over one semester and go active afterwards

Equipment connectivity – don’t worry about (5.1)

Assumption of web-based system with SSL

Logon with username and password (encrypted in DB) (both admin page and user page)

User passwords do not expire

Forgot password link, send password to user’s email

No backup information