Biological Pathway based Design and Implementation of GUI Based Network Management System to Manage Live Network Nodes

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Abstract: This work specifies a set of tools for the network administrators to solve specific, but common problems of LAN, focusing on management issues like fault, configuration and performance. The system is capable of remotely configuring, monitoring and managing live network nodes and serves as a platform for enhancements in order to develop a feature rich yet affordable management system. The proposed system for network management may helpful to minimize the fast intensifying network's cost and complexities by offering improved set of simple tools to the network managers or supporting workers to rapidly resolve or identify network problems. Since it is a significant requirement for the network and personnel resources management to control and manage network problems from a central locality.

Keywords: LAN; GUI-based; Managing; Efficiency; Networks

1. Introduction

1.1 What Is Network Management?

In literature several definitions of network management exist (Bruce, 1996) and (Gavalas et al., 2002). Today's ever growing large networks can't be handled and examined by human's effort alone. The complication of such a system motivates the need of some networks management tools which will be fully automated. The importance for having such tools is augmented and the complexity of supplying such tools is also boosted, if the networks involve stuff from multiple vendors. There are several network management tools available in the market (Partridge et al., 1988), companies like Cisco Systems, HP, Paradyne Networks and many others have developed systems of this nature but these solutions are generally very expensive with prices in several thousand dollars.

In this work, we have designed and implemented a GUI based Network Management System to manage live network equipment. The system is capable of remotely configuring, monitoring and managing live network nodes and to serve as a platform for enhancements in order to have a feature rich yet affordable management system.

The Management System for Networks is a set of tools for network examining and controlling i.e., integrated in the following meanings:

- An interface controlled by one person having a strong but easy to manage and integrated sets of command for doing all or most of network managements task.
- A few numbers of divided tools i.e., most of the software *&* hardware essential network

managements are integrated into the available user equipments.

1.2 Why Management is Needed?

Networks management is necessary to observe and control the operations of the networks and to react to adjusting user requirement.

Network Managers are not only responsible for not only planning, designing, and implementing networks, their job is also to keep the network running smoothly and efficiently, with little or no down time. Generally speaking, the functions of a manager include installing and configuring devices, diagnosing and troubleshooting problems, controlling access to services, etc.

These functions fall into five main categories as follows:

- Capable to configure management
- Ability to boost management performance
- To handle fault management
- Capability to solve security issues for management
- Efficient accounting mechanism for management

Each of these network management functions will be described in later sections.

1.3 Components of the Networks Management System

Question is that how does the networking manager knowing, what user is answerable for and then control such a system? Answering to such queries, we have to know the networks management system architecture and that how it performs and achieves its goals. This system is also known as the

agent/manager model, which is further divided into a system (i.e., fully managed), an information database for management, a system manager and the networks protocols (see Fig. 1) (Case, et al., 1988), (Bruce, 1996).
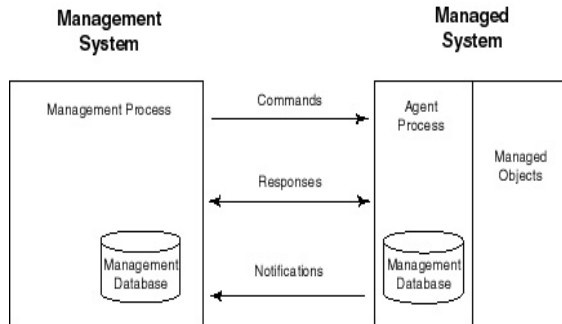

Fig. 1: Network Manager/Agent Relationships

As Fig. 1 presents, the managed system includes the managed objects and the agent process. The network management operations are performed by the agent process.

Project Scope: There is always scope for improving technical software products, and the Networks Management System (NMS) are no exception. This work focuses on the following:

- Performance Management
- Configuration Management
- Fault Management

Each problem area is examined separately and a solution is sought for each of the problems identified like services management, processes management and event tracking. As a result, a set of tools is developed to solve these problems using a number of different network management techniques like SNMP (Case et al., 1990) and CIM implementation (Cerf, 1988).

2. Proposed System Architecture

We have proposed the system after detailed study and analysis of the various technologies used in network management. Currently almost all of the network management systems (NMS) have been developed using standalone network management architecture like SNMP (Simple Network Management Protocol) (Case et al., 1990) or IEEE Network Management Model etc. We have proposed a system which will be a merger of SNMP technology (Uebele, 2007) and CIM (Common Information Model). DMTF (Desktop/Distributed Management Task Force) proposed CIM as an industry standard. The information management functionality to get information about any system on the network will be accomplished using SNMP while other management activities will be performed using

CIM implementation. It will help the network administrators to detect and solve problems of remote machines form a central location and they will also be able to perform effective processes and services management and troubleshooting activities.

In the subsequent sections, we will explore the advantages by explaining and comparing the technologies used for the proposed system.

2.1 Overview of CIM-Common Information Model

DMTF proposed CIM-Common Information Model, initially as part of the WBEM program. CIM is a technique (based on the object-oriented paradigm) to systems, software, devices, systems, user managements and the networks. It presents an integrated intangible frameworks and standards for expressing logical and physical objects into unified managed environments. CIM describes a numbers of objects for providing the general frameworks concerning the basic sets of classification, class and association.

It consists of the following information approaches:

From an architectural point of view Fig. 2 presents the CIM's three-layers approach that includes its CIMOM (Objects Managers), Providers and Management Applications.
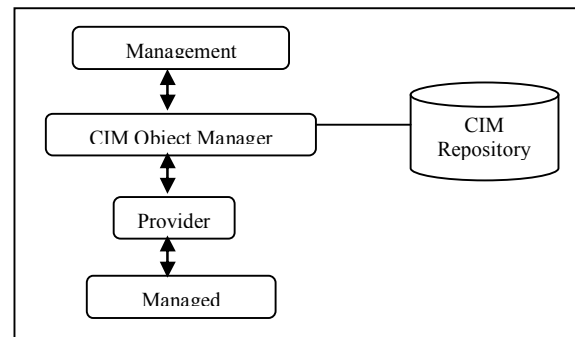

Fig. 2: CIM Architecture

2.2 Proposed System Advantages

2.2.1 Security: The security vulnerabilities of SNMP architecture will be removed by using CIM implementation and the proposed system will provide enhanced level of security to access machines remotely.

2.2.2 Reliability: The proposed system will be more reliable than others as it will provide a connection-oriented service. SNMP based network management systems provide connection-less service because it works on UDP. The proposed will provide more reliable service for the management tasks.

2.2.3 Bandwidth: The proposed system will consume less bandwidth according to the architecture

specified because the nature of the proposed system will be connection-oriented so it will consume less bandwidth.

2.2.4 Latency Time: As the proposed system will consume less bandwidth and requests can be mapped to available different protocols, the latency time or round trip time for the request will be less then other network management systems.

2.2.5 Efficiency and Performance: In the light of above stated characteristics, the proposed system will be able to perform network management tasks with efficiency and reliability. The information retrieval and other network management activities performed by the proposed system will be fast due to reduced cycle time. Hence, the overall performance and efficiency of the proposed system will be improved.

3. Results and Discussions

The nature of the system is distributed and based on client/server architecture. The GUI is designed in a very user friendly manner. This section gives a bird's eye view of application through the snapshots.

3.1 Main Switchboard

When user starts the system following Main form will appear on the screen as shown in Fig. 3. This main form provides three menu options: File, Management Panel and Utilities. Each of these menu options provides further sub-options.

3.1.3 Management Panel

-System Information
-Services Management
-Process Management
-Track Services
-Track Processes
-Event Log

3.3.2 Utilities

-Ping
-Trace Route
-IP/Host Name Resolution
-Reboot Machine

Clicking on any of above menu options, system will enable network administrator to perform his desired task.

3.2 System Information

By clicking on system information option following form shown in Fig. 4 will be appear on screen, containing options to customize the information required about any machine on the network.

To access information of remote machine, following information is required.

-Host Name or IP address
-User ID
-Password

To Access information about local host or local system, just select option button for local system as shown in Fig. 4. Different buttons are available on the form to get information according to requirement. Further to access information about number of Drives, free space, total space etc. select Drive list from the tab menu (Fig. 5). As we will select remote system option button, the text fields for host name, user id and password will become enable and after providing necessary fields values, we will be able to retrieve information.
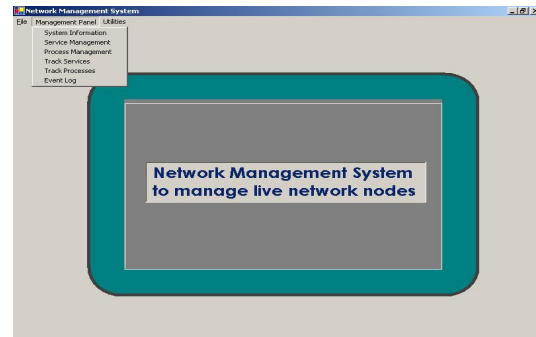

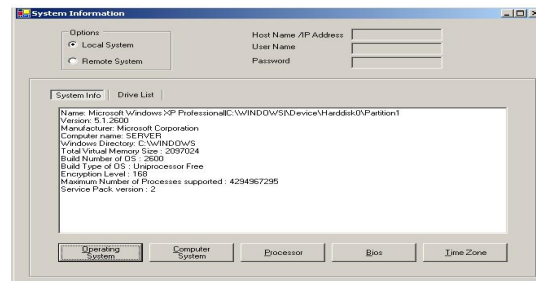**Fig. 3: Management Panel and Utilities**
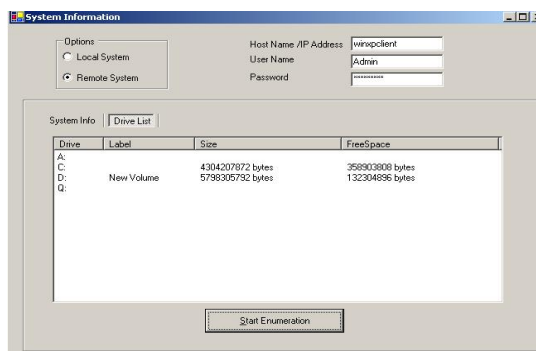

Fig. 4: System Information

Fig. 5: System Information Drive Listing

3.3 Service Management

Service management option is included in Management Panel menu. This system option will enable network administrators to perform service management effectively. According to the requirement, different services can be stopped and

started for necessary troubleshooting and performance upgrading. By clicking on this option, a management panel form will be appeared on screen and selected option from the top tab menu will be Service management. On this tab of service management, there are four buttons available to perform service management effectively named as Load/Refresh, Toggle Service Mode, Start Service, and Stop Service as shown in Fig. 6.

3.4 Process Management

By clicking Process Management, Process Management form will be appeared. On process management from, we can view processes on local or remote machine by giving IP address or Host Name. Further we can Start Process or kill processes according to requirement by providing process name and executable path as shown in Fig. 7. There are three buttons available on this form named as Load/Refresh, Terminate Process and Start Process. Following fields are necessary to fill in case process management of remote machine.

3.5 Track Services and Processes

With the help of Track Services option, user can view and track that which services are being initiated and which services are being are stopped. The facility is available on local or remote machine of the network as shown in Fig. 8. With the help of Track Processes option, user can view and track that which processes are being initiated and which services are being stopped.

3.6 Event Log and Ping Utility

The system will enable user to view event log of any computer system on the network by specifying its machine name or IP address (Fig. 9). Ping utility is provided to check the physical connectivity between machines. It is a useful utility to troubleshoot the problems regarding network. Host Name or IP address is required to check the physical connectivity. The other features of the system are: Host Name/IP Resolution, Reboot Machine panels.
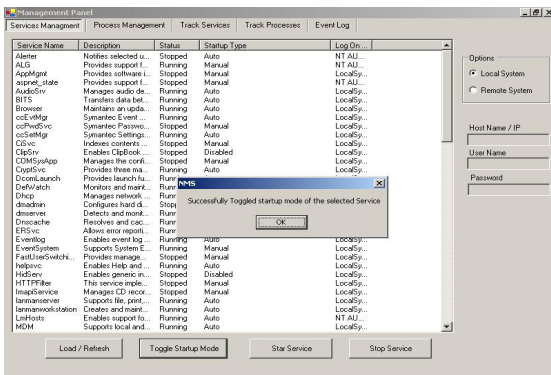

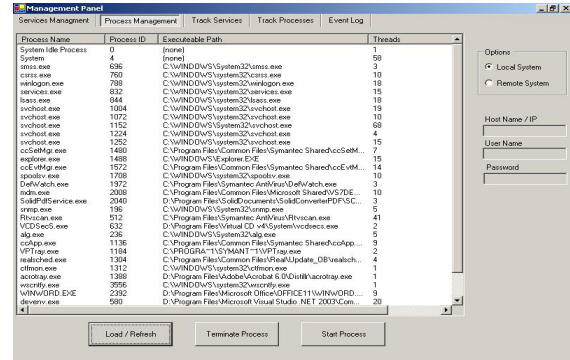**Fig. 6: Services Information and Management**

Fig. 7: Process Management

Table 1: Process Management Parameters

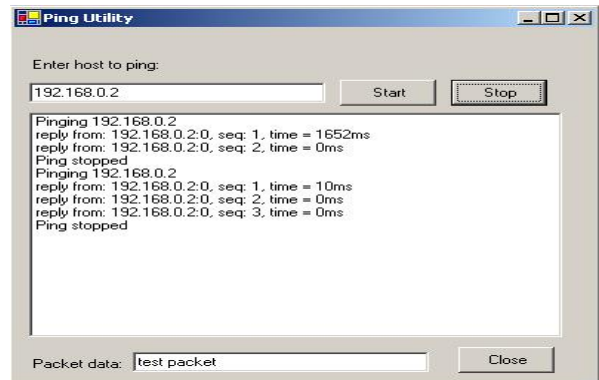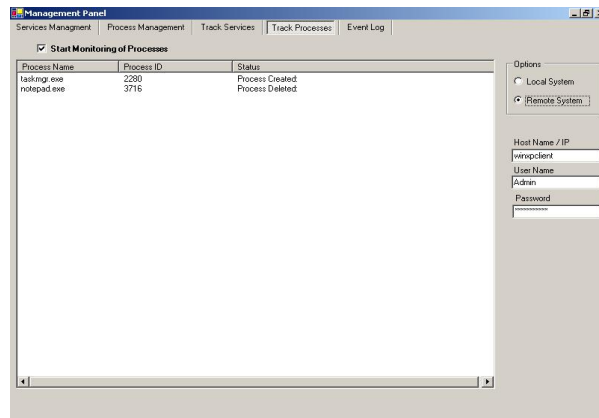| Field Name	Description	Remarks
Host Name/IP Address	Name of the remote Host or IP Address to access the machine over the network	User has to choose remote system option
User Name	Name of user which is used for system use	User has to fill this field
Password	Password of user. This is displayed in decrypted form	User has to fill this field

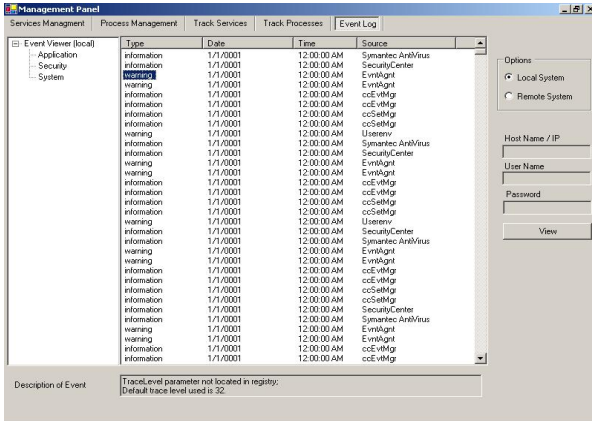**Fig. 8: Track Services and Processes**

Fig. 9: Event Log and Ping Utility

3.7 System Testing

In this section, some tests are performed to check the proposed system expected behavior. Such testing technique is not related with how input is changed into output. Since the internal implementation detail of the system is not noticeable to the tester. This provides inputs through an interface that the system offers and tests the outcomes. If the output match with the estimated result, system is okay if not a fault is indicated (Patrick, 2007). Here are two sample test cases for this project to perform black box testing.

Table 2: Testing Results
Project Name: NMS; Module Name: Track Processes

Test case ID: TC 1	
Objective:	To test the functionality of "Track Processes" method.
Inputs:	1. Select local machine for monitoring, click check box of monitoring.
	2. Select remote machine for monitoring and enter values of machine name or IP Address, User name and password. Click check box to start monitoring
Result expected:	1. Monitoring of local machine should start and list of processes, which are being initiated or terminated, will available to user.
	2. The system will connect to the remote machine using credentials provided and monitoring details of processes will be visible to the user.
Outputs:	1. The monitoring of processes is started successfully of local machine.
	2. The monitoring of processes is started successfully of remote machine.
Result:	**Test Passed.**

4. Conclusions

"Network Management System to Manage Live Network Nodes" is developed to provide a user-friendly environment that could help Network

Administrators and Network Managers to perform necessary management tasks from central point. This system does various functions as of the OSI Networks Managements Functional Area, those being, Configuration, Fault and Performance.

A main objective of the system is to retrieve information about any remote machine on the network quickly and instantly. Network Administrators can perform effective services management and processes management. Further the system is capable to check physical connectivity and name resolution tasks and perform network management activities according to the requirement. Different network management techniques have discussed in detail.

SNMP and CIM model (DMTF industry standard) is used to develop the system. All the basic requirements have been achieved and different utilities have been added to the system to make it more efficient and reliable. Event Tracking and monitoring has been deployed effectively to enhance the overall network performance, as a whole system is working properly to fulfill all the functional requirements.

Table 3: Testing Results
Project Name: NMS; Module Name: Service Management

Test case ID: TC 2	
Objective:	To test the functionality of "Service Management" method.
Inputs:	1. Choose local machine or remote machine for process management
	2. For remote machine also provide, machine Name, User Name, Password.
	3. Click load /refresh button to view list of processes
	4. Click Toggle startup mode button to change startup type of service.
	5. Click / press start button to start selected service
	6. Click/Press stop button to stop the selected service
Result expected:	1. Local machine option button or remote machine option button will be selected.
	2. For remote machine connection, necessary data fields will be accepted.
	3. A list of services will be displayed
	4. The selected service will be started.
	5. The selected service will be stopped.
Outputs:	1. Remote machine / local machine is selected
	2. Connection to remote machine is established via credentials provided.
	3. A list of services is successfully displayed.
	4. The selected service is started successfully.
	5. The selected service is stopped successfully.
Result:	**Test Passed.**

Acknowledgments

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