Volume 2, Issue 1
February 2013

ITEE Journal
Information Technology & Electrical Engineering

ISSN: - 2306-708X

A Modified Approach for Fault Localization and Rectification in Next Generation Intelligent Networking Environments

[1]Matasam Saleh, [2] Shahbaz Pervez Chattha, [3] Adeel Akram

Faculty of Telecommunication and Information Engineering University of Engineering and Technology, Taxila, Pakistan.

E-mail: [1]matasemsaleh@hotmail.com, [2] shahbazchattha@gmail.com, [3] adeel.akram@uettaxila.edu.pk

ABSTRACT

With the astounding developments in the field of electronics and communication, the world has truly turned into a global village. People around the globe are interconnected by what is commonly known as 'Internet' which is essentially a combination of many diverse networks. Since we do not live in an ideal world, these networks are error prone and endure faults of various degrees. Different types of networks have to cope with different types of faults. These faults cause degradation in the reliability, performance and availability of the services provided by these networks. The Network Fault Management (NFMs) systems have to continuously monitor the networked devices to locate, isolate and fix the faults that may develop with the passage of time and usage of the equipment. Different commercially available software tools are available for detecting the faults in the networks. However most of them are not able to detect and locate all types of faults. Moreover these software packages do not allow customization and modification of their source code which makes the task of fault management a tedious and arduous one.

In this paper we address the issues related to fault monitoring and rectification with an efficient and user friendly software solution that is based on open source architecture allowing development and improvement by the public community.

Keywords: *Network Fault Management (NFMs), Fault Localization and Rectification (FLR), Intelligent Networking (IN)*

1. INTRODUCTION

With the recent advancement in the field of information technology there is a significant growth in the deployment of new networks. This has facilitated the network users in sharing their data, resources and services. On the other hand it is crucial for the Network Administrators to monitor these networks to ensure zero downtime for their users. In Small Office/ Home Office Local Area Networks (SOHO LANs) the services offered to the users are easily manageable by the Network Administrators due to minimal infrastructure complexity. On the other hand, the complexity of corporate networks grow significantly with the increase in the size and the services offered to the users, It becomes impractical for the Network Administrators to manually check the availability of all the networked services, applications and devices. To accomplish this goal various commercial network monitoring tools are available for the monitoring of networks and services. These tools are either too expensive or too complex, thus requiring specialized trained personal further increasing to the Total Cost of Ownership. Moreover with the passage of time and introduction of newer services over the network, these software packages become obsolete unless newer updates are provided by the manufacturer.

In our software we are providing a very user friendly interface with a provision to add more devices and to monitor network services according to the requirements of the Network users.

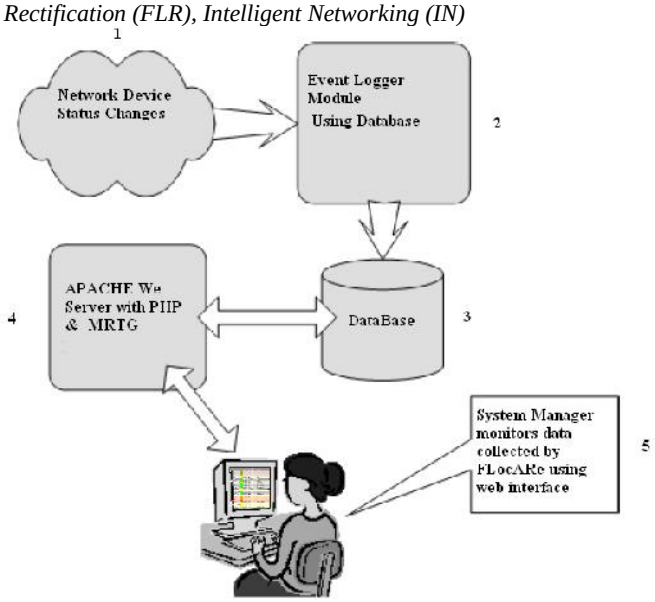


Figure.1 Functional Diagram of FLocARE

Maintaining connectivity across the networks is the focus of recent studies across the globe. A lot of efforts have been made to resolve the issues related to Fault rectification and Network Management.

A lot of work is being put into network fault management systems which are vindicated by the emergence of a number of research papers on the subject of fault management in recent years. Network management is regarded as a major challenge facing the network community. Network managers have to cope with diverse communication resources that are produced by numerous vendors. The interoperability of such resources poses obstacles in maintaining efficient and resilient networks. Apart from error management, the network managers have to come up with solutions that are affordable and inter operable as well as equipped to deal with the network errors and faults. The network management providers

are in the process of developing standards that provide interoperability among different management platforms. Such groups include the International Standards Organization (ISO) ,National Institute of Science and Technology (NIST), OMNI Points, Internet Engineering Task Force (IETF) and Open Software Foundation (OSF) etc to name a few. These groups have presented several standards that provide fault tolerant network management capabilities.

Most of these standards make use of Management Information Databases (MIB's) of the faulty equipment to know why it is faulty. An example of one such system is the one proposed and implemented by Elias et.al. [1]. the proposed system is based on SNMP (Simple Network Management Protocol by IETF) service allowing the system to examine the MIB's of crashed objects through working objects. The proposed scheme implements the replication of both semi-active and passive, selected SNMP MIB objects. As well as providing fault tolerance the system enables the manager to poll one object to get the status of other objects in the network

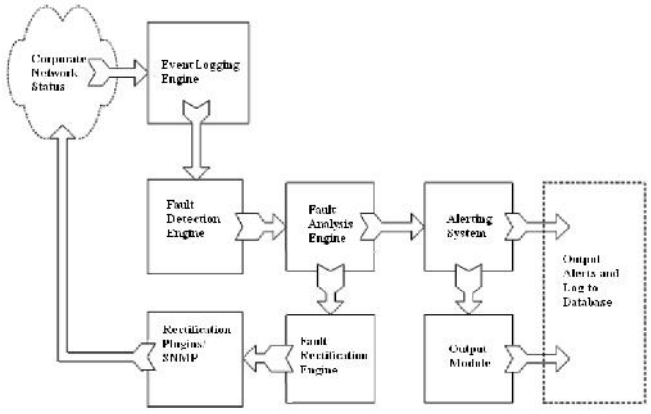


Figure.2 Component Level Diagram of FLocARE

2. COMPONENTS OF FLOCARE

Following are the components of FLocARe System.

Corporate Network Status Probe:

The network devices are probed (checked repetitively) after a specific interval configured by the System Administrator. The Status Probe reports “up”, “down” or “unreachable”; for each device depending on the result from the last probe. These events are reported to the Event Logging Engine for further processing and logging.

Event Logging Engine:

Event Logging Engine checks the incoming events generated by network probes. These events are categorized as Ok, Unknown, Warning and Critical events indicating level of severity of device status. Normal events are logged into the database for historical reference and reporting. Warning events cause change in the color of visual representation of devices on the FLocARE web interface. Devices with warning events are represented in Yellow. This helps the System Administrators to easily identify devices that have been reported a degradation in their performance. Critical events for devices are shown in Red. Moreover visual, audio as well as text message alerts are generated for Output.

Fault Detection Engine:

This module identifies the warning and critical events and adds additional information and error codes to the event logs according to a predefined fault signature database. This helps the Fault Analysis Engine to take appropriate remedial measures to rectify the problem.

Fault Analysis Engine:

Fault Analysis Engine takes into consideration the error codes and event specific information added by the Fault Detection Engine. This helps in selecting remedial actions depending on the type of device (e.g. the action taken for PCs may differ from those for routers and switches). Appropriate actions required to be taken by the Fault Rectification Engine to fix the fault reported by the network device probes are decided here.

Fault Rectification Engine:

Rectification actions suggested by Fault Analysis Engine are performed by the Fault Rectification Engine on the effected device. The device status is again checked after application of rectification procedure to the effected device. If required, further fixes are applied in case of failure of the previous rectification procedure.

Rectification Plug-in/SNMP:

Rectification Plug-in or SNMP set commands are used to modify the status of network devices depending on the availability of SNMP or Plug-in options on the target device to fix their problems.

Alerting System:

This module generates alerts after detection of change in the status of any device or service. Alerts are generated in the form of Network Messages, Emails and SMS Messages to the predefined Recipients, Email Addresses or Cell Phone Numbers of the System Administrators. Entries logged by the system include subsystem name, device name, time stamp, event type, event description, action taken etc.

Output Module:

Depending upon of the configuration of the system the output alerts are generated to the specific output device.

Volume 2, Issue 1
February 2013

ITEE Journal
Information Technology & Electrical Engineering

ISSN: - 2306-708X

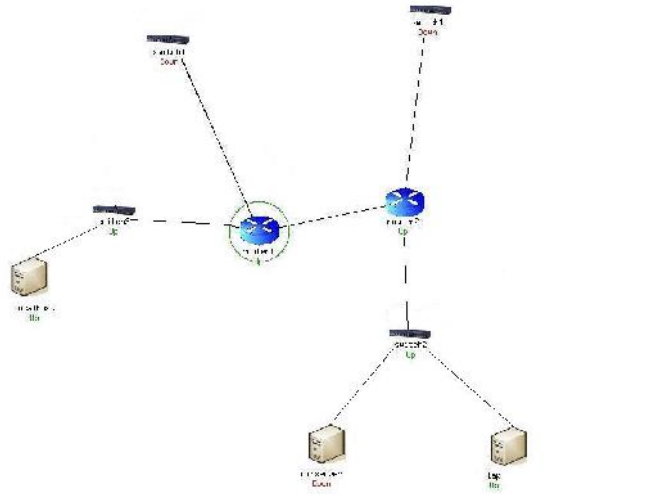


Figure.3 Status Map of Devices in FLocARe

3. COMPARISON WITH COMMERCIALLY AVAILABLE PRODUCTS

An interesting piece of literature was presented by R. Hoo, D. Lee, J. Ma and J Yor,g [2], which is based on the on-line monitoring of the networks working on link state routing protocols e.g. OSPF and integrated IS-IS.

The proposed scheme works by on-line monitoring of the link state network databases, analyzing the events generated from the network faults for the correlation of the events whereby locating and isolating the fault. The scheme is elegance in the sense that it performs location and isolation of the fault in a timely manner without disrupting the normal network operations.

Earlier researches in the fault management focused mainly on logical and physical parts of a network. However the future telecommunications networks will be based on service oriented networks and therefore it is important to monitor the management activities keeping in view the functionality and services of the network. The idea was proposed by Hyung-Deug Bae, Moo-Ho Cho, Cheol-Hye Cho [3] where an architecture was proposed for evaluating the effects of the faults in the network on the services and functionality of the network in question.

Baras et.al considers fault management on application level. Their proposed system [4], was based on X.25 protocol and worked on the properties of the Markov Modulated Poison Process (MMPP) packets generated by each application. Server fault scenarios, such as reduced switch capacity, disabled switch in the X.25 cloud, increased packet generation etc were used in the training of the neural networks. Their work details SNMP monitoring and SNMP traps, (based on the RFC 1382 implementation), OPNET interface, first and second level of fault detection in neural networks and expert systems along with single and multiple faults. NFMi, Inter-domain Fault Management System, is another system proposed by Qingchun Jiang et. al. [5]. The system works on stream processing techniques to provide an integrated fault management system for multi-layered network with on-line processing and near real-time responses to the various faults.

These and other approaches can be used along with available software packages in achieving our objectives.

Among other resources there is also a lot of help available from professional IT personals in the field of network fault management

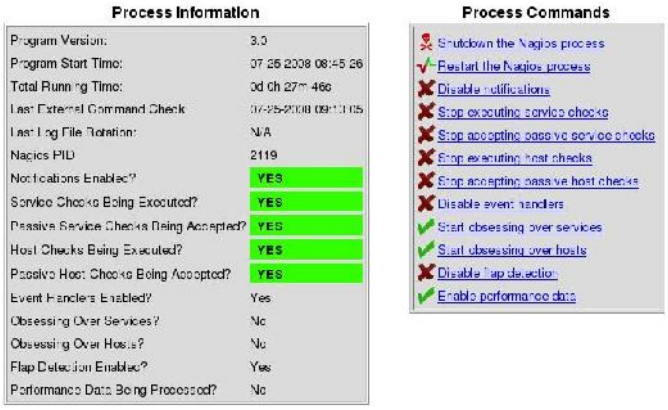


Figure.4 Process Status information

Fault Localization is the process of identifying the components of a network that cause the temporary or permanent disruption in the normal flow of traffic.

Fault localization is the first action towards eradication of the fault on the network. In early days of networking it was done manually but nowadays the task is carried out by the use of expert software's. The use of such software's speed up the task as well negates the human error factor in the underlying tasks.

Many software's are available in market but these software's do not cover all the user's need, some of these software's are simple and attend to localize the faults only and others are complex and difficult to use and as these software's are commercially found they are of high price. This area requires a lot of research which attracted us to work on it and try to study these softwares and merge the best qualities of these software's in single software solution.

4. EXPERIMENTAL SET UP

Good software should be able to perform the required task efficiently and with as little effort as possible without putting much strain on the system itself. The experimental setup includes the existing fault management systems e.g. (SiteScope[6], WhatsUp[7], ATVIEW[8], HP Open View[9]). An important aspect of designing any technical software is to be in touch with the intended user, so a lot of help and input was taken from IT professionals managing the fault management systems on various networks across the country.

We went through the several cycles of testing, improvements and redeployment of FLoCARE on a corporate network of UET Taxila.

5. METHOD OF ANALYSIS

To evaluate the performance and usability of our software solution, we utilized software engineering methodologies and

ITEE Journal
Information Technology & Electrical Engineering

ISSN: - 2306-708X

techniques developed by NASA and other companies that test the complexity and suitability of softwares.

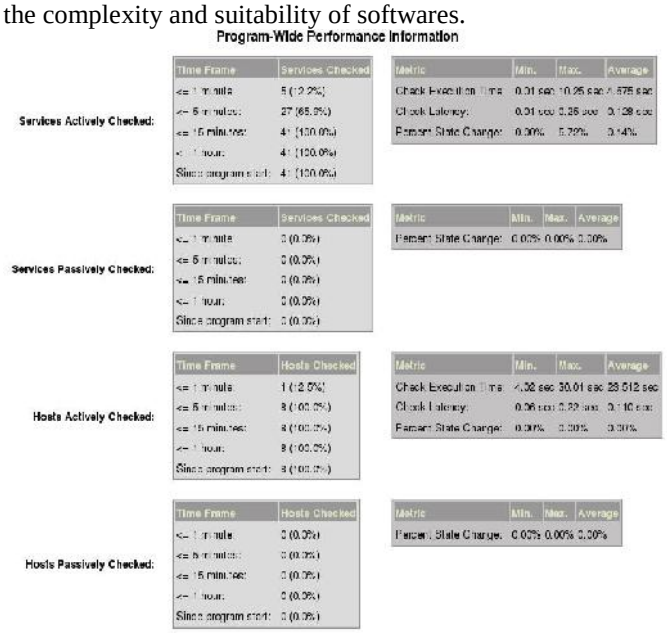
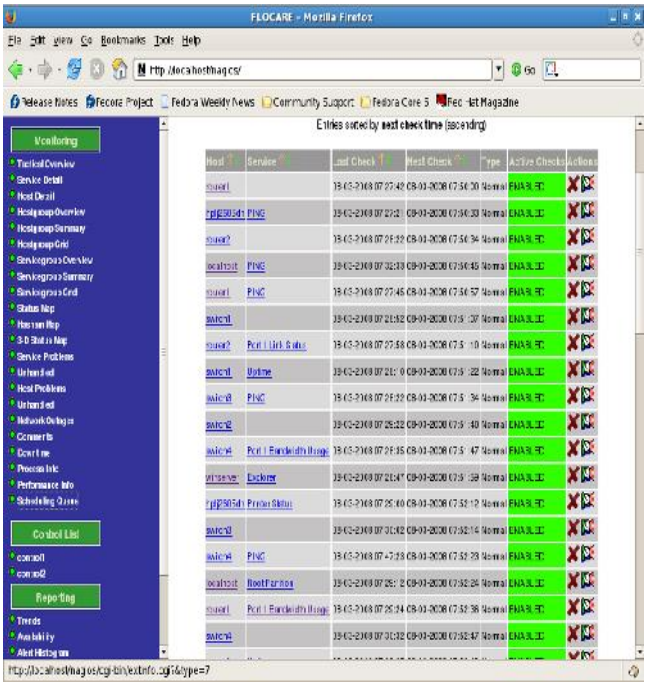


Figure.5 Performance Information Program wide

6. RESULTS

The result from our work is to attain a complete software solution that provide all the possible services to the network operators / administrators to localize and rectify the network faults with ease and utilizes a single software solution to take care of their network. This software will be provided with user friendly interface and features to make it useful even in small networks which are run by unprofessional end users.



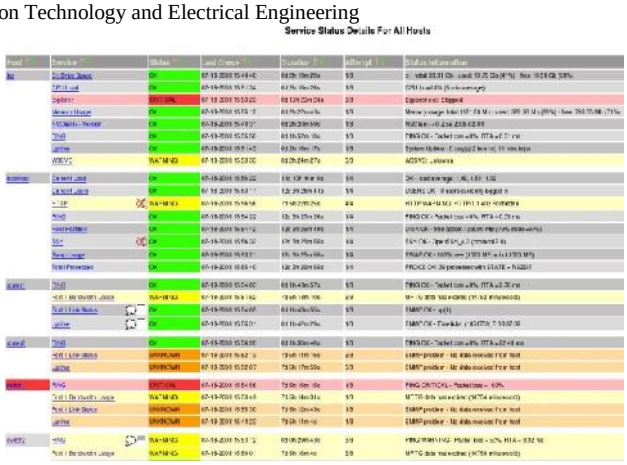


Figure.6 Services Status

7. CONCLUSION

We presented an overview of our proposed Fault Localization and Rectification System explaining its functional and architectural features. An effort has been made to highlight the strengths of FLocARe in comparison with other commercially available software. Developed on open source architecture provided additional benefits of flexibility, maintainability and further improvement by the public community.

8. FUTURE WORK

Although FLocARe can identify and rectify the faults in network components it may be further enhanced to provide alternate routes or paths in the network to maintain end to end connectivity. Moreover mechanism for bottleneck identification and jitter minimization may also be incorporated to further extend its capabilities

REFERENCES

[1] Elias Proc6pio Duarte Jr. Aldri L. dos Santos" Network Fault management based on SNMP agent groups",Federal University of Parana', Dept. Informatics, P.O. Box 19081 Curitiba 81531-990 PR Brazil, pages 51-56.

[2] R. Hoo, D. Lee, J. Ma and J Yor,g "Fault management with Link State Routing Protocols", Bell Loborarork Research China, 15FAem Space Grier Wall BLDG,30Hai Dior, Nan Lu Beijing, P. R China 100081.

[3] Hyung-Deug Bae, Moo-Ho Cho, Cheol-Hye Cho," A Fault Effect Assessment Architecture of Advanced Intelligent Network", Operation Technology Section Mobile Telecommunication Technology Division Electronics and Telecommunications Research Institute Yusong.

[4] J.S. Baras, M. Ball, S. Gupta, P. Viswanathan, and P. Shah, "Automated Network Fault Management", Center for Satellite and Hybrid Communication Networks, Institute for Systems Research,University of Maryland, College Park, Maryland 20742 pages 1244-1249.

[5] Qingchun Jiang, Raman Adaikkalavan, and Sharma Chakravarthy "NFMi: An Inter-domain Network Fault Management System", Department of Computer Science & Engineering The University of Texas at Arlington.1084-4627/05 © 2005 IEEE.

[6]http://www8.hp.com/us/en/software-solutions /software.html?compURI=1174244#.UNy7lOSOTQg.

[7] http://www.whatsupgold.com.

[8] http://www.atview.com.

[9]http://www.hp.com/bizsupport/wja/live/manual/8.1/installs/ wja-openview-nnm.pdf.

[10] H. Bjerring, D. Lewis, and I. Thorarensen." Inter-Domain Service Management of Broadband Virtual Private Networks". Journal of Network and Systems Management.

[11] R. Diaz-Caldera, J. Serrat-Fernandez, K. Berdekas, and F. Karayannis." An Approach to the Cooperative Management of Multi technology Networks". Communications Magazine, IEEE, may 1999, 0163-6804/99,pages 119-125.

[12] Bhattacharyya, S.; Huang, Z.; Chandra, V.; Kumar, R. "A Discrete Event Systems Approach to Network Fault Management": Detection & Diagnosis of Faults Proceeding of the 2004 American Control Conference Boston, Massachusetts June 30~July2, 2004.