Networking Monitoring in Distributed Systems Using Smart Agents

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Abstract

The main objective of this study is to implement smart agents in distributed systems to identify, predict, analyze and suggest an appropriate solution to networking problems which occur in distributed systems due to various reasons. This study includes various domains like networking and data mining. Networking domain is used to study various networking issues; data mining is used to classify the issues and accordingly used to predict the proceedings in future. Taking these considerations this study focuses on these issues and plans to design develop and implement an intelligent smart agent (simulated model) which has the combination of both these domains to identify and rectify the problems occurring in the distributed systems.

Keywords: Networks, distributed systems, Decision Tree, Smart Agents, Index Terms, Data Mining Simulated Model.

I. Introduction

One of the major challenges is that computer networks have evolved to have great many dependencies on a seven layers. Some of the major ones are identified which is network applications may depend in order to provide correct. So that dependencies are roughly from top layer to bottom layer being dependent upon the upper layers although a detailed dependency would be quite complex. Failures in any of those layers can result in visible application-level errors, inconsistency, service of each layer, or other problems, like damage, corruption ,too large packets, heavy load ,hanging service unavailable, even if there are duplicate packets. For example in the Transport layers response is large message into smaller message that respect only limit the size (not all sizes).imported by the network communication only. if one layer is failure, we are not able to communicate from one place to another place. We have to find out

where it was the problem occurred.. Fig1.depicts different servers

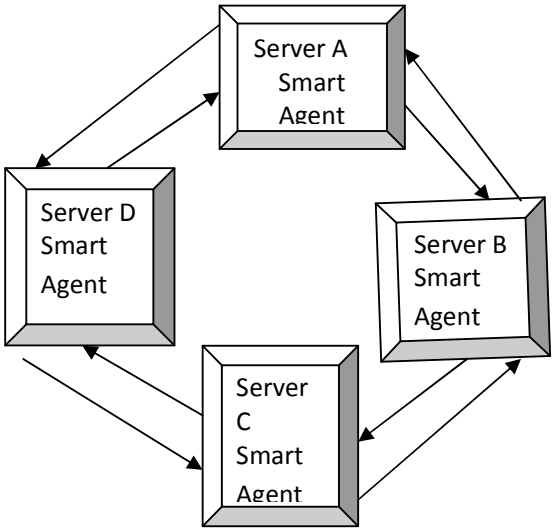


Fig 1.0 Smart Agent Networks Architect

Overview:

The fundamental model of networks is that they provide communications between network nodes and that the routing and priority of the communication is independent of the content. A Smart Network's focus is on delivering information to users with the user in control of how, when, where and whether the information is delivered. The key point of this statement is that the user is in control of the network's behaviour. This control is exercised through instruction provided by the user and through observations of the user's interaction with the network. Components of a Smart network: for a smart network to work, it requires several forms of intelligence. It requires an inference system for collecting information about the user's interaction with the network. It requires smart agents with the associated framework for processing messages and routing them through a network of servers. And it requires gateways to allow access to the network. The inference system usually would consist of an inference engine, a set of rules and a method of delivering event information to the engine. This system would reside at the network gateway on a server at the user's point of access to the network and would analyze the user's interaction with the network and assist in customizing the network's behaviour for the use. An agent based architecture and smart networks provide a promising solution to the problems of implementing large-scale distributed simulations. An agent system using the remote programming paradigm could reduce the network bandwidth requirements and computational loads associated with a large distributed simulation. This reduction would occur by eliminating unnecessary pdu traffic through the use of smart agents that represent the originating entity. These agents would travel to and

reside on the host computer of other entities and provide the necessary state information for stationary entities without using network resources. Smart networks could be used to create a flexible area of interest manager that allows entities to specify Their area of interest and the information they require from within that area. This approach allows an entity to get all of the information it requires to represent its view of the simulated world while eliminating all unnecessary Information processing. Further research must be done to examine the real-time performance of both agent systems and smart networks to ensure that they can meet the real-time requirements of distributed simulations and to measure the reduction in network traffic and computational lot of method for a network topology aided by a smart agent download, the method comprising: authenticating, with at least one authenticator device, at least one claimant; transmitting, by at least one transmission source, the smart agent.

The smart agents operate on three types of networking topology

1. Hierarchical Structure
2. Star Structure
3. Multiple Bus Structure

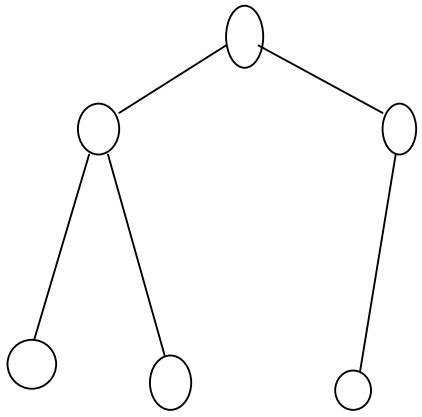
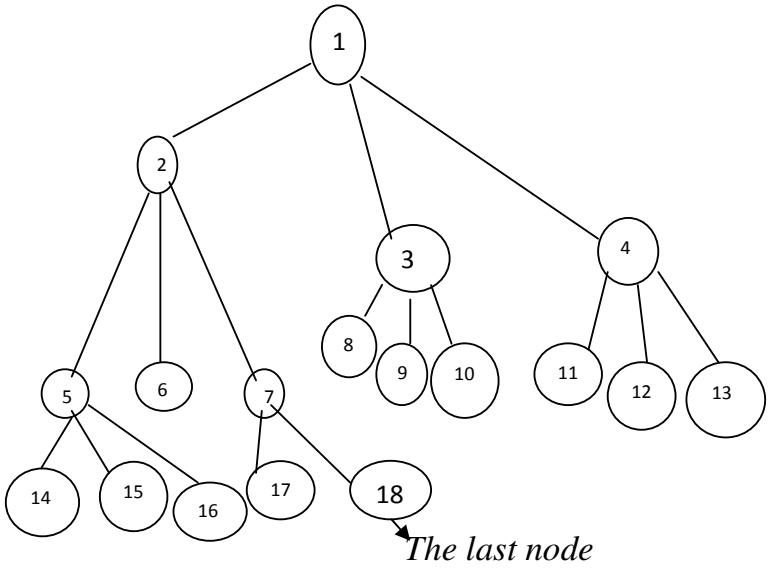


Fig 1.1 Tree Structured Network

In a tree-structured network, the nodes are connected as a tree. A tree has three different types of node, a root node, interior nodes, and leaf nodes, each with different degrees. In these systems, the basic cost grows linearly with the number of nodes in the tree. The scalability of the tree-structured network is better than that of the fully connected network, since new node can be added as the child node of the leaf nodes or the interior nodes with fewer connections while limiting the height (the diameter) of the tree. However, in such systems, only messages transmitted

between a parent node and its child node go though one link, other messages transmitted between two nodes have to go through one or more intermediate nodes. The worst case happens when the two nodes are both on the bottom level of the tree and the root is the only common ancestor of them. In this case, a message from the source has to go upwards until it reaches the root and go downward to reach the destination. If a parent node fails, its children nodes cannot communicate with other nodes in the system. Figure 1.2 shows an example tree-structured network. In a multi-access bus network, all the nodes in the system are connected to a single shared bus link. The bus link becomes the bottleneck and if it fails, all the nodes in the system cannot connect to each other. Figure 1-6 shows an example of a multi-access bus network. Figure 1-7 Multi-access bus networks



Complete n-ary tree: Informally, a complete n-ary tree is a tree in which all the nodes have at most n children nodes and a11 the levels are full except for the bottom level and the bottom level is filled from left to right [4]. If we assign each node in the complete n-ary tree an id with the order by breadth-first- search while the root of the tree has id 1, then for a node with id i, its parent node is the node

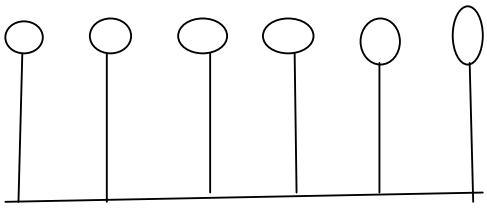


Figure 1-3 Multi-access bus networks

with Id[(i - l)/n], its child nodes are the nodes with ids: ϒ (i-1)+2, n fi-1)+3, n fi-p4, ... ni+l. ... ni+l. example of a complete ternary (~3) tree. We call the node with the maximum ID in the tree the last node. Figure shows an example of a complete ternary (~3) tree. An example of a complete ternary (12'3) tree.

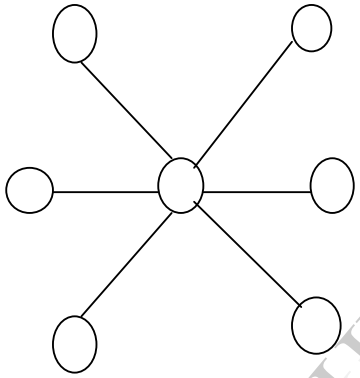


Fig 1.4 Star structured networks

The Master Node and the Slave Nodes Our work has examined the construction and the recovery of the tree-structured and the ring-structured network. In both the tree-structured and the ring-structured networks, there are two types of nodes in the system: the master node and the slave nodes. Each system has only one master node and can have up to hundreds of slave nodes. In the tree-structured network, the master node is the root of the tree while in the ring-structured network the master node is the head of the ring. Other nodes are the slave nodes. There are two major responsibilities for both the master node and slave nodes. One is to maintain the given system structure. The other is to manage the system resources. of simplify the management of the system, each node in the system is assigned a position 1D that is determined by its position in the system. In the tree-structured network, the position ID of a node is the browsing order of the node using breadth-first-search where the root of the tree has position ID 1. In the ring-structured network, the position ID of the node is the position index of the node in the ring where the head of the ring has position ID The Tree-Structured and the Ring-Structured Network In the tree-structured network, nodes are connected as a complete n-ary tree. When the system starts, there is initially only a master node that is the

root of the tree. When new nodes request to be added to the system, they are added to the bottom level of the tree from left to right to maintain the complete n-ary tree structure. If any node in the system fails, a node in the system is used to replace the failure node to keep the given system structure. To minimize the number of nodes involved in this event, we choose a node from the last node in the system backwards until we find a node that is still active to replace the failed node, Since it is possible that during the recovery process, the last node, its previous node and so on may fail, so that the node with the maximum position ID that is active is used to replace the failed node. All the child nodes of the failed node will connect to the node that is used to replace the failed node. Using the complete n-ary tree as the network topology has two benefits for the network's scalability. The first one is to minimize the height of the tree thus minimize the longest path to send a message to its destination. The second benefit is to fix the maximum degree of the nodes so that when the number of nodes in the system becomes very large there is no need to increase nodes' ability to handle more connections. In the ring-structured network, nodes are connected as a ring. When the system starts, there is initially only master node that is the head of the ring. A new node is added to be the tail of the ring. When a node in the system fails, its previous node and next node are linked together. However, as in the tree-structured network, it is possible that during the recovery process the failed node's previous node and next node may fail, so that we need to find two nearest neighbors of the failed node that are active and link them together. In the ring-structured network, the degree of each node remains to 2 no matter how many nodes are in the system. However the diameter of the ring increases as This results in a longer average message

transmission delay. the number of nodes increases.

II. Distributed systems.

A distributed system is a system consisting of computers that do not share a common memory or a synchronized clock. The computers in a distributed system are connected via a communications network. Each computer has its own memory and runs its own operating system. The computers can access remote resources as ell as local resources in the distributed system. A computer accesses remote resources via the communication network. generally, it is more expensive to access the remote resources than to access the local resources because of the communication delays and the CPU overhead to process communication protocols ,

The motivation behind the development of distributed systems is the availability of the low-cost, high performance computers and network devices. When a few powerful computers are connected and communicate with each other, the total computing power available can be enormous. Such a system generally costs tens of thousands of dollars. Figure2.depecits Architecture of the systems

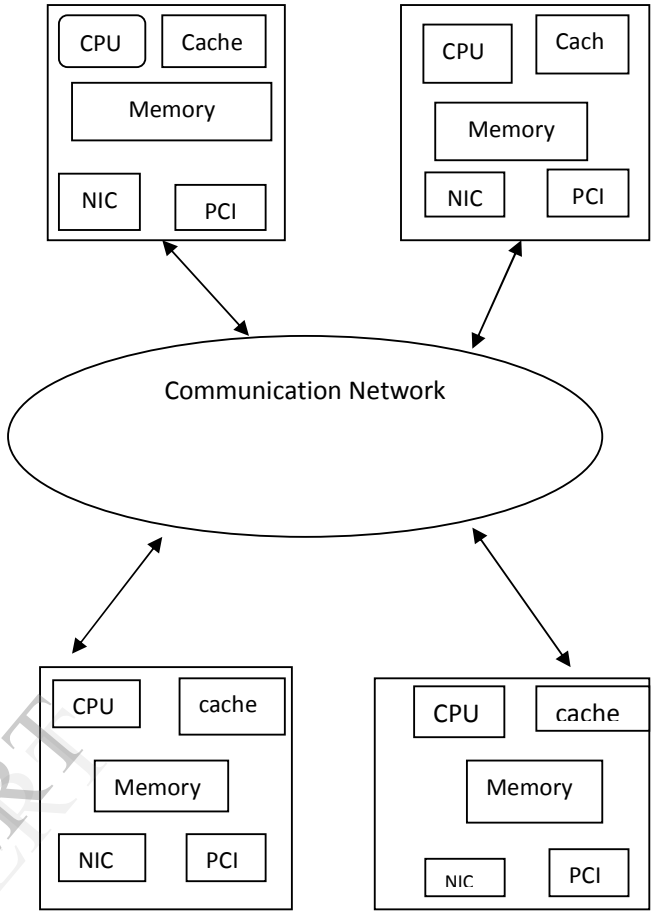


Figure 1.5 Architecture of the Distributed system.

III. Role of Data mining

Role of Data mining in Network Monitoring Data mining. Finding hidden information in a classified and clustered data is the main role of data mining. Classification Maps data into predefined groups or classes. Can be classified into three types

1. Supervised Learning
2. Pattern Recognition
3. Prediction

In the study classifying various networking issues and labeling the tuples, which helps to analyze and predict the problems which may happen in future. Various predefined networking issues are collected on the following issues

1. Server Crash
2. Network Congestion
3. Cable failure
4. Networking
5. Equipments fault

Using these predefined data a model is designed. Smart Agents acting on various servers will collect the data (which will act as test data) collected based on various parameters will be tested on model. Test data which satisfies the predefined set will be accordingly labeled. After classifying the data using appropriate queries smart agents can predict and forecast the issues that may happen in future. Based on the information apt decisions can be made to prevent drastic errors.

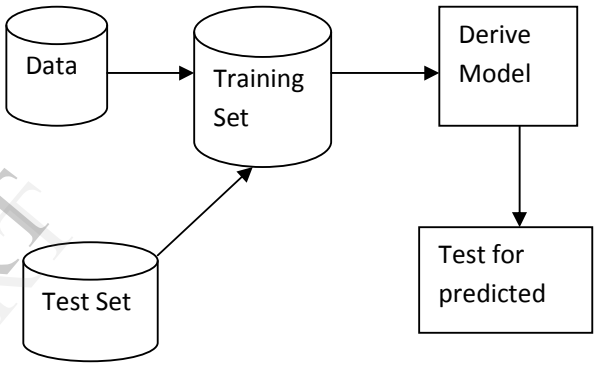


Fig 1.6 Model showing the role of Mining

Various models are in practice to perform classification, but in our study we are proposing decision tree model for classification.

Why decision tree used for classifying?

- Requires no domain knowledge.
- Can handle high dimensional
- The learning process is are simple and fast.
- Many applications use this
- algorithm for classification

- Rules can be generated which are easy to understand and interpret
- They can scale large database since tree size is independent of database size

Role of Decision Tree Based classification in the Proposed Model

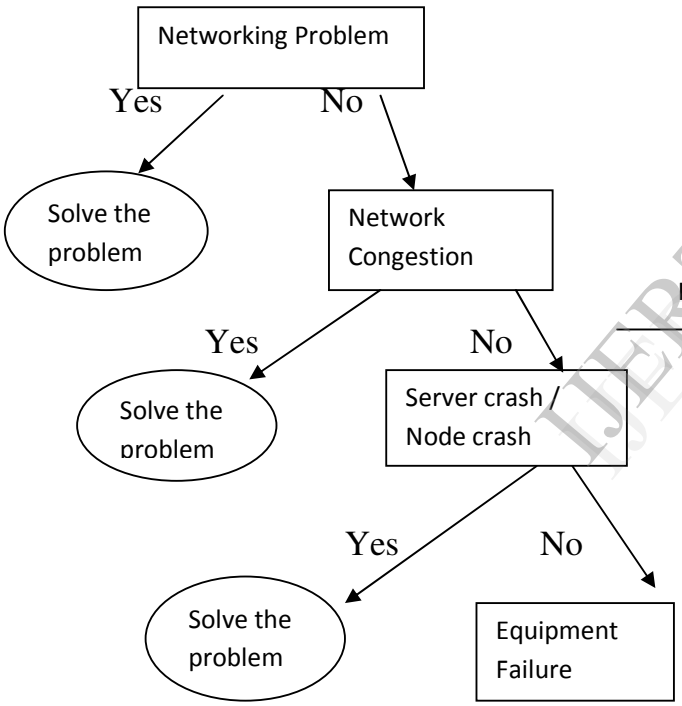


Fig 1.7 Decision Tree Based Classification Implemented in the Model

Proposed Simulated Model.

This model will have the combination features of Networking and Datamining techiniques. Networking model will focus on monitoring networking issues and Data mining techniques will concentrate on predicting and forecasting the problems that may occur. These smart agents will be distributed in servers.

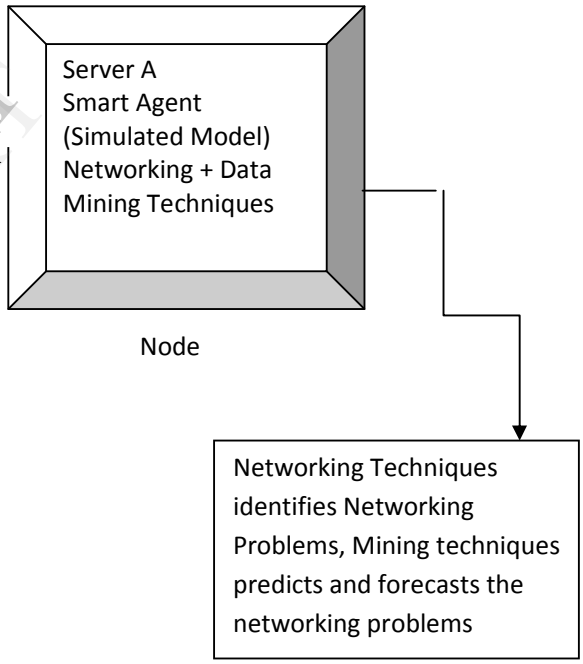


Fig 1.7 Proposed Model Showing how simulated model (Smart Agent) works for a single node

Simulated Model Algorithm

- Creation of Smart Agent.
- Initialize all the servers and deploy the smart agents
- Develop appropriate routing algorithm to identify the problems in the distributed environment.
- Develop suitable GUI to visualize the problems by the user.
- Develop an Mining algorithm to classify the problems**.**
- Based on the problems classified, adopt suitable visualization techniques to display the problems that may occur in future

IV. Conclusion

Thus the smart agents which are implemented in distributed servers will monitor the servers as well as the clients attached to it from networking failures and also helps in load balancing. Data mining concepts which are implemented in the proposal helps to analyze, predict and forecast the networking issues that may occur in future. Based on the outcomes that smart agents will intelligently take some actions to prevent the major issues**.** Development of suitable networking and datamining algorithms to implement the smart agent is our future plan**.**

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