Ensuring Better Service Assurance using Scalable Monitoring and Resource Management

G.K.Viju, Md. Jassim Mohammed Jassim

Abstract— ***In this project a scalable monitoring system was constructed for monitoring the network in both online and offline. The goal of this system is continuous monitoring of network status and its resources like host, router etc. in a scalable manner to ensure proper network operation. The monitoring system is scalable in terms of network size, speed and number of customers subscribed to value-added services. It provides measurements for network provisioning, dynamic resource allocation, route management and in-service verification of services.***

Keywords— ***IP, Monitoring, Traffic Engineering, Differentiated Services, Active/Passive Measurements, Scalability***

I. INTRODUCTION

Quality of service (QoS) monitoring is becoming crucial to Internet service providers (ISPs) for providing quantified QoS-based services and service assurance. In this project the performance requirements of a customer's requested service are described in a service level specification (SLS) [1], which is the technical part of a service level agreement (SLA) with the provider. In such a provider's network, QoS is supported in a scalable manner with the differentiated services where routers aggregate traffic that belongs to several service classes according to predefined QoS policies. QoS refers to the service offered where one or more performance parameters (i.e., throughput, delay, loss, delay variation) are quantified. As the network attempts to offer several different service types, such as real-time traffic, virtual private networks (VPNs), and best effort services, network and service monitoring are important for providing end-to-end QoS and service assurance.

In this, monitoring not only has the diagnostic role, but also becomes an important tool for supporting network operation and providing service auditing. Given the multitude of services with different performance requirements, measurement information needs to be collected at finer granularity than that of per ingress-egress node pairing, and the service type also needs to be taken into account. Therefore the design and implementation of scalable monitoring system should provide measurements for network provisioning, dynamic resource allocation, route management, and in-service verification of value-added services [2].

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The goal of monitoring system is not only to measure QoS metrics, but also provide information in order to guarantee the contracted services by means of tuning and controlling network resources. A monitoring system provides information for the following three categories of tasks:

1. Assist dynamic online Traffic Engineering (TE) in making provisioning decisions for optimizing the usage of network resources according to short to medium term changes. This information can be used to take appropriate actions on setting up new routes, modifying existing routes, performing load balancing and rerouting traffic
2. Assist offline TE in providing analyzed traffic and performance information for long term planning in order to optimize network usage and avoid undesirable conditions.
3. Verify whether the QoS performance guarantees committed to in SLSs are in fact being met. SLSs can differ depends on the type of services offered and different types of SLS have different QoS requirements which need processing of different type of information. It is required per service type for in-service verification of traffic and performance characteristics.

Monitoring can occur at different levels of abstraction. Measurements can be used to derive packet level, application level, user/customer level, traffic aggregate level, node level and network wide level information. There are two methods to perform low-level measurements in monitoring systems: active and passive measurements. Active measurements inject synthetic traffic into the network based on scheduled sampling in order to observe network performance. Active measurements tools require co-operation from both measurement endpoints. Passive measurements are mainly used to observe actual traffic patterns in the network but can also be used for network performance monitoring. Traffic monitoring requires continuous collection of data and monitoring of links at full load.

Scalability in QoS-enabled IP networks and their associated services has three aspects: size of network topology, number and granularity of classes of service supported, and number of subscribed customers. Network topologies are characterized by a number of parameters, such as number of nodes and links, degree of logical and physical connectivity and network diameter. A large number of subscribed customers subsequently require a large amount of information to be gathered for service monitoring and assurance, as in service verification of QoS performance guarantees are required for individual customers.

The scalability of a monitoring system is the ability of effectively deploying the system at the scale of a large network offering a number of services to a number of customers. The monitoring system is having a number of design features for a wide range of monitoring tasks that ensure a scalable solution for delivering the expected performance. The monitoring tasks include data collection, data aggregation and data analysis for providing feedback.

II. MATERIALS AND METHODOLOGY

The principles of the scalable monitoring system include the following:

1. Defining the QoS monitoring process granularity at the aggregated levels.
2. Dispersing the measurement data collection system at the node level.
3. Minimizing the information exchange by processing data close to the source.
4. The use of Hop-by-Hop instead of Edge-to-Edge measurements.

The scalable monitoring system is implemented by using the Simple Network Management Protocol (SNMP)[5]. SNMP is used to communicate management information between the network management stations and the agents in the network elements. It is an application layer protocol for exchanging management information between network devices. SNMP is an application layer protocol used for management of information between network devices. The major operations supported by SNMP are: GETREQUEST, GETNEXTREQUEST, SETREQUEST, TRAP and GETRESPONSE.

The SNMP protocol monitors the current status of the network by accessing the Management Information Base (MIB) of network resources like host, routers, switches, bridges etc. The MIB contains all network related information like interfaces, system information, IP information etc.

III. WORKING

The monitoring system has the following components: **Node monitor** which is responsible for node related measurements, **Network monitor** for network-wide post-processing of measurement data using statistical functions, **SLS monitor** for customer related service monitoring, auditing and reporting, **Monitoring repository** consisting of data store for storing large amounts of data and information store for storing smaller amount of configuration type information and **Monitoring GUI** is used to display measurement results.
The monitoring system works as follows and it consists of the following phases:
Configuration: Client that requires monitoring first registers to one/more of the monitoring components (Node, Network, or SLS). The client must request monitoring actions by providing the necessary information (metric to be monitored, sampling and summarization periods, thresholds, etc).
Execution: NodeMons perform the measurements based on the received configuration. Passive measurements may be performed using SNMP.
Reporting and exception: NodeMons send back the analyzed data and/or push the threshold crossing events to the interested monitoring clients. Network and SLS monitoring can provide both current and historical longer-term in-depth statistical analysis of monitoring data as requested by clients. System administrator may request the graphical display of any measurement data at node, network, and SLS levels.

IV. COMPARISON WITH EXISTING SYSTEM

The previous network monitoring system makes use of Traffic Engineering (TE) algorithm. Traffic Engineering (TE)[3] can be defined as a set of techniques to maximize network resource utilization. It deals mainly with performance optimization of operational IP networks and encompasses the application of principles to the measurement, characterization and control of traffic.
The existing TE method of monitoring has the following two drawbacks:

1. TE algorithms need typically an overview of the network status for their dynamic reactions.
2. TE is a continual and iterative process of network performance improvement. The optimization objectives may change over time as new requirements and policies are imposed.

So we are going for the proposed monitoring system which is generic enough to cope with such changes as well as it does not require knowledge of the history for taking actions. The proposed monitoring system is scalable as well as dynamic, which reflects the current state of the network based on real-time data.

V. CONCLUSION

When delivering QoS-based value-added IP services, careful engineering of the network and its traffic are essential for efficiency of resource usage while meeting the required performance targets. The presented system is distributed in order to guarantee quick response times and minimize necessary management traffic. The proposed monitoring system provides good accuracy for one-way delay and packet loss while it also provides highly comparable edge-to-edge and hop-by-hop results. The presented principles result in scalable monitoring systems that can contribute towards operationally optimized traffic-engineered networks that can support a large number of customers.

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Dr.G.K.Viju, Professor received his PhD (Software Engineering) in 2006, presently working with Karary University, Khartoum, Sudan. He published 6 books and a number of Research Papers in National & International Journals and Conferences. His Research interests are in Software Engineering, Digital Image Processing and Computer Networks

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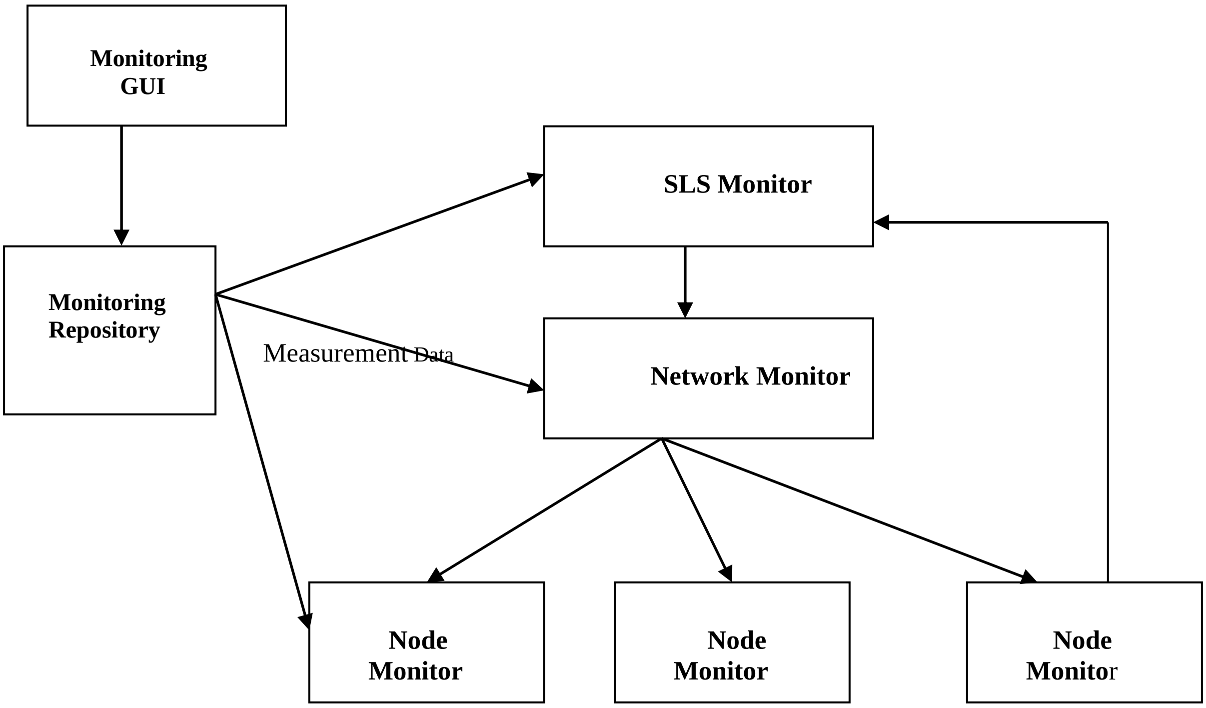

Figure-1 Architecture of Scalable Monitoring System

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