DEVELOPMENT OF A MONITORING AND MEASUREMENT PLATFORM FOR UKLIGHT HIGH-CAPACITY NETWORK

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Key words to describe the work: Traffic monitoring, Network simulation, Grid computing

Key Results: Implementation of a simulation platform for the UKLight high-speed academic research network to enable traffic modelling and measurement of traffic patterns on UKLight network

How does the work advance the state-of-the-art? Enables high-speed algorithms and web services/Grid services to analyse high-density traffic on 10 Gbps networks, this has just been made possible physically by introduction of 10G network cards by Endace®, a partner in the MASTS project.

Motivation (problems addressed): The project objectives have been to set-up and exploit a traffic monitoring system for the UKLIGHT international high capacity experimental network. The proposed system will record data flow and topological information at a range of time scales (from fractions of a second to years). It will make this information available to the community as a web service and management interfaces; and will develop advanced monitoring and analysis algorithms. This will enable network management and fault finding.

Introduction

The area of traffic measurement and monitoring has been neglected in the early days of network development and protocol analysis, with simple tools such as SNMP and TCPDUMP becoming increasingly insufficient to analyse high speed IP backbone networks. As a result there has been a serious lack of consistent and accurate monitoring platform at the core of important internet exchange points. Recently there have been projects in the e-science framework to enable data collection on core activities on such high speed networks such as the IPMON[1] project for the Sprint IP Backbone and the Grid-Probe[2] project as a scalable monitoring platform for the GRID. The MASTS project is a £1.2M EPSRC project to measure the evolution of the topology and traffic in and around the UKLight Network. UKLight is a national facility in UK to support projects working on developments towards 10Gbps optical networks and the applications that will use them.

The objectives of the MASTS project are:

- Develop and deploy Grid Probe technology on the network
- Develop 'back end' feature extraction and data compression
- Archive flow traces and statistics
- Provide real-time views on specific flows for other UKLight users
- Provide Grid Service based access to archive data[3]

System Architecture

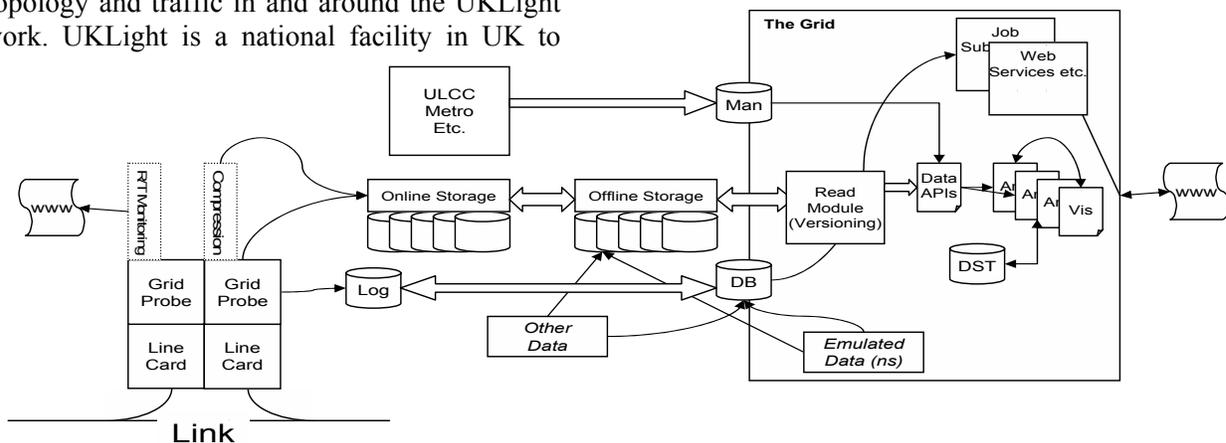Figure 1 displays the architecture of the monitoring and proposed analysis and web services platform.

Figure 1: Architecture of the MASTS monitoring, archiving and web services system

Grid Probes are located at each Point of Presence (PoP) and they capture the packets at full rate using high speed line cards. This will then be analysed using fast feature extraction algorithms, as opposed to pure packet and header dumping, to avoid extremely large file storage needs. The interesting information is analysed using a GRID of computers and presented in XML format to various web services interconnected to the monitoring platform. The authors' contribution to the project is mainly focused on research into fast data compression and feature extraction algorithms. However the physical synthesis of the Grid Probes is not complete at present and the need arises for a simulation platform to test the algorithms and network architecture.

Simulation platform and NS2

The analysis of the feature extraction and compression algorithms, alongside with traffic pattern monitoring, requires a configurable network which enables the user to set traffic models and data rates and the analysis results must be able to verify the behaviour of the network routers and traffic loss models. This brings the need for a simulation platform of UKLight network, which allows various configurations of the network traffic patterns. Various simulation tools were available, including J-Sim [4], Iperf [5] and Network Simulator 2 (NS2) [6] but none of them produce realistic packets due to complexity of the packet generation. As this project has emphasis on IP traffic, NS2 was chosen to model the UKLight network. The output trace file includes various routing information such as source and destination, protocol, timing and sequence numbers:

{- 1.4 0 1 tcp 40 ------- 1 0.0 1.1 0 0
  r 1.400042 0 1 tcp 40 ------- 1 0.0 1.1 0 0}

The output trace file can then be fed into TCL and C scripts in order to append various Ethernet headers and fields to it and then feed the results into the analysis algorithms. Figure 2 displays the architecture used in the simulation environment.
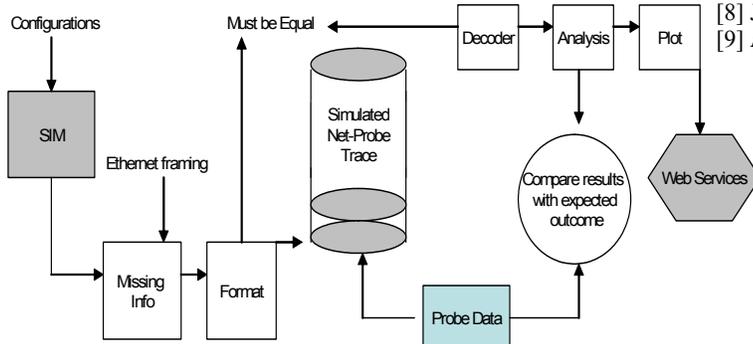
Web Services interface

The data generated by the simulation platform, as well as the real probe data, will be archived in a standard format and will be accessible through a number of Web Services.

The Web Services are specified in WSDL[7] and thus, other GRID applications will be able to invoke the services functionality, which will include querying facilities for trace retrieval and access to analysed data.

A web-based user interface is currently being developed to provide access to the simulation data, by invoking the Web Services functionality. The Java Servlet technology [8] and the Apache AXIS SOAP processing engine [9] are being used.

Summary and future work

In this paper we have looked at the architecture of a monitoring platform for high speed IP networks. This work is carried out as collaborative research project MASTS. The use of simulation platform allows set-up and modification of different scenarios of the UKLight network traffic pattern and the results should be able to verify the behaviour of the system. Once this is completed, the analysis platform is going to be ported to the real-time system, using a grid of computers to perform the algorithms on the collected data and web services will enable acquisition and broadcasting of interesting details for the wider research community using the UKLight facility

References
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[7] WSDL specification: www.w3.org/TR/wsdl
[8] Java Servlet technology: java.sun.com/products/servlet/
[9] Apache AXIS: ws.apache.org/axis/

Figure 2: Simulation protocol