

## NETWORK MONITORING FOR E-SCIENCE

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**Key words to describe the work:** Network Monitoring, Grid, e-Science, Network Metrics, Grid Publication

**Key Objectives:** The end-to-end provision of network monitoring and measurement between e-Science centres within the UK with the purpose of informing the Grid middleware, via publication, of network metrics as a part of their brokerage activities. Monitoring data will also be visualised and be available to end users, and the providers of the underlying network services.

**Motivation for the work (problems addressed):** Network performance monitoring and measuring provides two key inputs for the exploitation of Grid technologies and e-Science. Firstly it provides knowledge of network metrics for use by the Grid resource broker services and the Grid middleware, and secondly, it describes the network performance from the perspective of a Grid application which can be used to identify any strategic issues, e.g. bottlenecks, points of unreliability, Quality of Service needs, etc, which may arise and required action

### Introduction

The concepts and practice of network monitoring are well understood and are widely in use to identify problems, to quantify performance, and to set against expected levels of service. Network monitoring already addresses all level of network operation from basic connectivity to application throughput. It can for example provide a broad-brush sense of performance or look in detail at the behaviour and performance on TCP itself.

Monitoring for the Grid is different in intent and purpose. Grid monitoring deals with end-to-end performance. It is closely coupled with real Grid applications and may allow those application to vary their transport strategies for optimal performance by, for example, tuning TCP parameters, running multiple TCP streams, or by making use of QoS provision in the network. To achieve this end, the products of monitoring, the network metrics, are made available through publication to the Grid middleware. This same data can also easily be made available to the end user and to network service providers.

To that end, work has been funded to design and deploy a monitoring infrastructure within the e-Science community. This paper describes the vision of that architecture; a summary of the infrastructure, the tools and methods to be used; and the detail of progress made towards its completion. As a part of the presentation, a live demonstration of capability will be provided.

### A Network Monitoring Architecture for the Grid

The architectural design has as its objective a simple, and easily extensible framework within

which a variety of monitoring tools may be deployed. This architecture (Figure 1) permits the publication of network metrics to the Grid middleware, and makes them available, via visualisation, to the human observer.

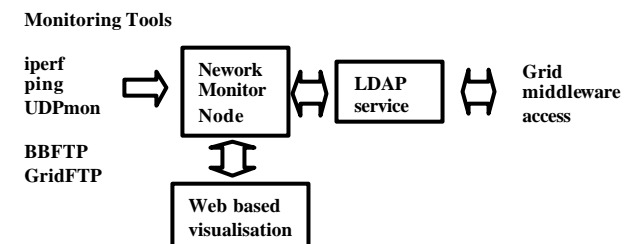


Figure 1 : Network Monitoring Architecture

Grid applications are able to access the network metrics via an LDAP service according to a defined LDAP schema. The LDAP service gathers and maintains the metric data via scripts that fetch or have pushed the current measurements from the local network monitoring data store. Independently a set of monitoring tools run to collect monitoring data. This describes, from the local perspective, the view of network access to other sites in the virtual organisation. In addition scripts are associated with the monitoring tool to provide Web based access for viewing and analysis of the raw data. This architecture allows additional monitoring tools to be easily added with the only requirements being the provision of the means for analysis and visualisation of the data; a means of transporting the data to the LDAP service and of including the products within the schema itself.

### Metrics, Measurements and Tools

The monitoring described here is concerned with an understanding of round trip time (RTT), packet loss,

