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GUEST EDITORIAL

IP Operations and Management

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The classical IP best-effort network technology is evolving into a ubiquitous all-service networking infrastructure through the introduction of quality of service (QoS) and traffic engineering. Networks providing a rich set of complex features and supporting a relevant rich set of services, such as Web access with guaranteed QoS, voice over IP (VoIP), real-time video, multi-media multi-party conferencing, etc., require careful planning, operations and management.

There has to be a paradigm shift in managing this new breed of IP network. In such a network, QoS support will be provided through Differentiated Services (DiffServ), with Multi-Protocol Label Switching (MPLS) been potentially deployed for traffic engineering. Both DiffServ and MPLS-enabled network elements need to be configured and monitored carefully, with end-to-end QoS path provisioning and monitoring becoming an important challenge. Service level agreements negotiated and customised through electronic interfaces will need to be automatically mapped to appropriate traffic engineering mechanisms, with QoS policy parameters set at various levels.

Provisioning and configuration needs to take place together with dynamic control and reconfiguration through feedback from monitoring mechanisms. With more sophisticated services being provided, accounting and billing based on state-of-the-art usage metering and pricing mechanisms will become necessary. Simple monitoring of network health, which is mostly the case today, will not be adequate for providing quality services to customers. Operators running a complex network require tools that can make *sense* out of large amounts of monitoring data. Sophisticated health monitoring and analysis tools should be able to *predict* impending faults by analysing and correlating traffic patterns. IP management systems should evolve out of passive remote (central) poll-oriented monitoring and management. A paradigm shift towards distributed, active network management should be an attainable goal. The articles in this issue touch on the above issues providing possible solutions.

The first paper by Jae-Young Kim et al presents a framework for managing edge-to-edge traffic in a DiffServ-enabled network. The proposed system uses MIB II and DiffServ instrumented traffic data, and relates that data with network topology information to deduce edge-to-edge DiffServ related traffic patterns, that is, monitor traffic along a Diffserv QoS path.

The second paper Stiller et al presents a pricing scheme for IP differentiated services and an associated generic accounting and charging system. The proposed Cumulus Pricing Scheme (CPS) is based on flat fees but with feedback regarding use of network resources. Such a scheme is potentially more efficient than a flat-rate one, but easier to understand and implement than fully-fledged usage-based pricing scheme.

The third article by Thottan et al proposes a traffic management system based on network fault modeling. It proposes in particular an algorithm for reliably predicting network fault condition. A hardware or performance fault manifests itself through a certain traffic pattern. As the pattern starts to show up, the impending fault condition can be predicted. This observation is made by monitoring persistent and correlated abrupt changes in traffic related MIB variables.

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The fourth article by Raz et al presents a distributed network management employing active network technology. In an active network a network element, such as router is programmable. The proposed system hosts an active engine with a router, where the engine interacts with router's data and control variables. Active packets carrying management code are diverted by a router's filtering engine to the active engine where the code is executed.

We hope that these articles will help readers to understand emerging issues and proposed solutions in this challenging new area. We also take this opportunity to thank the authors for their contributions and the reviewers for their valuable reviews that contributed through constructive comments to the quality of this issue.

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