Switched Networks:

Meeting the Management Challenge

A Technology Brief on SMON –

The LANNET Switch MONitoring Management Application

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A Madge Networks Company

Solving the Switch Management Riddle

Overview

The era of the shared media LAN is rapidly drawing to a close. As schools embrace an expanding list of bandwidth-hungry applications such as networked multimedia and voice/ data integration, network architects are struggling to accommodate their district's needs for performance and quality of service while maintaining investments in existing equipment.

On the backbone, recent evolutions in switching architectures are replacing older store-and-forward bridges and routers and offering extremely high-speed methods of interconnecting multiple network segrnents. New high-performance switches are simpler and more cost-effective than their predecessors and offer the on-demand bandwidth required to support today's complex applications.

As switching technology becomes mainstream, and as costs drop, LAN switches have expanded their market beyond the largest enterprise environments and are starting to become popular with small to mid-sized networks. Workgroup switches are handling bandwidth-intensive computing needs, such as graphics file transfers, in fractions of the time shared media LANs require to perform the same functions.

Switches also provide an ideal transitional technology between traditional Ethernet and Token Ring environments and the ATM-based networks of the near future. Most enterprise-class switches sold today will offer ATM modules and uplinks to ATM backbones, letting network architects deploy switches now without fear of short-term obsolescence.

In fact, there's essentially only one significant aspect of networking in which switches have thus far been deficient: Management.

The Switch Management Dilemma

Moving from shared media to switching means rethinking basic management issues. The very technology that makes switches so efficient also makes them inherently difficult to monitor and control. The old management model, used successfully for years by hubs, bridges and routers, doesn't work with switches.

Networking technologies remain a moving target as standards committees continue to evolve new variations on a theme. Districts today barely have the staff to handle existing conditions, to say nothing of adding new technologies to the mix or providing adequate training.

On the technical side, switching creates its own list of management challenges. Switching handles many times the volume of data carried by a shared media hub and it doesn't use a fixed information path. Instead, it creates temporary connections that can be dropped when the data reaches its destination. While efficiency is greatly increased, switched LANs make conventional monitoring methods obsolete.

In the shared media model, network managers can get information on an entire segment by installing a single RMON probe in a hub. But, putting a single RMON probe on a switch provides only an small piece of the total picture since a switch isolates traffic to specific segments rather than to a single shared segment. Alternatively, putting an RMON probe on each port is not only costly but also ineffective since, to make any sense of the captured data, network managers would need a management application capable of correlating statistics from all probes into a single compound analysis of the switch traffic. Even if such an application did currently exist it would be very difficult to tailor the analysis to provide more detailed operational information. Some networks have implemented a system of distributed protocol analyzers to capture and decode switch traffic. This is an extremely expensive method and doesn't necessarily do the job in all cases.

Various switch vendors have added to the problem by designing switching architectures that make management even more difficult. Some use a matrix switching architecture, in which traffic can take a number of different paths between ports. This eliminates any chance of selecting a single point at which to identify and correlate switch Statistics. Matrix switches also scale poorly, since a relatively small number of connected workstations can produce thousands of possible connection paths, all of which need to be monitored.

Other switches let a fast CPU handle the actual switching tasks. Sophisticated management tools tend to be somewhat CPU intensive. The management agents will actually borrow cycles from the same CPU that is intended to switch traffic at high speeds. The end result is that the process of monitoring the switch actually degrades switch performance, the exact variable that is so critical to the effectiveness of the switch itself. This is a classic example of the law of unintended consequences at work.

A more popular solution is the "port-mirroring" technique employed by a majority of switch vendors. Under this system, a user connects a packet analyzer or dedicated probe to the mirrored port and views specific segments. This approach is, however, quite limited because only traffic specific to the chosen segment can be monitored. The probe in this case is blind to all other traffic. This could mean that only part of one conversation (a multicast, for example) is viewed, or that most other conversations are missed entirely.

Scalability is also a problem as the number of ports increases. Since the analyzer or dedicated probe accesses only the bandwidth of a single port of the switch, this bandwidth quickly becomes inadequate as traffic from the rest of the switch is mirrored to this connection.

Obviously, with districts of all sizes demanding high network availability, proactive switch management and the ability to begin with a global view of switch traffic are absolute requirements. The management approaches described previously completely miss the global picture and, instead, start - and often end - at a very low level in the switch. To achieve optimum switch management objectives, a new model is needed to handle the unique challenges of managing switches.

SMON: A Practical Approach to Switch Management

Network managers have identified several core requirements for effective switch management. Management agents and probes must be able to see all traffic crossing the switch. They must monitor traffic without interfering and without adding administrative overhead. And they need to be cost-effective.

Further, the most efficient fault isolation and problem resolution model takes a "top down" approach. Network managers need both the big picture and the microscopic view of switch activity, using global statistics to zero in on the root cause of the problem.

To address these issues, LANNET has developed a set of switch management specifications, called SMON, that works in conjunction with LANNET's MultiNet line of switching hubs as well as the Visage line of workgroup switches. The SMON management suite complies with the Internet Engineering Task Force's RMON remote monitoring standard. Of RMON's nine basic functional groups, SMON currently supports four: Host Matrix, Host, Host TopN and Ethernet Statistics. All have been extended to accommodate switched traffic. LANNET will support additional RMON groups in future SMON releases.

SMON uses the strengths of the high-speed bus in each product line to aggregate and examine all switch traffic at a single management point. SMON monitors passively without affecting switch performance. And SMON is fully scalable as the switch expands to its capacity.

The SMON application integrates with LANNET's Montage network management system. The SMONMaster console also integrates with other SNMP-based enterprise management consoles, including IBM's NetView for AIX and HP OpenView (UNIX) from Hewlett-Packard.

SMON's top down approach gives network managers the detailed information and tools needed to perform both proactive and reactive switch management.

- At the highest level, SMON lets managers take the pulse of the network, looking for warning symptoms like an unequal division of traffic among virtual LANs or a high rate of broadcast traffic.

- Users can then drill down to the next level and look at individual conversations between specific stations, allowing managers to identify bottlenecks, look at error rates and analyze virtual LAN requirements.

- Moving farther down the management tree, administrators can use session monitoring data to determine traffic utilization and then use that information to plan for future growth.

- At the level of greatest detail, network managers can examine specific packets or groups of packets to get an in-depth look at the types of traffic moving between specific network nodes, find the top talkers or greatest error-generators and take appropriate steps to correct the problems - from partitioning the network to isolate high-bandwidth users to replacing a defective network interface card.

Such an approach begins with switch architecture. Matrix switches can't provide an overall view of network traffic and make problem isolation difficult. CPU switches require that management applications borrow CPU cycles, degrading performance. Only by deploying an architecture that allows a probe to collect data directly from the entire switch can network managers expect to manage all aspects of today's high-speed switches.

Managing ATM and the Cell-Based Switched Environments of the Future

The same model also holds true for other network infrastructures, most notably ATM. The speed and complexity increase greatly but the basic issues remain the same. Network managers still need a focal point at which to aggregate all information and, for optimal switch performance and quality of data, LANNET has linked that point to the core switch architecture. Network managers still need a top down model that offers a global view of overall statistics, as well as the flexibility to drill down to examine network traffic at the packet level. And network managers still need a tool set that lets them use data to make the best possible decisions about network growth, capacity planning and proactive problem resolution.

LANNET has extended SMON to its Collage 740 ATM backbone switch. This puts SMONMaster in the unique position of being the *only* product in the industry capable of giving Network Managers a real top-down insight into *both* their ATM (cell-based) and Ethernet (frame-based) switched networks. LANNET's SMON architecture offers a complete management environment for switch users today, while remaining flexible enough to adapt to the management requirements of the networks of the future.

Conclusion

Switch management is still in its infancy but, as switches grow in popularity with networks of all sizes, network administrators are looking for management products that offer proactive monitoring, error analysis, troubleshooting capabilities and diagnostic solutions to keep these vital infrastructure components running at peak efficiency. Most switch management implementations fail because the underlying switch architecture isn't built to support management

The combination of LANNET switching products (Meritage, LANswitch, Collage and Visage) and the SMON switch monitoring application points the way to an innovative, cost-effective switch management solution and offers a top down view for comprehensive switch traffic analysis and problem resolution. The SMON application spans the entire product line, from the workgroup to the backbone, to provide a single, consistent, end-to-end management approach for the entire network. LANNET's SMON architecture offers network administrators the management model they need to migrate to high-speed infrastructures based on new technologies.