Span/Mirror Ports and OptiView™ Analyzers

Background

Switching technology is everywhere. The price of switches has steadily dropped over the past few years, making switched links to the desktop a possibility for companies all over the world. Although switching provides considerable bandwidth to the end user, it makes troubleshooting and monitoring much more difficult, especially when using a protocol analyzer.

Switch Operation

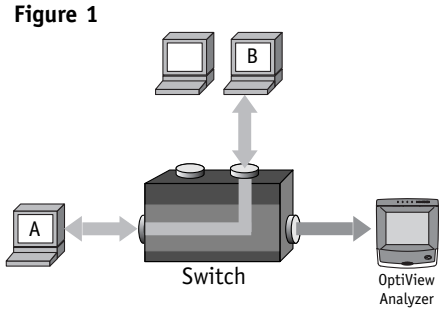
When a monitoring device is connected to a switch, the forwarding rules for that switch remain unchanged. After a switch learns the MAC address for a host attached to a port, it forwards traffic for this MAC address directly to the corresponding port. If the switch does not yet know the port on which this address resides, it will forward traffic to all ports. Broadcast frames are also forwarded to all ports. Because of these rules, a host that is attached to a particular switch port will only receive broadcast frames, unicast frames addressed to that host, and frames with a destination address that is currently unknown to the switch. The limited amount of traffic forwarded to a monitoring device would not be very useful. The monitoring device would not even see unicast traffic between two other hosts on adjacent ports of the same switch.

Switch Diagnostics

Most switch manufacturers recognized this issue, and built a diagnostic feature into their switches. This feature is known by several terms, including port spanning and port mirroring. It allows a port to be configured so every frame passing in either direction through a designated port or ports will be copied to the mirror port.

In **Figure 1,** the OptiView Analyzer is attached to a port configured to receive a duplicate of every frame sent to or from Host A. The conversation between Host A and B can now be captured by the OptiView Analyzer. The port the OptiView Analyzer is attached to is referred to as the mirror or span port. Both Host A and Host B are unaffected by the presence of a mirror or span port.

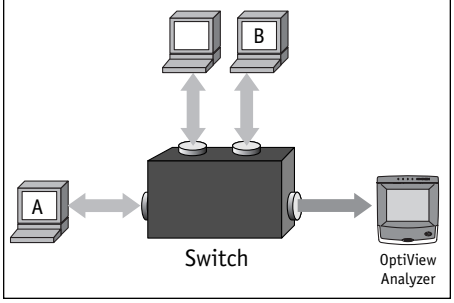
Figure 1



Limitations to Mirroring/Spanning

One major issue when using mirror or span ports with OptiView Analyzers is the inability to access the network from the mirror or span port. Depending on the switch vendor and configuration, this mirror or span port can be a receive-only, or a receive/transmit port. OptiView Analyzers may or may not be able to transmit back into the port.

Figure 2

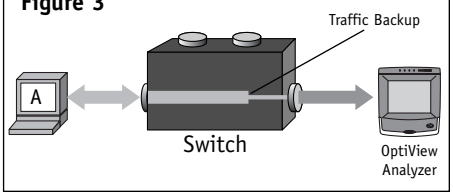


In **Figure 2,** the ports for Hosts A and B are set to mirror to the OptiView Analyzer. Information is copied to the OptiView Analyzer, but the Analyzer cannot transmit into the switch.

Network discovery relies largely upon queries transmitted onto the network. Since most mirrored or spanned ports don't allow a host to transmit frames onto a network, the OptiView Analyzer won't be able to discover and interrogate hosts on the network. Because the Analyzer will be unable to answer queries, the OptiView Remote User Interface will not initialize. A user might be able to transmit to the OptiView, but won't be able to get a response back from it.

Certain vendors permit configurations where frames may be transmitted back into a mirror/span port. The mirror/span functionality of the port remains the same, but instead of blocking traffic from entering the port, the switch will accept and forward these frames. This feature is not implemented on all switches. Depending on the switch and configuration, your results may vary.

Figure 3



Another issue to consider with mirroring is the speed of the mirror/span port. It needs to transmit fast enough to keep up with all traffic coming from the source port(s). For example, if Host A is on a heavily utilized 100 Mbps link, and the OptiView Analyzer is on a 10 Mbps link, the switch will not be able to keep up with the copied frames destined for the mirror port **(Figure 3)**.

Somewhat less obvious, if the mirrored/spanned traffic comes from a 100 Mbps full-duplex link, the aggregate amount of traffic can theoretically reach 200 Mbps. Since full-duplex allows traffic to flow simultaneously in both directions, it effectively doubles the available network bandwidth, each of the paths (the TX and RX connections) can carry 100 Mbps of traffic. If the aggregate amount of traffic exceeds 100 Mbps, the switch will drop all excess traffic going to the mirror/span port without providing any indication that traffic was dropped. All copied traffic must "fit" into a single 100 Mbps transmit path.

In situations where mirroring a port is used for troubleshooting slow links, it is important to remember the forwarding operation of the switch. Most switches perform store-and-forward switching at wire speed as a default state. This forwarding method performs full error checking on a frame before sending it on its way, so collisions and errors are not propagated onto other segments. Two low-latency forwarding techniques are also available, one of which only buffers a frame long enough to read the destination MAC address. This allows errors and collisions occurring after the destination address in the frame to be forwarded to other ports of the switch.

Under normal operation, traffic from the source port(s) will also be sent to the mirror/span port. If a segment is slow because of excessive collisions or errors, copying "all" traffic from that segment to a mirror port probably will not include these bad frames–unless the switch is using a low-latency forwarding technique and the error occurred after the forwarding decision was made. Some vendors no longer offer low-latency forwarding on their products, making it impossible to detect the collisions and errors with OptiView Analyzers without introducing a hub on the suspected segment.

When using a span/mirror function on a switch for testing and monitoring, it is important to know the actual forwarding technique being employed by the switch under test. This will differ from vendor to vendor, and at times they might not even know how the switch actually passes traffic. Mirroring is typically best for traffic analysis and frame capturing on a switch.

With switching to the desktop technology throughout the marketplace, it is important to remember the mirroring functionality built into most switches. When used properly, mirroring is a powerful feature for monitoring and troubleshooting a switched network.

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