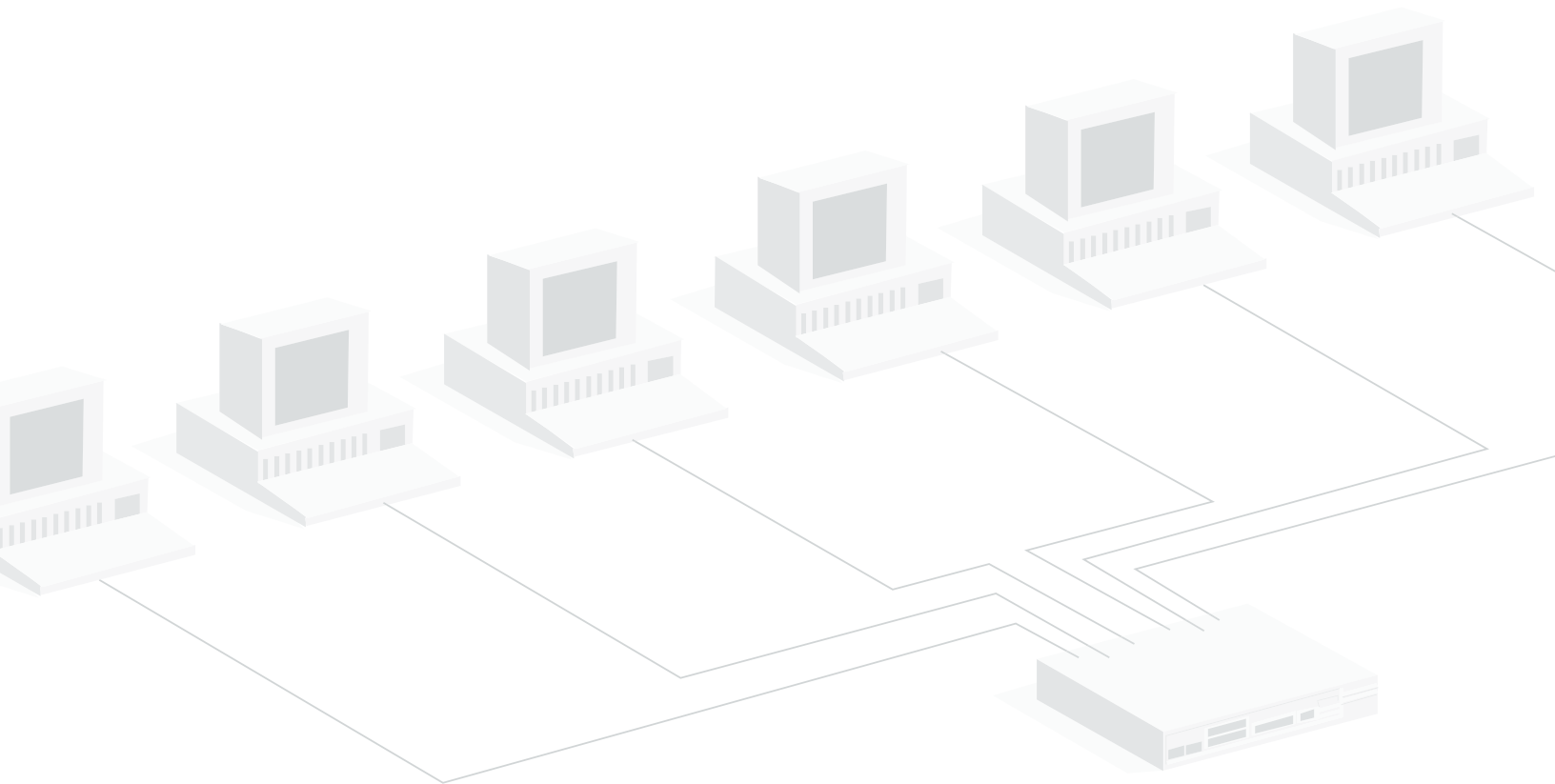


Benefits of WAN-Level Visibility in Monitoring and Maintaining your Network

A WAN Analyzer offers essential insight into your WAN links, including Service Level Agreement verification, WAN frame visibility, performance metrics and problem resolution abilities.

This white paper discusses the benefits gained from deploying a WAN Analyzer into your network and what items to consider when reviewing WAN analysis options.



Introduction

The effectiveness of monitoring Ethernet traffic passing through switches on corporate networks is well understood: without a network protocol analyzer to show you what is happening on your network, you will be blind when trying to solve LAN problems and security threats, and when attempting to enforce corporate network usage policies.

The need for Wide Area Network (WAN) visibility is less well understood. What justifies the additional hardware investment required to capture and analyze WAN traffic? If getting your money's worth from expensive WAN connections is important to you (and it should be), WAN-capable analysis tools offer essential insight into your WAN link that will be unavailable from a standard analyzer. By choosing a heterogeneous, integrated tool set that is able to monitor both WAN and LAN traffic in a distributed manner, you will be well-armed with the knowledge required to keep your network running efficiently now and in the future.

WAN analysis (in other words, capturing and decoding the WAN frames that encapsulate LAN packets passing between linked sites) not only allows you to troubleshoot the problems that can occur on the WAN circuit, it also tells you whether you are getting the availability and throughput you are paying for. When you confront your provider with service level issues, you will have hard evidence of what the problems are, which will make the service provider more likely to respond to your issues in a timely and effective manner. Not only that, a WAN-capable analyzer can tell you whether you are buying a higher level of service than you actually need or are using.

Service Level Agreement (SLA) Verification

High-bandwidth WAN connections are expensive, which is why customers have pushed for Service Level Agreements to precisely define the service obligations the provider must meet, including the financial incentives for the service provider to maintain its contractual obligations. But a Service Level Agreement by itself is not enough to guarantee you are getting the level of service you are paying for: Relying on your service provider for service metrics on WAN link availability, throughput and latency is equivalent to letting the fox guard the hens: It is not in the service provider's interest to inform you when their quality of service fails to meet their contractual obligations to your organization.

This is why you need an independent view of the WAN link connections that your business depends on. Determining link availability is usually not the issue; you do not need a monitoring tool to tell you when a link is down, as this will be immediately and obviously evident to your users. You need tools to measure performance compliance, because a comprehensive Service Level Agreement defines link throughput performance as well as availability. This is usually expressed as a Committed Information Rate (CIR). In addition, a comprehensive Service Level Agreement will also define an unacceptable level of dropped frames and other such performance metrics.

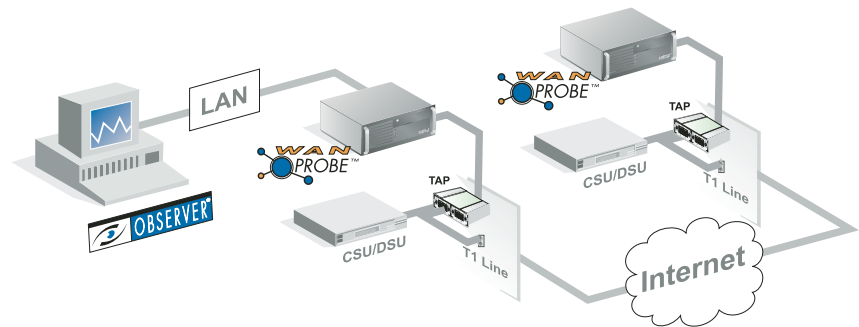
Enforcing Service Level Agreements has a related question that you should answer: Are you paying for a higher level of service than required? Again, WAN analysis can provide the answer. By comparing your actual usage to the CIR that you have paid to ensure, you can easily see if you are paying for service that is way beyond what is required. This will allow you to re-negotiate your link speed or Service Level Agreement to bring it more in line with your actual needs.

How a WAN-Capable Analyzer Works

The most cost effective way to perform WAN analysis while ensuring data integrity is with a Test Access Point (TAP). A TAP feeds a bit-for-bit copy of the WAN link traffic to an analyzer that can decode and analyze OSI layer 2 WAN frames. Because the TAP is passive the analyzer can be attached and detached from the network without interrupting the data flow.

Tapping the Source

The TAP is placed between the WAN line and the CSU/DSU and connected to a WAN-capable probe or dedicated analyzer. For centralized, multi-site management, the ideal solution is a distributed analyzer with WAN-capable probes deployed on each link:



The TAP is a passive device that does not interrupt the WAN signal between the WAN line and the CSU/DSU in any way. Electronics within the TAP copy the data stream, allowing both a “pass-through” link and an identical data stream for analysis. Even if TAP power fails, the pass-through signal is unaffected.

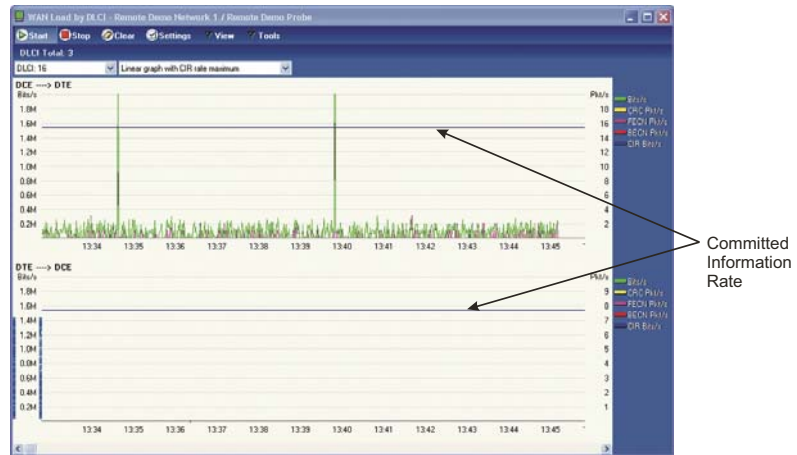
WAN-Specific Analysis

What measurements does a WAN-specific analyzer provide that are unavailable from a standard protocol analyzer? In addition to telling you what’s inside each WAN frame (i.e., the OSI layer 3 packets that a standard protocol analyzer shows you), it also decodes the layer 2 WAN frame itself, showing you the management fields within the frame header that keep track of link congestion in both directions of the link. It also senses transmission problems that could be caused by bad or improper cabling between the CSU/DSU and WAN line. Because the WAN router strips the WAN frame encapsulation data, a standard analyzer cannot detect these conditions.

Link Congestion

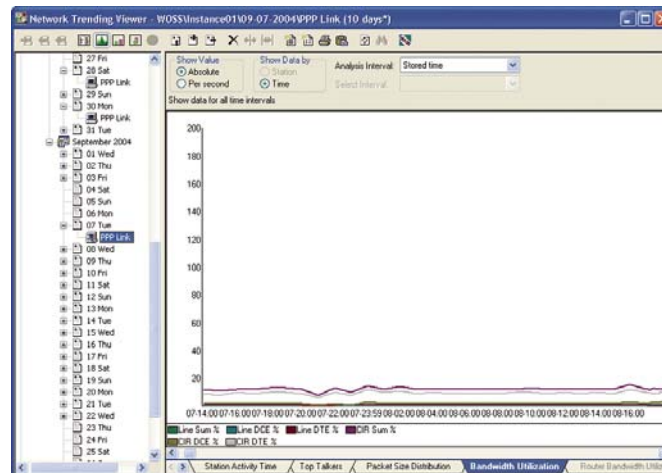
Some commonly deployed WAN networks (such as HDLC and Frame Relay) use an explicit notification scheme to manage congestion. If the header’s Forward Explicit Congestion Notification (FECN) bit is set, it means that the available network bandwidth (at that time) is not as great as can be supported by the destination terminal. Once a router receives a FECN, it will send a Backward Explicit Congestion Notification (BECN) to the routers upstream, informing them of the congestion. In any case, the root cause of FECNs and BECNs is often lack of available bandwidth.

Tracking FECNs and BECNs alone cannot tell you whether your service provider is failing to meet service obligations. The analyzer must also be able to show you the underlying traffic levels against which the congestion is occurring. If the link is generating many congestion notifications, and bandwidth usage levels are below the CIR, your service provider probably owes you an explanation (or, if your SLA specifies it, some monetary compensation). The following screen shot (from Network Instruments’ WAN Observer) shows FECNs and BECNs occurring well below the CIR, which is an indication that the service provider is not meeting its contractual obligations:



By tracking WAN bandwidth usage over time you can determine if you have purchased a higher level of service than you actually need. This data can afford your team the opportunity to renegotiate with your service provider to realize significant savings over time.

The following screen shot (from Network Instruments' Observer Network Trending) shows a network with bandwidth usage that stays well under one quarter of the CIR actually purchased. The vertical axis shows percentage of CIR bandwidth used, on a scale from 0% to 200%. The horizontal axis shows time (10 days of monitored traffic):



By renegotiating the Service Level Agreement for a lower CIR, the network administrator can bring significant cost savings to the company.

Transmission Errors

In addition to measuring the congestion indicated by FECNs and BECNs, a WAN-capable analyzer can measure WAN-specific transmission problems found in the physical layer. For example, a WAN Analyzer can identify Cyclical Redundancy Checksum (CRC) errors, Aborts and Residual Bit (Rbit) errors. These errors typically indicate a problem with hardware and/or cabling. Once you have either confirmed or eliminated these possibilities on your end of the link, you have hard evidence for your hardware vendor or service provider to further investigate the matter. A dedicated WAN analysis solution can pinpoint and isolate the issue so you can quickly resolve the problem.

WAN Visibility plus LAN Visibility Equals Total Control

What if your network is consistently utilized above the CIR? Do you need to buy a higher level of service? Not necessarily. Before you spend money on more bandwidth, you want to ensure that bandwidth is being used for legitimate business purposes. This is where having a comprehensive solution that analyzes both WAN and Ethernet LAN traffic can really add value. By looking at the Ethernet side, you will be able to eliminate the possibility that your WAN link is being clogged with traffic from file sharing networks such as Kazaa or virus-compromised systems that are being used as SPAM relay zombies.

Troubleshooting Multi-link WANs

WAN connectivity is becoming critical to business operations, and as a result many IT departments are deploying multi-link WAN connections to balance traffic load (through aggregated links) or to provide failover redundancy (through backup links). Ensuring the proper configuration and operation of multi-link WANs is another reason to invest in WAN analysis equipment.

What can go wrong with multi-link WAN connections? Well, quite a few things, because such links not only depend on equipment on the service provider's end, but on your routers or multiplexers as well. A WAN-capable analyzer will include configurable alarms that will trigger when service on any of the multiple links becomes marginal. This may be indicated by a large number of FECNs/BECNs appearing when usage is still within the parameters of the CIR you have set. Your WAN analyzer can proactively alert you to developing problems, allowing you to prevent poor service and downtime from affecting your business. And once again, an integrated tool set that covers both WAN and LAN sides of your network will help you eliminate any problems with your router or network configuration before you lodge complaints against the service provider.

Conclusion

A WAN-capable analyzer typically costs more than an Ethernet analyzer, but the additional expenditure is easily justifiable. As demonstrated by the examples in this article, a WAN-capable analyzer verifies that your service provider is meeting its link performance obligations. If the provider is failing to meet these obligations, the contractual refunds made possible by WAN analysis can recover the extra hardware and software investment in a matter of weeks to months. Making sure that you have purchased the appropriate level of service can give you an even faster return on investment.

Moreover, if you choose a WAN analyzer that is part of a heterogeneous, integrated toolset to monitor and analyze local LAN/Gigabit/WLAN traffic as well as WAN links, the benefits multiply. With a heterogeneous analyzer, you will be able to:

- Separate LAN problems from WAN problems
- Verify your service provider is fulfilling its contractual obligations
- Ensure the connections and cabling on your end of the link are error-free
- Determine if you have purchased the appropriate amount of bandwidth
- Monitor bandwidth usage and network congestion

By using such a toolset that allows distributed operation, you can accomplish this from a single desktop location. When purchasing WAN services, the ancient maxim of "caveat emptor" (buyer beware!) still applies. Only a WAN-capable analyzer allows you to monitor your WAN investment day in and day out.

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