White Paper

# Diagnosing the cause of poor application performance

*When it comes to troubleshooting application performance issues, there are two steps you can take to make diagnosis easier, faster and more accurate. First, understand the common causes of application performance problems; and, second, use the right tool to diagnose them. This paper will outline some of these causes and will explain why having the right diagnostic tool can enable network professionals to quickly identify and resolve a problem.*

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FLUKE networks

## Diagnosing the cause of poor application performance

As every network professional knows, users frequently complain about a slow network when it's often an application that's sluggish. It's difficult to determine the cause of poor application performance, however, because it can be caused by everything from bad code to over-worked servers to bandwidth that's not up to par. The time it takes to chase down the problem can be quite costly: employees are unable to work efficiently, business processes are bogged down, users are annoyed and even customers are negatively impacted.

Since poor application performance impacts user satisfaction and even business productivity, network professionals must deal with these issues rapidly and efficiently. The faster the root cause of a problem is identified, the faster it can be fixed…and damaging impacts on business mitigated.

When it comes to troubleshooting application performance issues, there are two steps you can take to make diagnosis easier, faster and more accurate. First, understand the common causes of application performance problems; and, second, use the right tool to diagnose them. This paper will outline some of these causes and will explain why having the right diagnostic tool can enable network professionals to quickly identify and resolve a problem.

> *"…40% of Packeteer/NWW survey respondents said that application performance degradation had either a high or very high impact on individual employment productivity…"*[1] *Mary Petrosky*
>
> "Understanding the true costs of application performance problems" Network World Special Report

## Understanding the common root causes of application problems

When a user claims the network is slow, the network professional must first determine if it really is the network or if an application is performing poorly. To determine the cause of a slowdown, the network professional first should understand four common root causes of application performance problems and how to resolve them.

| Problem | Common cause | Resolution |
|---|---|---|
| **Small packets**<br>Small packets are used to move large pieces of information | Poorly written applications that are requesting data in chunks that are simply too small | Provide information about application behavior to the developers; rewriting the code could speed performance. |
| **Latency**<br>Evenly spaced long delays between each packet | High latency links or devices in the line; for example, long distances or a device that adds latency | Determine if the latency can be removed from the line; examine LAN, WLAN and WAN response times. If not, look at a different application access strategy (remote access, application change, etc.). |
| **Inconsistent delay**<br>Inconsistent delays between packets but without re-transmission | Usually server or client slowdown | Determine the cause of the slowdown by examining client or server processes and resolve it. |
| **Re-transmission**<br>Many re-transmissions occur, either TCP or application layer | Packets are dropping somewhere in the stream | Determine where the packets are being dropped and fix the problem. |

## Other factors affecting application performance

The move towards web-based applications has driven many companies towards implementing server farms for their web based and client server applications.

There are many different server farm topologies that can be used but each one must take into account some level of server redundancy. For example, a five server cluster may be configured where two servers are acting as web servers and load balancers. These accept user queries and pass the requests to a third server on which the actual application is installed. Then, an additional two servers that may be database servers are mirrored for redundancy that accept requests from the application server.

Obviously, by breaking up the processing of the data, as well as the greater the number of application servers that are available, the faster the response time resulting in increased end user satisfaction.

However, when balancing applications across multiple servers, some type of load balancing process must be implemented. One common method is to use "Round Robin" Domain Name Services (DNS) as a load balancing technique which relies on a DNS server instead of a dedicated machine to route users to a specific server. One major drawback to this technique is that if a server at one of the addresses in the DNS list becomes unreachable and fails to respond, the DNS server will continue to hand out that address to the clients, who in turn will still attempt to reach the defective server resulting in what appears to be a slow application response. To combat this, some companies implement software load balancing which generally runs on the front end Web servers, or, to reduce the amount of processing required on those servers, hardware solutions which balance and direct traffic to the front end web servers.

These scenarios now make it essential for the network professional to know exactly how many, and which servers are involved in application transactions when attempting to diagnose the cause of reported application problems.

Because of this, one of the major challenges faced by IT organizations was the proliferation of servers, especially in client-server based applications where load balancing and multiple servers are common.

This server proliferation has driven demand for server consolidation which is often implemented using server virtualization. Server virtualization is generally implemented using a single or a few large physical servers, and running multiple "virtual" servers on those physical servers. While server virtualization reduces the number of physical servers required, it does not decrease the number of logical servers that are still needed to support the applications. Additionally, this increases complexity and it is still necessary to manage each virtual machine instance independently.

While it may be efficient to consolidate multiple applications on a single physical server, it also increases the risk of downtime because more of the corporations, critical applications will be running on fewer servers, a single outage will affect more applications and consequently, more users. Therefore, it is even more essential that server redundancy be considered during the design phase.

In addition, troubleshooting a virtual server system can be more challenging. In some cases, the data that is needed to troubleshoot the network does not even leave the physical server. To troubleshoot these cases, it is sometimes necessary to be able to move a single virtual server out of the physical server onto it's own machine. A portable analyzer can then be used to troubleshoot the application.

## Using the right diagnostic tool

The second step in isolating performance problems is using the right tool: one that's portable, integrated and comprehensive, meaning it provides insight into the entire network. A variety of alternative tools are available, from fixed enterprise monitoring and troubleshooting hardware and software, to free or low-cost open-source software you can run on a laptop. The difficulties of these tools include hardware that's mounted in a rack and not portable – more likely than not your problem will occur where you don't have a probe. Portability is important because you want to go where the problem is, the root cause of problems could be distributed across the network infrastructure, so you need to be close to the source to solve the issue effectively.

In addition, none of these alternative tools offers every capability needed to diagnose the problem, so several are required, each for a different purpose:

- SNMP polling tool
- Wire speed, hardware packet capture tool
- Protocol analyzer
- Traffic monitoring tool
- Host management utilities (telnet) tool

That means network engineers must learn how to use and interpret multiple tools. Then it's difficult and time-consuming to integrate all the information from the multiple tools for a comprehensive view of your enterprise network. There is also a cost associated with owning multiple tools that comes from training, the user's learning curve, maintenance and upgrade costs.

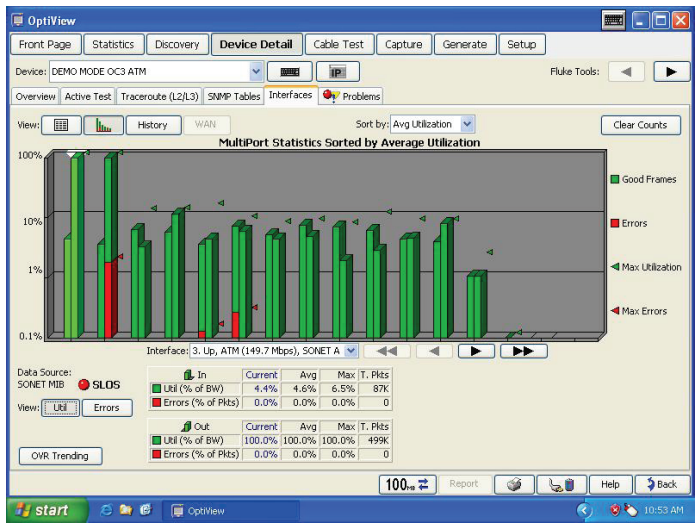
To really understand the advantages of a portable, integrated analysis tool for diagnosing the common causes of application slowdown, consider the following scenarios. In each case, a portable integrated network analyzer was used to first determine or eliminate the possibility that the slowdown was caused by a network problem, then to determine the actual cause of an application problem.

## Application slowdown hinders productivity

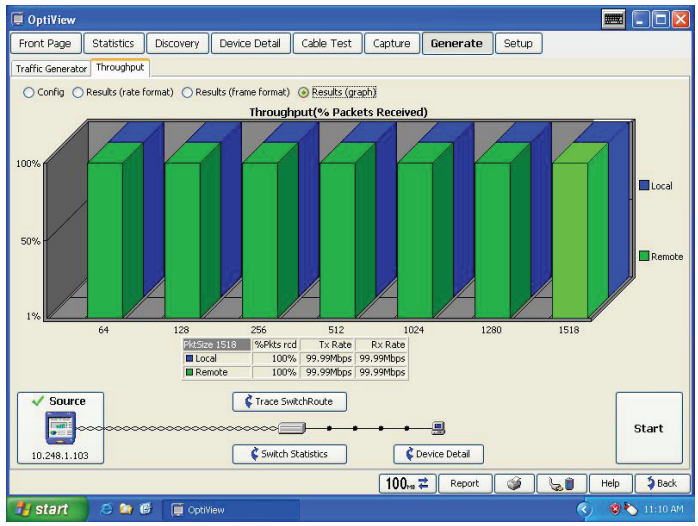
At an international sales call center, inside sales personnel were complaining about a slow application. The slowness was causing them to exceed their call-time metrics and resulting in unhappy customers frustrated by having to wait on the phone to get information.

The network engineer used the portable analyzer to quickly and easily find the root cause. First, he looked at the server/client connection path to determine if network latency was contributing to the problem. Ping/trace route, combined with active queries of all the routers and switches in the path, made sure there were no over-utilized switch ports or interface errors. He also looked at WAN bandwidth to determine if the WAN was oversubscribed, and to benchmark results for comparison in case the meaning of "slow" in this case was a subjective judgment, not an actual indication of network performance – providing proof that the problem was "not the network".

Having ruled out the network as the cause of the slow down, and since the sales application used a custom port, the engineer used the tool's protocol setup feature to validate, monitor, and capture traffic to determine the behavior of the application. Assisted by automated expert analysis, the engineer determined that the application was using small packets. The engineer sent the capture file to the application developers so they could use the data to rewrite the application and eliminate the problem.



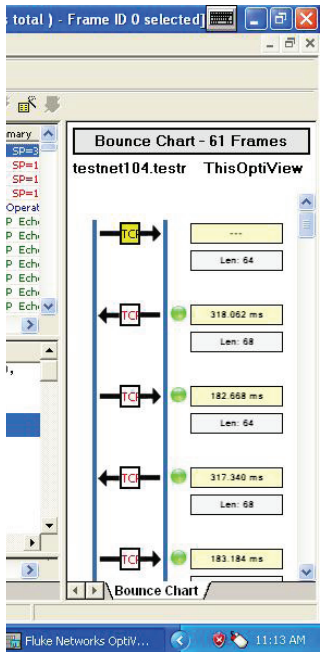

*WAN interface statistics*




*Throughput results*

## New accounting software performs poorly

Shortly after implementing new accounting software, management started to get complaints from users that it was much slower than the old application. With both application and web servers in the local server farm, it was simple to show that network issues were not the cause of the problem – but was the problem server related (which one?) or the application? To find out, the network engineers focused on the communication between servers, capturing transactions by mirroring the traffic to a laptop protocol analyzer. They quickly realized that their analysis was hampered by the laptop analyzer dropping a significant number of frames, consequently missing much of the traffic. Efforts to filter out extraneous traffic were stymied by not being able to isolate down to one particular client's session, as multiple sessions were occurring between the web and application server nearly simultaneously. As a result, any analysis they did on the capture file would be potentially flawed.




*Bounce chart*

Using a hardware-based portable analyzer with the ability to capture traffic at gigabit line-rate and trigger on specific user input text strings, the engineers were able to focus on the relevant transactions and capture the required data. After looking at the data capture in the analyzers' application bounce chart, they realized that between each request there was a significant delay from the application server while it processed a request.

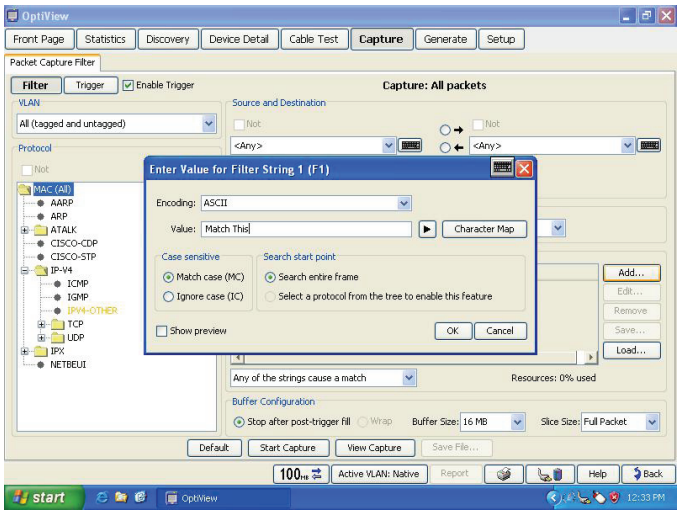
This information was passed on to the server group, who examined and tuned server processes to remove the delay. Then, the engineers used the tool to verify the problem had been resolved from the end-user perspective, meaning users were getting the application response time they expected.

## Software slow down hinders shipments

The shipping department of a manufacturing company complained that the ERP (enterprise resource planning) software used for entering and tracking shipments sometimes slowed way down at seemingly random times, generating a "waiting for server" error message when the problem occurred. As a business-critical application, it was essential that the problem be solved as quickly as possible, but the random nature of the error made it extremely difficult for the network engineer to be in the right spot at the right time to diagnose it.

To solve this, she used the tool's free string match mechanism to "turn on" and "turn off" the capture engine just when the problem occurred by setting the analyzer to trigger on the contents of the error message. This allowed her to capture the relevant traffic without having to be there when the problem occurred. By looking at the traffic captured, the engineer determined the cause of the problem: just prior to the slowdown, another user had submitted an improperly structured SQL query that locked the entire database.

The scenarios above illustrate how to use a portable analyzer to identify application problems that result in a slowdown. The scenarios also illustrate the importance of keeping networks and applications running smoothly, because poor performance impacts users and operations…and sometimes even customers.

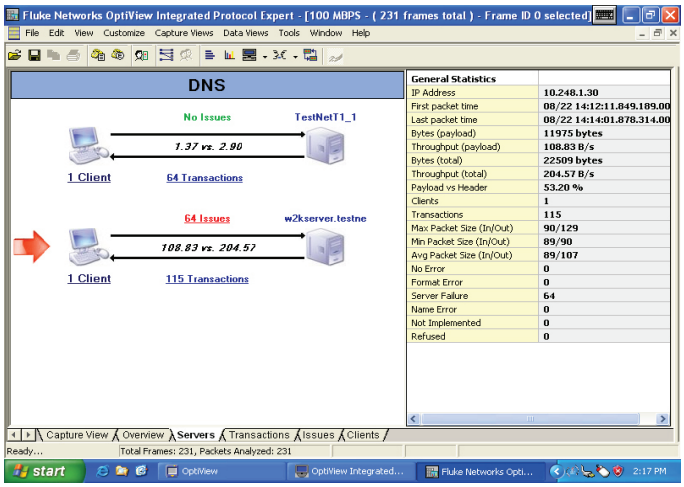



*Free String Match*

## DNS problems slow down manufacturing

A manufacturing company with multiple worldwide sites had recently consolidated all their servers at the headquarters data

center. Rather than use dedicated hardware or software load balancers, they decided to use "round robin" DNS load balancing. Users at a remote manufacturing site were complaining that the network was slow because it took a significant amount of time to access and download bar code label files which were required during the manufacturing process.



*IPE Servers*

The server group at the data center insisted that there were no problems with the application or database servers and the network team had already checked all the network infrastructure and WAN links for over utilization and errors. The network engineer decided to investigate the traffic to and from the application server cluster and in doing so noticed an unusually high level of UDP traffic which was predominantly attributed to the Domain (or DNS) protocol. Knowing that the server cluster used DNS load balancing both for application server as well as database server load balancing, she decided to check for correct operation of the DNS services. Using the portable analyzer, she ensures that the primary DNS server is correctly resolving some of the server names, but noticed that there are multiple DNS servers being queried, and that the time taken to resolve the names is relatively slow.

She then captured all packets containing the DNS protocol and quickly determines that in some cases, the primary DNS server provides a negative response to the application server request which subsequently, after a long timeout, makes additional requests to other DNS servers until the name is resolved thereby adding a significant amount of traffic and time which resulted in an apparent application slowdown. Reconfiguration of the primary DNS server solved the problem.

This scenario illustrates how to use the portable analyzer to identify what was perceived as an application performance problem but was caused by incorrectly configured network services.

## Solution: portable integrated analyzer

The OptiView Series III from Fluke Networks is an integrated, comprehensive network analyzer that combines multiple functions in one portable device, so network professionals can go directly to the source of a problem and analyze numerous possible causes with just one tool.

### Portable

Portability is important because engineers must go where the problem is, and networks are never fully instrumented. The root cause could be distributed across the network infrastructure, so troubleshooting must happen close to the source to solve the issue effectively. The OptiView analyzer is a portable, handheld tool that can go anywhere to isolate a problem.

### Integrated

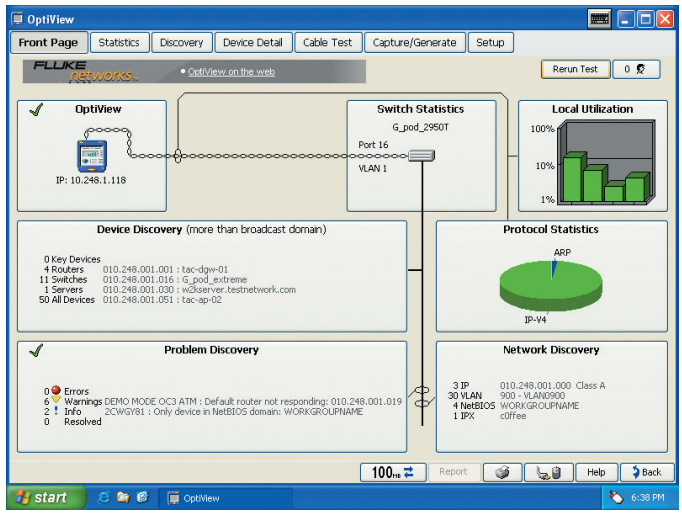
Once at the source of a problem, network professionals want answers. The OptiView analyzer offers all-in-one capability to conduct detailed troubleshooting. It integrates the results of multiple advanced network tests into one information-rich front page – including data from the devices already on the network with SNMP analysis, a unique capability for a portable network analyzer. In addition, it's the only integrated analyzer that combines network discovery,

traffic analysis, infrastructure analysis, advanced packet capture/decode, and 10/100/Gigabit copper, Gigabit fiber, 802.11 a/b/g WLAN, WAN, and VoIP capabilities into one portable tool.

### Enterprise-wide vision

The front page of the OptiView simultaneously displays the results of multiple advanced network functions, for an in-depth understanding of the network within seconds, gathering information at a glance without drilling down and using numerous tools. The tool enables troubleshooting and device discovery across the enterprise, and insight into every part of the network – including VLAN, WAN and WLAN segments.

To accomplish the same level of analysis without the OptiView would require several different tools. With the OptiView Series III, the capability of many tools is integrated into one portable, easy-to-use device. It's also complementary to other products already in use, offering the functionality they lack.




*OptiView Front Page*

*"Being able to avoid or quickly resolve application performance problems yields a variety of benefits, from increased employee productivity and higher customer satisfaction to avoiding the need for bandwidth, server and other resource upgrades." Mary Petrosky*

"Understanding the true costs of application performance problems," Network World Special Report

## Record metrics and share data

The OptiView Series III Integrated Network Analyzer can also be used to establish a benchmark for determining a user's definition of "slow," and to pass along data to the owner of an application problem to help resolution.

- Since slow means different things to different people, a network professional sometimes must answer the question: Is the network or application actually slow, or is the user just applying a different measure to it? After troubleshooting a problem the first time, the information gained can be used to baseline the application for the next call, making the measure applied much more accurate.
- Once a network professional has diagnosed the cause of an application problem, the granular data made available through OptiView can be used by other IT staff such as application developers, giving them a head start on resolution.

### The business case for a portable, integrated network analyzer

The OptiView Series III Integrated Network Analyzer helps network professionals manage IT projects, solve network problems and support IT initiatives, resulting in reduced IT costs and improved user satisfaction. It gives you a clear view of your entire enterprise – providing visibility into every piece of hardware, every application, and every connection on your network. No other portable tool offers this much vision and all-in-one capability to help you:

- **Deploy new technologies and applications**
- **Manage and validate infrastructure changes**
- **Solve network and application performance issues**
- **Secure network from internal threats**

It shows you where your network stands today and helps you accurately assess its readiness for the changes you need to make now and in the future. Leverage the power of OptiView to give you vision and control of your network.

## Summary

Using a portable, integrated network analyzer means faster diagnosis and resolution of application performance problems, before they have any further negative impact on user experience, productivity or customer satisfaction. Compared to other tools which are designed for specific functions and therefore limited in use, the Series III Integrated Network Analyzer is designed with the capability of multiple tools and the convenience of portability to help network professionals efficiently determine the cause of a slowdown, the first step to getting applications – and users – back up to speed.

To learn more about the benefits of the OptiView Series III Integrated Network Analyzer, visit **www.flukenetworks.com/optiview.**

1, 5 Mary Petrosky, "Understanding the true costs of application performance problems," Network World Special Report, 2004: p. 4.

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