FLUKE networks

White Paper

A New Paradigm for Network Problem Solving

It's a paradox. As more reliability is built into networks, organizations still spend substantial time troubleshooting and are pressured to reduce time to resolve problems. This white paper discusses state-of-the-art network problem solving and how a new approach—based on the Fluke Networks' OneTouch™ AT Network Assistant—can reduce troubleshooting time by one full week each month.

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Are Problems a Thing of the Past?

Every year, networks become more reliable. New standards promise interoperability, new devices simplify configuration and advanced monitoring solutions offer to detect problems before users are impacted. IT departments are entering an era where problems will be a thing of the past.

Or are they? A recent research study of over 300 network professionals in large - and medium - sized organizations found that:

- 48 percent of all organizations average longer than half a day to close trouble tickets
- 46 percent of all organizations are under pressure to reduce the time it takes to close trouble tickets
- Network professionals spend about 25 percent of their time solving problems

Why is this happening in light of so many IT advances designed to eliminate problems? One explanation is that for every reliability and simplicity advancement, there is an offsetting technology advancement that makes things more complex: unified communications, 802.11n, cloud computing or IPv6. Regardless of the reason, there is still much to be gained by improving problem-solving productivity.

To increase productivity, troubleshooting tools not only need to keep up with technology changes, but must continue to improve processes used to solve problems.

How Troubleshooting is Done Today

The vast majority (72 percent) of organizations do not follow a standardized troubleshooting process. Not only does this process vary within an organization but the tools used to troubleshoot problems vary substantially. Survey respondents reported using eight different types of tools to solve problems. In 47 percent of the situations, two or more tools were needed. With all the variability in troubleshooting practices and tools, it's not surprising that 63 percent of troubleshooting sessions lasted more than an hour.

There is a part of problem solving that is worth considering separately. In many cases, technicians can't resolve the problem themselves. Sometimes they need additional help with especially difficult problems. In other instances, it's because the problem lies outside their domain of responsibility, and they need to work with a separate group inside (server management or application developers) or outside (service providers or equipment vendors) the enterprise. This is far from a rarity—our research indicates that 41 percent of all issues require collaboration of this sort. This can take too long for at least two reasons. First, it's not always easy to give the responsible parties visibility to the problem when it's occurring. Second, the technician may not have the ability to easily capture the trace files that are often required (19 percent of the time) for these problems.

A Study of Problem-solving Techniques

This white paper refers to a Fluke Networks' research study of 315 network professionals in April 2012. The respondents came primarily from medium- to large-sized networks in a variety of industries. Most of them were top-level networking support staff.

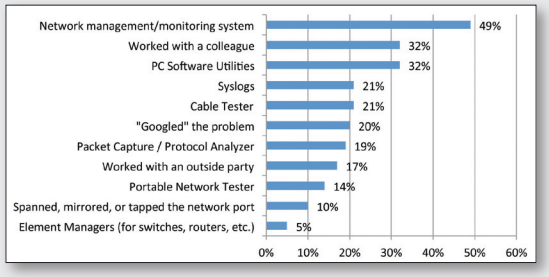


Figure 1. Which of these tools did you use to troubleshoot your most recent user problem?

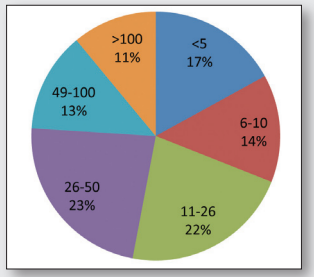


Figure 2. How many trouble tickets do you process in a typical month?

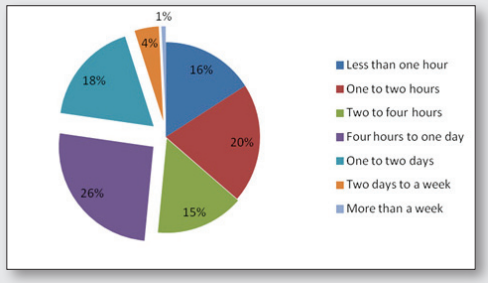


Figure 3. What is your group's average time to close a trouble ticket? Note that 48% report more than four hours.

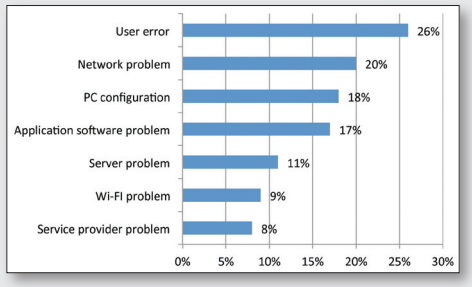


Figure 4. What was to root cause of the last user problem you solved? (Multiple responses allowed.)

The survey asked respondents to identify the root cause of their most recent user-reported problem (respondents could select more than one root cause). The most common cause was network problems (wired or Wi-Fi), occurring in 27 percent of instances. However, end-user configuration or operation problems combined were at fault in 42 percent of cases.

Changing the Problem-solving Paradigm

At Fluke Networks, we looked to shorten the entire problem-solving process. The process, as described earlier, traditionally consists of two steps—solo troubleshooting and collaboration when necessary. To streamline troubleshooting, Fluke Networks developed a three-step process and designed a new tool based on it. The three steps are:

1. Automated Testing
2. Troubleshooting
3. Collaboration

Fluke Networks' new solution, OneTouch™ AT Network Assistant, enhances each of the steps and greatly reduces the time to solve problems.

Step 1: Automated Testing

It may seem counterintuitive that adding a step reduces time. But if the additional step actually saves more time in subsequent steps, the total time is reduced. That's the idea behind automated testing.

The OneTouch AT identifies the most common network problems in about one minute[1]. It performs a thorough network analysis from the end-user's point-of-view. Such an analysis, performed manually, would take roughly one hour[2]. The OneTouch AT performs that same testing in about a minute (tests are configurable and can take anywhere from ten seconds to a few minutes, with most being less than a minute). Results are then compared against user-defined limits to provide a simple pass/fail result. This approach allows technicians to find the most common problems that result in end-user complaints.

There are several benefits to automated testing. First, it's much faster than a typical trial-and-error test. Second, it's more thorough than a manual approach, which means it can find problems that the technician may not have even considered. Third, it allows anyone, regardless of skill level, to run tests and identify problems.

Step 2: Troubleshooting

While the AutoTest uncovers a wide variety of problems on its own, not all problems can be found that way. The OneTouch AT provides a veritable arsenal of troubleshooting power to reduce the time spent in this phase.

AutoTest—even if the initial AutoTest does not identify the problem, all the measurement results are ready and available to help the technician understand what is happening. Further, the AutoTest can be modified in seconds and re-run to test a different server, application or wireless connection.

Wired Tests—a complete set of tests provide information on the cable, Power over Ethernet, the nearest switch and network services. The OneTouch AT features a web browser, Telnet and a SSH client to assist with configuration of network devices including switches and access points. It features a toner and can flash switch port lights to help locate unmarked cables in congested closets. A video probe can be connected to the OneTouch AT to inspect the endface of fiber optic connectors for contamination.

Wireless Tests—OneTouch AT provides more analysis of the Wi-Fi network than a library of wireless freeware and shareware tools, and provides answers in an easy to understand format. The OneTouch AT discovers all the networks, AP's and clients in range and quickly identifies problems such as improper security, interference, bandwidth hogs, overloaded channels, unauthorized devices and more.

Step 3: Collaboration

As noted earlier, network technicians regularly need to work with someone else to resolve problems. The process of getting the right information to the right people, however, can drag on for days. Even if the technician is able to work on other problems during this period, that's little comfort to an end user who can't get their job done or the IT manager missing targets for trouble ticket times.

[1] See appendix A, "An Hour of Troubleshooting in One Minute"

[2] See appendix B, "Problems That can be Discovered by the OneTouch AT Network Assistant AutoTest"

The OneTouch AT includes features specifically designed to expedite collaborative troubleshooting.

Reporting—a detailed report of everything that the OneTouch AT tested and observed can be created with a couple of screen touches. This allows the tech to show a colleague exactly what is happening when they are observing the problem. This report includes results a less-experienced technician might not have looked at but are there for more knowledgeable team members to evaluate.

In-line Packet Capture—a trace file is indispensable for very difficult problems or as evidence to an outside group such as application developers, service providers or equipment suppliers. Collecting this information typically requires reconfiguration of the switch or a network tap. This can take 30 minutes or more. Worse, many techs may not have access to switch provisioning or a tap. That means even more delay as the problem is escalated to another individual.

The OneTouch AT can perform an inline packet capture in just a few screen touches without the need to access the switch or a tap. This means the tech can capture the problem packets immediately while the user demonstrates the problem.

Web Remote Interface—while it's not always possible to get a colleague physically in the location of the problem, the OneTouch AT can be accessed and controlled through a remote device such as a PC, tablet or smartphone. Not only can the remote user see what the tech is seeing, but they can control the OneTouch AT and export trace files or reports to their device.

Camera—connect a webcam to the OneTouch AT USB port and the remote helper can see live video of the physical environment the tech is working in. This is useful if the tech is in a wiring closet or a data center and the remote colleague needs to see the switch or patch panel, for example.

Savings

The first step in estimating savings from the OneTouch AT is to look at the time saved in each of the three parts of the test.

Automated Testing—Table 1 compares the amount of time it would take to perform the AutoTest functions with the actual time of the AutoTest. The time is dependent on the skill of the technician as well as how many applications would need to be tested.

Troubleshooting—it's less straightforward to quantify these savings, as it is highly dependent on the actual problem and the skill of the technician. Users of other Fluke Networks' test equipment generally report 30 percent to 40 percent faster troubleshooting, but we will set that aside and consider it a "bonus" savings in addition to what is demonstrated here.

Collaboration—to quantify the time savings in these scenarios, we compared time to set up a packet capture using port mirroring (roughly 20 minutes) versus the inline packet capture with the OneTouch AT (three minutes). In instances where the technician does not have access to reconfigure the switch, the time savings would be much greater.

Better collaboration offers a bigger benefit by reducing the overall time to close trouble tickets. Without the OneTouch AT, it's often difficult to get all the relevant data in front of the appropriate people quickly. This is a significant cause of trouble tickets dragging on, sometimes for days. Armed with the OneTouch AT, the first responder easily generates a report or a trace file and shares these plus provides remote access for the rest of the team in real time. So while the total amount of time the staff spends on a problem may not be reduced, the time the end user spends waiting for a resolution is greatly reduced.

Again, such a benefit is hard to quantify—so we won't—but for many organizations this may be more valuable than actual hours saved for the department staff.

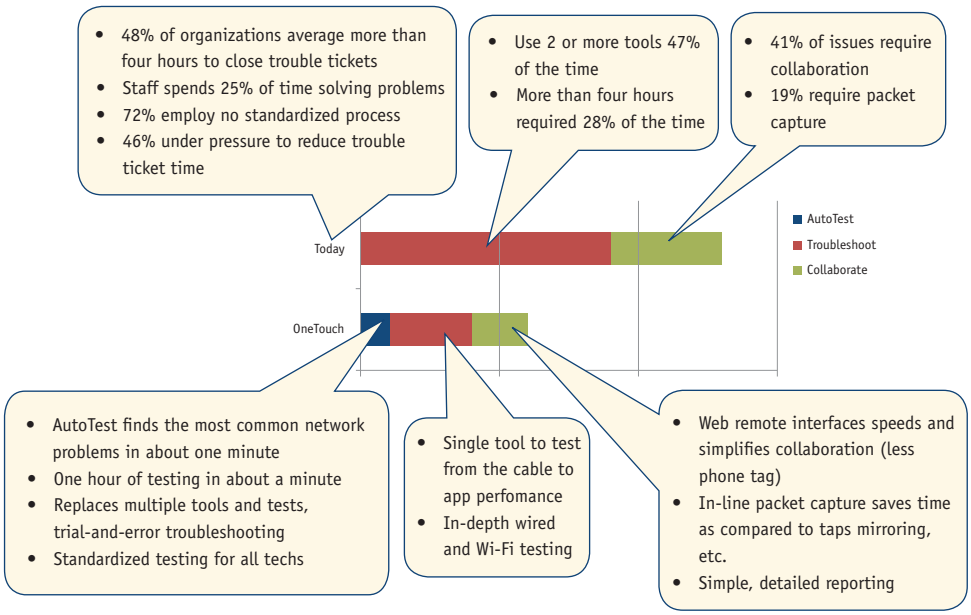
Conclusions

An estimation of the savings expected from using the OneTouch AT is presented in Table 1. Even ignoring the time saved in solo troubleshooting and purchase of the top of the line model, one would expect payback in less than six months.

AutoTest Savings		
Trouble tickets per month per tech	20	(median)
Minutes per ticket	90	
AutoTest time	1	minute
Time to manually perform autotest functions (from Table 1)	60	minutes
Time saved per ticket	59	minutes
Hours saved per month	19.7	per tech
Collaboration Savings		
Percentage requiring packet capture	19%	(average)
Number requiring packet capture	3.8	
Time for packet capture setup	20	minutes
Packet capture setup with OneTouch AT	3	minutes
Time saved per capture	17	minutes
Hours saved per month	1.1	per tech
Number of users	2	per OneTouch AT
Total time saved	41	hours per month
Dollar Savings		
Hourly rate	$60	
Total monthly savings	$2,489	
OneTouch AT cost	$10,000	
Payback	4.0	months

Table 1. An estimation of time and cost savings provided by the OneTouch AT

Figure 5 summarizes the concepts of this paper: the ways in which the OneTouch AT saves time throughout the entire problem-solving process as compared to traditional methods.



Appendix A – An Hour of Troubleshooting in One Minute

Getting to the root cause is critical but can involve extra steps. For example, when you go to the doctor's office, regardless of your complaint, you're first seen by a nurse who immediately measures your weight, temperature, blood pressure and often reviews your health history. This step not only saves the doctor's time, but often catches issues that might otherwise be overlooked.

This concept also applies to testing a network. Since your team doesn't usually include a nurse, the OneTouch AT automates a complete test of "network vital signs" into an AutoTest that compresses an hour of traditional testing into about a minute. The results are then compared against user-defined limits to provide a simple pass/fail result. This approach not only saves time, but allows technicians to solve more problems.

Testing Step	OneTouch Network Assistant (AutoTest)	Traditional Methods	
Basic Connectivity (Wired or Wi-Fi)	1 minute	Cable Tester, PC, Wi-Fi Utilities	5 minutes
Infrastructure Services		PC, Utilities	5 minutes
Wireless Operation and Performance		Two PC's, iPerf	10 minutes
Network Services and Application Performance		Packet Capture, Protocol Analyzer	40 minutes (three apps)

Table 2. The OneTouch AutoTest performs nearly an hour of manual testing in one minute

Basic Connectivity—OneTouch AT tests both wired and Wi-Fi connectivity. On the wired side, it checks the physical layer (including cabling and Power over Ethernet), identifies the switch port, speed and duplex settings and identifies the switch port and VLAN. For Wi-Fi, it verifies connectivity and security settings for the nearest AP and tests connection speeds.

Infrastructure Services—OneTouch AT tests availability and response time of DNS and DHCP across both the wired and wireless network.

Wireless Operation and Performance—the exclusive Veri-Fi™ test measures the actual wireless performance by sending a stream of traffic out the wireless port, through the nearest AP, the wired infrastructure and back to its wired port. The test runs simultaneously in the reverse direction with programmable upstream and downstream rates. The test provides measurement results for throughput, loss, latency and jitter in both directions. These latter two measurements are vital for quality performance of real time application such as streaming video or voice over Wi-Fi.

Network Services and Application Performance—these tests provide a detailed breakdown of application performance by analyzing an actual interaction with the server/service under test. Seven different tests/applications are supported and can be customized for specific sites or applications whether hosted locally or through cloud-based providers.

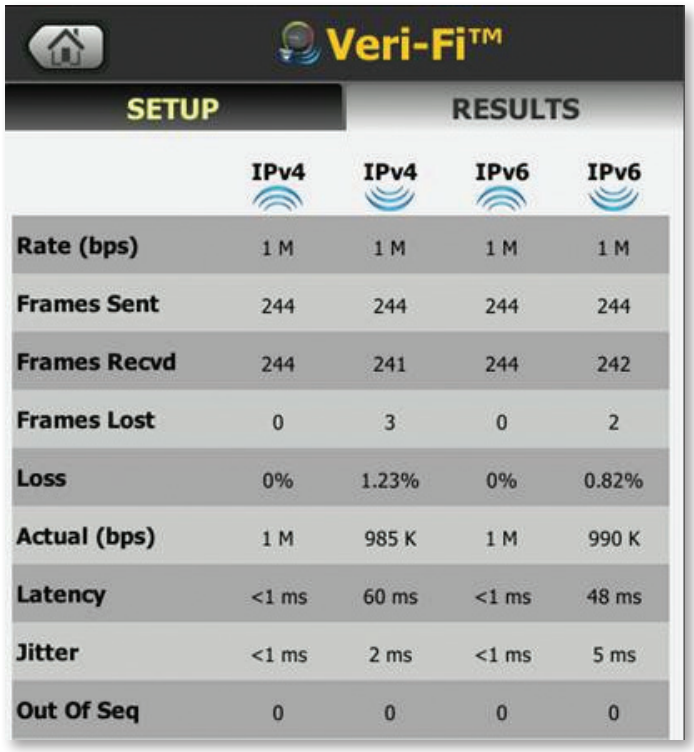
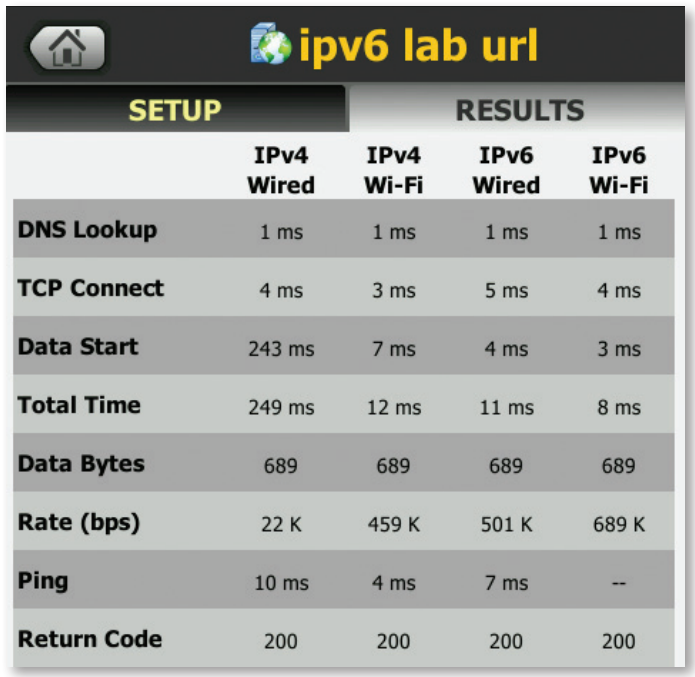


Figure 6: The Veri-Fi test measures performance of the wired and Wi-Fi network

The detailed breakdown provides the results shown in Figure 7 and shows the results for both the wired and Wi-Fi network side-by-side for easy comparison.

While the overall measurement can be used to quantify the performance of the application, the detail can be used to determine the cause of the slow performance, whether it's the network, application server, or the DNS server. While an expert can provide this level of analysis in ten or twenty minutes with a protocol analyzer (once they have a trace file), the OneTouch AT provides it under a minute as part of a standard AutoTest.



	IPv4 Wired	IPv4 Wi-Fi	IPv6 Wired	IPv6 Wi-Fi
DNS Lookup	1 ms	1 ms	1 ms	1 ms
TCP Connect	4 ms	3 ms	5 ms	4 ms
Data Start	243 ms	7 ms	4 ms	3 ms
Total Time	249 ms	12 ms	11 ms	8 ms
Data Bytes	689	689	689	689
Rate (bps)	22 K	459 K	501 K	689 K
Ping	10 ms	4 ms	7 ms	--
Return Code	200	200	200	200

Figure 7: The application performance tests provide a detailed breakdown of the response time of servers and services.

Appendix B: List of problems that can be discovered by the OneTouch AT Network Assistant AutoTest

1. Fiber problems
    a. Wrong SFP/vendor mismatch
    b. Dirty fiber endface*
    c. Dead port/broken fiber
    d. Low power
2. Twisted pair problems
    a. Open cable
    b. Bad cable mapping
    c. Shorted cables
    d. Mislabeled/undocumented cables*
    e. Too long cable
    f. Dead port
3. PoE
    a. Not present or disabled
    b. Switch unable to supply adequate power
    c. Wrong pins
    d. Low voltage
    e. Non-Ethernet voltage
    f. Low power under load
    g. Class 4 negotiation mismatch
4. Link
    a. Polarity mismatch
    b. Low link level
    c. Receive pair issues (MDIX)
    d. Speed mismatch
    e. Duplex mismatch
5. Switch port
    a. Incorrect switch
    b. Incorrect port
    c. Incorrect data VLAN*
    d. Incorrect voice VLAN*
    e. Unstable switch uptime*
    f. Switch congestion*
    g. Switch errors*
    h. FCS errors*
    i. Frame size errors*
    j. Other frame errors (7)*
    k. Excessive broadcast traffic*
    l. Excessive multicast traffic
6. Wi-Fi
    a. Security settings wrong
    b. AP missing
    c. AP misconfigured
    d. AP not connected
    e. WLAN controller problems*
    f. Excessive noise*
    g. AP congestion*
    h. Channel over utilized*
    i. Too many APs on channel*
    j. AP overlap on channels*
    k. Roaming problems*
    l. Unauthorized APs*
    m. Finding rogue APs*
    n. Ad hoc networks*
    o. Insufficient network coverage
    p. Slow connection
    q. Bandwidth hogs APs and client*
    r. Bad client NIC*
7. Veri-Fi
    a. QoS settings wrong*
    b. MTU problems*
    c. Port problems*
    d. Upstream bandwidth issues
    e. Downstream bandwidth issues
    f. IPv6 issues*
    g. Excessive loss
    h. Latency issues*
    i. Jitter issues*
    j. Sequencing issues*
8. DHCP
    a. Missing
    b. Slow
    c. Out of addresses
    d. Incorrect lease time
    e. Rogue DHCP server
    f. Wired versus Wi-Fi configuration problems
    g. Duplicate static IP address
    h. IP address hijacked
    i. Incorrect address delivery
    j. Incorrect subnet delivery
    k. Incorrect router address
    l. Incorrect DNS address
9. DNS
    a. Missing
    b. Slow
    c. No secondary server*
    d. Wired versus Wi-Fi configuration problems*
10. Gateway
    a. Missing / Failed
    b. Not IPv6 capable*
    c. Unstable gateway uptime*
    d. Overloaded*
    e. Bad traffic*
    f. Incorrect routing protocols*

*May require a secondary test after the AutoTest.

11. Discovery
    a. Wrong VLAN*
    b. Wrong subnet*
    c. Unexpected IPv4/IPv6 devices
12. Web (HTTP)
    a. DNS lookup failure
    b. DNS lookup slow
    c. Server unavailable
    d. Slow connectivity
    e. Server slow to start
    f. Server slow to complete
    g. Wired versus Wi-Fi transport problems
    h. IPv4 versus IPv6 transport problems
13. Ping (ICMP)
    a. DNS lookup failure
    b. DNS lookup slow
    c. Server unavailable
    d. Slow connectivity
    e. MTU misconfigurations
    f. Wired versus Wi-Fi transport problems
    g. IPv4 versus IPv6 transport problems
14. Connect (TCP)
    a. DNS lookup failure
    b. DNS lookup slow
    c. Server unavailable
    d. Slow connectivity
    e. Firewall misconfigured for ports
    f. Wired versus Wi-Fi transport problems
    g. IPv4 versus IPv6 transport problems
15. Multicast (IGMP)
    a. Server not multicasting
    b. Switch IGMP snooping disabled
    c. Incorrect port configuration
    d. Server authentication
16. File (FTP)
    a. Slow WAN
    b. DNS lookup failure
    c. DNS lookup slow
    d. Server unavailable
    e. Slow connectivity
    f. Server slow to start
    g. Server slow to complete
    h. Wired versus Wi-Fi transport problems
    i. IPv4 versus IPv6 transport problems
17. Video (RTSP)
    a. Slow WAN
    b. DNS lookup failure
    c. DNS lookup slow
    d. Server unavailable
    e. Slow connectivity
    f. Server slow to start
    g. Server slow to complete
    h. Wired versus Wi-Fi transport problems
    i. IPv4 versus IPv6 transport problems

*May require a secondary test after the AutoTest.

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