

Validate LAN installations for optimal service delivery

Network installers have completed a new local area network segment. New cabling was installed to the appropriate work areas from the equipment closets. New switches and access points were installed, patched into the cabling plant and configured. How will the network perform? This newly installed network needs to be validated to prove the installation was done correctly, that the LAN will operate trouble-free, and that users will be satisfied with the performance.

This white paper discusses LAN validation – what it is, who benefits from this practice and why it should be part of a network installer's and network owner's best practices. An overview of how to perform validation testing will also be covered.

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What is LAN validation?

LAN validation is an element of the LAN and WLAN installation and maintenance workflow, and it is the final task associated with installation and upgrade projects. A network installation or upgrade project consists of three broad tasks: measuring current performance (for upgrade projects), installing and configuring the LAN infrastructure, and validating success.

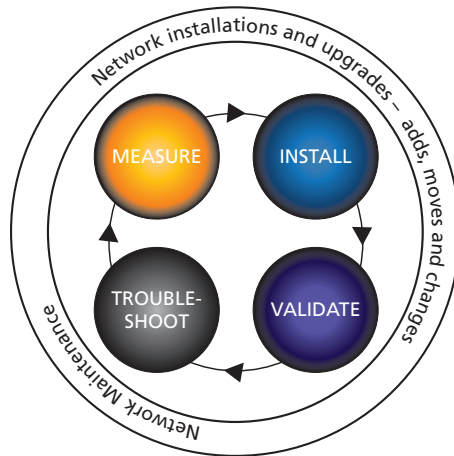


Figure 1

For upgrade projects where a network is already in place, measuring the current network's performance prior to the upgrade is useful for assessing whether the existing infrastructure can support a new technology rollout or the additional load of new users. It also serves as a pre-installation performance baseline for before-and-after analysis.

Installing and configuring the network infrastructure is typically the most time consuming task of an installation or upgrade project. It generally includes installing and terminating new data cabling between equipment closets and from closets to work areas. It includes installing new switches and access points, and using patch cables to connect these devices to the LAN cable plant. Next is the configuration of these devices to ensure correct Ethernet signaling, PoE delivery, subnet masking, VLAN membership, QoS traffic prioritization and more.

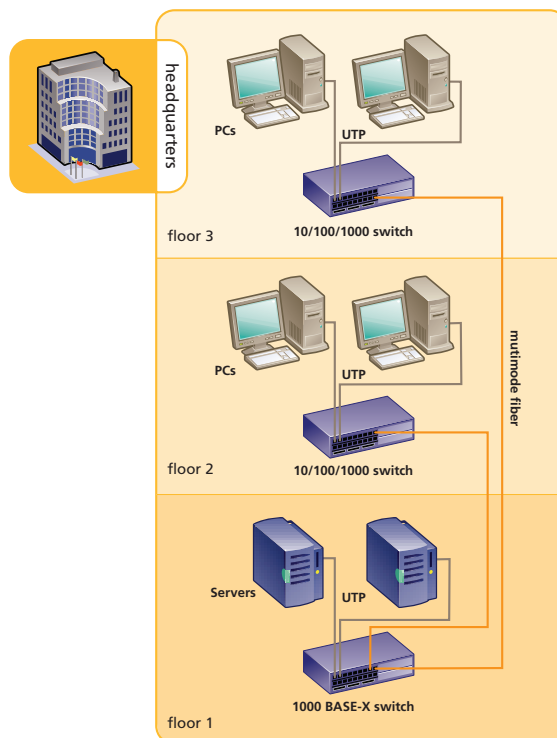
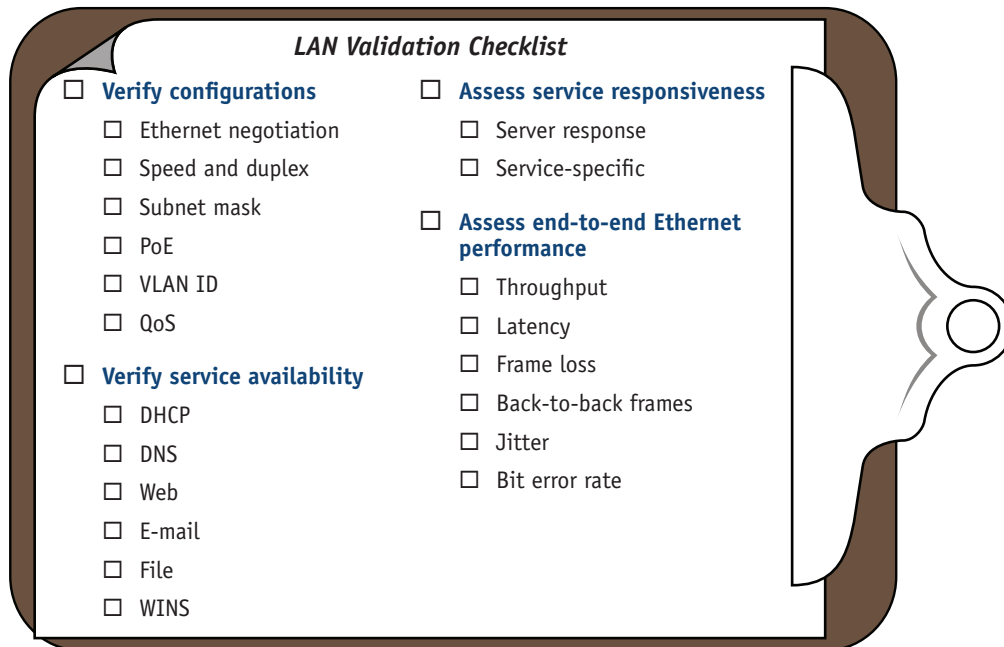


Figure 2

The final project task of the installation or upgrade is to validate the LAN. Validation is the process the network installer follows to demonstrate that all installation and configuration work is correct. The installer should verify several critical components of the network to ensure optimal operation:

- **Configurations:** test and verify speed and duplex, negotiation, subnet mask, PoE, VLAN ID, and QoS settings
- **Service availability:** test and verify access to key network services such as DHCP, DNS, web, email, file and WINS
- **Service responsiveness:** measure and assess the responsiveness of key network services
- **Ethernet performance:** measure and assess the end-to-end performance of important network links



LAN Validation Checklist

☐ Verify configurations	☐ Assess service responsiveness
☐ Ethernet negotiation	☐ Server response
☐ Speed and duplex	☐ Service-specific
☐ Subnet mask	
☐ PoE	☐ Assess end-to-end Ethernet performance
☐ VLAN ID	☐ Throughput
☐ QoS	☐ Latency
☐ Verify service availability	☐ Frame loss
☐ DHCP	☐ Back-to-back frames
☐ DNS	☐ Jitter
☐ Web	☐ Bit error rate
☐ E-mail	
☐ File	
☐ WINS	

Figure 3

To ensure optimal network operation, an installer validates a LAN by testing and measuring each of these critical components, demonstrating that each meets or exceeds design thresholds.

In the absence of an industry standard defining design thresholds, individual network installers and network owners need to establish their own pass/fail thresholds.

Who benefits from LAN validation

IT professionals engaged in designing, installing and maintaining LANs benefit from validation. These professionals include frontline installers directly employed by the network owner and frontline installers contracted by the network owner for a specific project. An owner may choose to contract installation to a third party IT service provider (system integrator, value added reseller, consultant) because of insufficient IT resources in-house or the lack of expertise a particular technology roll-out requires. In addition, network owners also benefit from LAN validation even if they do not perform the work personally.

Benefits of LAN validation

The value LAN validation brings to these IT professionals depends upon their roles and responsibilities. Frontline IT professionals directly employed by the network owners and assigned an installation or upgrade project will benefit in several ways. By providing confirmation of network quality, validation helps to reduce the anxiety that comes from uncertainty. Network validation provides the IT professional with the assurance that there will be fewer midnight phone calls. A smoothly running network will have fewer problems and generate fewer trouble tickets from unhappy users.

LAN validation provides additional value for system integrators and other IT service providers hired by network owners. A validated LAN exhibits fewer problems, resulting in fewer time-consuming and costly callbacks. Validation reports serve as proof of a project successfully completed per the clients instructions. Such documentation may be a contractual requirement. This documentation can also help clarify who is responsible for a reported network problem. For example, if a network owner thinks the cause of a current web access problem is due to a switch improperly configured during installation, the owner and service provider can review the validation documents to confirm this claim. Lastly, system integrators can use LAN validation as a way to differentiate their service from others, to show that their services are superior to those who do not validate their work.

Network owners, such as network engineers, LAN administrators or other IT managers, rely on validation to know that the network was correctly installed. If the network owner contracted the installation or upgrade to a third-party IT service provider (system integrator or VAR), the validation report demonstrates that the service provider successfully completed the installation or upgrade project and that the money paid to the service provider was money well spent. LAN validation is also an opportunity for network owners to establish best practices for LAN acceptance testing. They can rollout an agreed upon procedure to all their installers, both directly employed and third party, so everyone agrees on what constitutes the successful completion of a project. Standardized LAN validation methodology results in higher quality installations with fewer problems.

How to validate a LAN

Validation consists of testing and measuring those network aspects that are critical for acceptable network operation, and then analyzing each to determine if they pass or fail design thresholds. If all aspects pass, then the LAN is validated.

Verify configurations

The first step in LAN validation is to verify configurations by creating a configuration checklist with an understanding of what the configuration should be per the network design. Test each new network drop, comparing actual against the checklist. Pass/fail assessment is straightforward; either the configuration is correct (*pass*) or it is not (*fail*). The figure below is an example of a configuration checklist.

Configuration checklist		
Test	Design value	Pass/fail
Negotiation	Auto	✓
Speed	100 Mbps	✓
Duplex	Full	✓
Subnet mask	255.255.255.0	✓
PoE	N/A	✓
VLAN ID	1	✓
Overall assessment		Pass

Figure 4

Verify network services and measure responsiveness

Next, verify key service availability and measure responsiveness. Define which services are critical. For example, test DHCP, DNS and web services. Define pass/fail thresholds. Measuring the baseline responsiveness of known good services is useful for determining pass/fail thresholds. Switch and router manufacturers can provide performance specifications that can assist in establishing thresholds. The figure below is an example of a service availability and responsiveness checklist.

Service availability and responsiveness checklist			
Test	Design value	Actual value	Pass/fail
DHCP server response	< 100 ms	34 ms	✓
DNS server response	< 200 ms	82 ms	✓
Web server response	< 200 ms	83 ms	✓
Web server SYN/ACK	< 100 ms	78 ms	✓
Web server name lookup	< 100 ms	83 ms	✓
Web server first reply	< 100 ms	82 ms	✓
Web server receive	< 300 ms	261 ms	✓
Web server receive speed	> 10 kbs	49 kbs	✓
Overall assessment			Pass

Figure 5

Measure and assess Ethernet performance

Finally, measure and assess Ethernet performance. Define which criteria to measure. Typical criteria are throughput, frame loss, latency and jitter. Define pass/fail thresholds. A measurement of current baseline performance can aid in determining appropriate thresholds. Define which links to test. The figure below is an example of an Ethernet performance checklist.

Service availability and responsiveness checklist				
Link	Test	Design value	Actual value	Pass/fail
HQ datacenter to remote site 1	Throughput	> 128 kbps	128 kbps	✓
	Frame loss	100% of 128 kbps	100%	✓
	Latency	< 50 ms	29 ms	✓
	Back to back	2 s	2 s	✓
	Jitter	< 10 ms	1.9 ms	✓
	Bit error rate	< 1.0E-04	1.8E-06	✓
Overall assessment				Pass

Figure 6

Conclusion

LAN validation is the final task associated with a network installation or upgrade project. It consists of testing, measuring, and assessing those network installation aspects that are critical for acceptable LAN operation: infrastructure configuration, network service availability and responsiveness, and Ethernet performance. Network installers and network owners benefit from LAN validation. Validation provides assurance that the LAN will perform as designed; resulting in fewer trouble tickets, more satisfied users or clients, and less personal anxiety. By making LAN validation part of a network installation and upgrade best practice, installers and owners have an opportunity to define an agreed upon methodology for LAN acceptance testing.

LAN Validation Solution

The EtherScope™ Series II Network Assistant speeds and simplifies LAN validation. It assists with verification, measurement and assessment of infrastructure configurations, network services and end-to-end Ethernet performance.

The EtherScope analyzer features an RJ-45 port and supports fiber optic SFP transceivers for 10/100/1000BASE-T and 100/1000BASE-X configuration testing. Connect the handheld portable analyzer to the link under test and measure physical layer characteristics like length and wiremap. Observe connection details including TPC/IP settings, Ethernet signaling and 802.3af PoE voltages. Identify the nearest switch, slot and port. Monitor local traffic statistics including VLANs, protocols and top talkers.

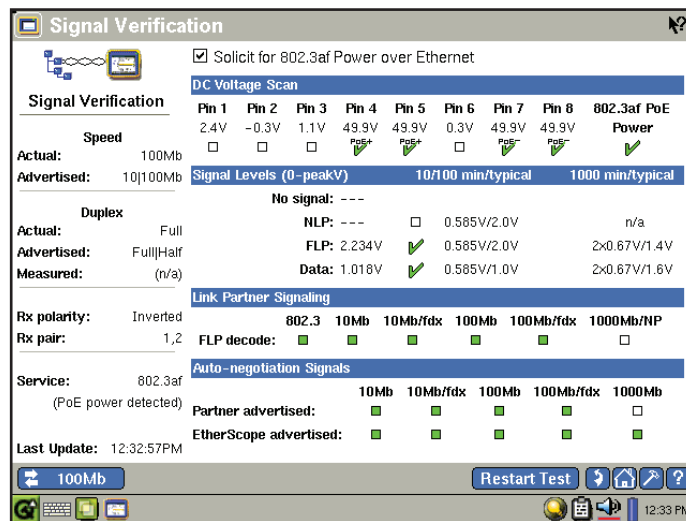


Figure 7

The EtherScope analyzer features the Service Performance Tool to verify the existence and measure the responsiveness of key network services. Add pass/fail thresholds for each service under test. Pass/fail assessment makes it easy for everyone to interpret the test results. Save the test configuration as a script for future testing or to share with team members. Configure the test and then click the start button to launch an automated series of service performance tests. View the results in tabular and graphical formats. Save the results for documentation and as an element of a LAN validation report.

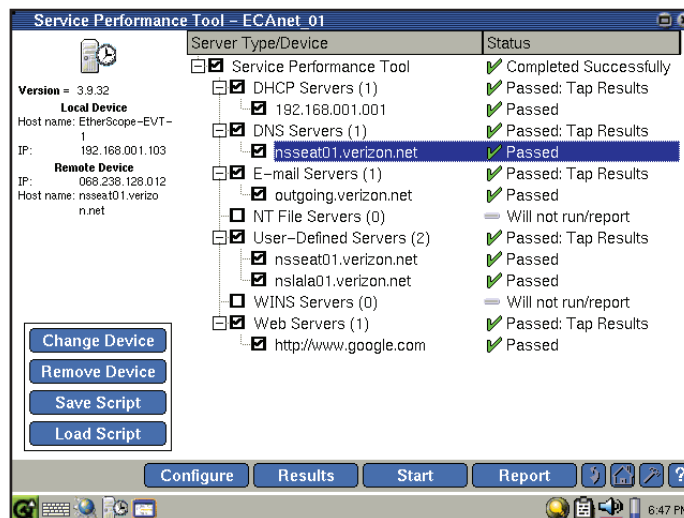


Figure 8

The EtherScope analyzer features Ethernet Performance tests for measurement of LAN and WAN links at rates up to 1 Gigabit. Select among four IETF RFC 2544 tests and two advanced tests to quantify end-to-end link performance. Add pass/fail thresholds for each test for simple results assessment. End-to-end tests require two test instruments, one at each end of the link under test. Using one EtherScope as the near end instrument, add another EtherScope or a LinkRunner Pro packet reflector at the far end. Add multiple far end devices at key points in your network and then run a network-wide assessment in a single automated test. View the results in tabular and graphical formats. Save the results for documentation and as an element of a LAN validation report.

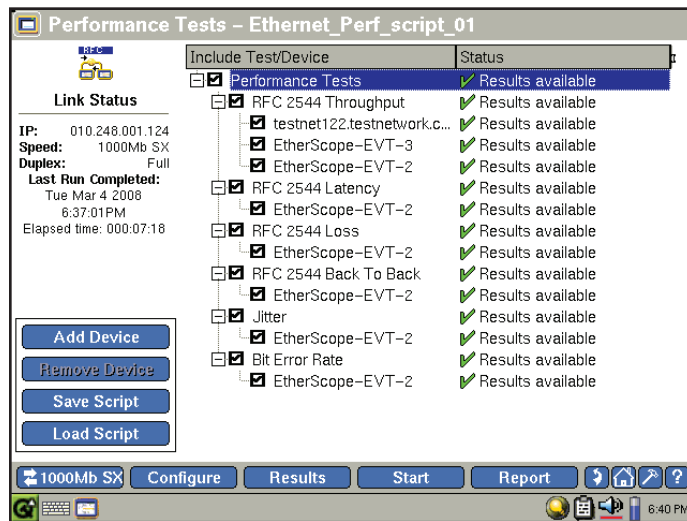


Figure 9

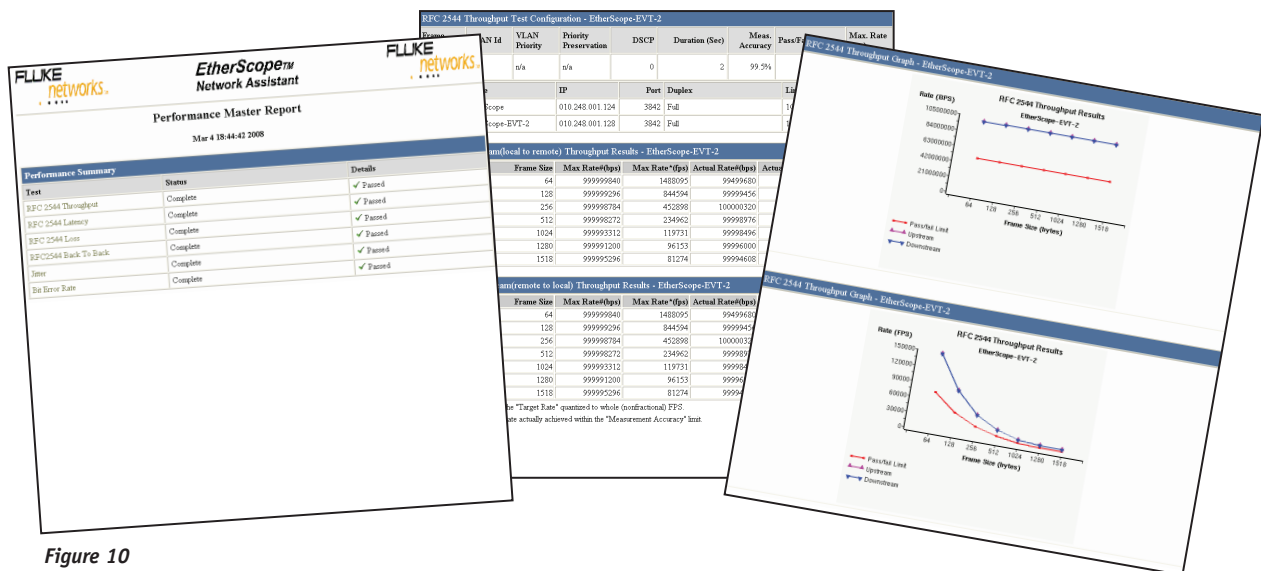


Figure 10

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