What to Look for in Selecting VDV Test Capabilities for Commercial and Residential Networks

Caroline Chen & Dan Payerle
IDEAL Industries, Inc.

The challenges of network testing are growing in a multi-dimensional fashion, with installers and maintenance staff having to deal with a widening range of physical cabling types and network services. Today's commercial and residential network environments present a variety of voice, data and video (VDV) communications requirements, which can stretch the capabilities of technical staff. In many cases, this means that both contract installers and internal IT staff need to expand beyond their traditional knowledge base to test and troubleshoot other services that they may not be as familiar with. With the proliferation of multimedia networks in residential and small business situations, many end users also are looking for cost-effective and easy to use devices that enable them to do their own first-level testing.

In addition to handling passive cabling of various types, users frequently need testing tools that can help them navigate, test and maintain "active" networks. Here again, the test devices need to be simple to operate, guiding the user through easy to understand testing procedures, and also need to be "fail-safe" to protect both the tester and the network from incorrect connections or usage.

The Growing Importance of VDV Testing

Current market research indicates that by the end of 2004, over 48 percent of all new homes will be pre-wired with structured wiring solutions. The market demand for such home wiring has grown by more than a factor of 10 during the past decade to support both new residential construction and retrofit requirements. The growth in residential wiring is also being driven by the tremendous growth in wireless networking, where smart home structured wiring provides a natural complement to flexibly position broadband access points as well as distributing video, data and voice services. The increasing interest in Voice over IP (VoIP) is also fueling the demand for residential structured wiring installations.

Increasingly sophisticated consumers and homeowners want to be able to move into their new homes and immediately take advantage of hassle-free services for voice, data, video, high-fidelity entertainment, integrated security systems, and HVAC control capabilities. They want integrated control over everything on the home network at their fingertips, as well as being able to remotely control all functions when they are away from home.

In addition to the dramatic growth in new residential requirements for VDV testing and structured wiring, the industry is seeing a similar evolution of commercial requirements, moving from the conventional deployment of separate voice and data networks to a convergence of voice, data and video. This convergence is being driven by the need to

simplify network maintenance and lower costs as well as new business-oriented applications such as integrated VoIP, security and bio-metric applications.

Today's and tomorrow's VDV installations also may use a variety of cabling types to deliver the specified services. For example, a single residential installation may include coaxial cable, structured cable, phone wiring, and possibly power-line carrier functions. Similarly, although commercial installations will continue to predominately use structured wiring for data traffic, a significant percentage of installations also use coax for closed circuit security as well as various legacy phone wiring modes for delivering POTS, PBX, ISDN, etc.

For installers, network maintenance staff and end-users in both residential and commercial environments, the above trends mean a greater demand for handheld instrumentation that can handle the whole spectrum of voice, data and video testing and troubleshooting requirements.

These handheld testers can come with a variety of different features and capabilities that allow them to be tailored to specific requirements and situations. As described in the following sections, they can range from simple low-cost, all-purpose testers to more sophisticated certification devices, both for use in passive networks, to handheld diagnostic testers for use in active networks.

Simple All-purpose Handhelds for Passive Networks

The first level of testers designed for simple operation but with the ability to test a variety of voice, data and video cabling in a passive network mode; that is before any active components such as routers are installed. These types of handheld test devices should provide easy-to-use push-button operation and simple-to-read displays that can be used and understood by relatively unsophisticated users, such as homeowners, but also provide the core set of features and the robust operation needed by more demanding users, such as residential cabling installers.

Key measurements that should be included even in the most basic testers are wiremap, length testing and the ability to detect opens, shorts and splits. Wiremap can be very effective for identifying the 80 percent of wiring problems that typically can be traced back to poor terminations. Length testing is another key feature that helps in spotting common problems. For instance, length tests that show a significantly different result for only one out of the four pairs on a cabling run can quickly point to problems such as a broken pair.

To allow for flexible testing across a variety of media types without juggling different add-on components, these testers should have built-in interfaces for multiple cables, including RJ45 (data), RJ11/12 (voice) and coaxial (video/data). In addition, to allow for easy one-person operation, the testers should include remote units that support all of the same cabling interfaces.

Picture 1: VDV MultiMedia Cable Testing

Ideally, this type of tester should be so simple to operate that virtually any use could pick it up, turn it on and begin useful testing without having to spend time in training or reading a complex manual. A good example of the all-purpose tester is the VDV MultiMedia Cable Tester, which gives users a single device that combines physical interfaces to support a full range of voice, data or video connections, with flexible "instant-on" testing that can be activated via a single button push for each type of media. Selecting between any of three buttons ("Voice", "Data" or "Video") on the face of the unit immediately puts the tester into the proper mode and sets it up for the correct continuity.

This tester supports USOC voice specifications and both shielded and unshielded data cable testing to T568A/B specifications. When not in use, the detachable remote conveniently and securely stores in the base of the main unit, allowing ready availability for attaching to any type of link and/or easy patch cable testing.

Sophisticated Handheld Cable Certifiers for Passive Networks

This next level upward includes a variety of handheld testers that offer the capabilities to test and certify passive networks to meet relevant industry standards and/or to diagnose and troubleshoot problems within passive networks. These devices are typically intended for use by professional installers and/or network maintenance personnel who need more sophisticated testing capabilities, however they still must be designed for ease of use in various field environments.

Testers in this category are designed to test and certify network cabling in conformance with applicable international standards, such as TIA, EIA, ISO, etc. Therefore they must provide a specified set of test functions that meet stringent accuracy levels, such as Level III or Level IV. Certification to stringent standards is an important requirement for structured networks in order to ensure the performance margins needed to run a variety of network protocols. This requires much more than just hooking up a couple of PC laptops running 10/100 Ethernet. The ability to transfer a few data packets is not a sufficient test to guarantee future performance under full load conditions or the possible deployment of other protocols, such as Token Ring, gigabit Ethernet, streaming video, etc.

Such certification testing is critical for structured cabling because of the care that must be taken during installation and the susceptibility of such networks to failure or degraded performance if not correctly installed. For example, overstretching or excessive bending in the cable runs can negatively impact performance without necessarily exhibiting a

hard failure. Sophisticated tests such as Time Domain Reflectrometry (TDR) enable the user to quickly measure the distance to such a fault condition and therefore can aid greatly in troubleshooting activities to find and fix problems before the network is certified and activated. In addition to supporting copper-based interfaces, many of these higher end testers also offer options for checking and certifying fiber optic links.

Picture 2: Testing with LinkMaster PRO XL

Picture 3: LAN cable certification with LANTEK

Typically, testers in this category are designed for use by professional installers or network maintenance personnel, rather than homeowners or other end users. But they should include capabilities to easily generate reports and test results in a format that can be understood by end users as well as the professional installers.

Depending upon the specific requirements, test functionality and accuracy levels needed, installers can choose between various testers in this category, which offer a range of price/performance alternatives. Examples include the LinkMaster™ PRO XL that is designed for relatively low-cost testing, troubleshooting and moves, adds or changes; up through the LANTEK 6 (Level III) and LANTEK 7G (Level IV) certification testers with advanced features such as TDR, NEXT, and PS ELFEXT.

Handheld Testing for Diagnostics and Troubleshooting in Active Networks

The final category of testers that need to be considered are those designed for use in active networks, where data, voice and/or video services are already up and running. In these situations, it is important that the test instrumentation be able to automatically sense the presence of such services and to navigate within active network topologies.

In-house IT administrators or facilities staff who are responsible for network maintenance and updates (moves, adds and changes), need to inactively map network links within existing active networks and to quickly verify newly installed links. In addition, many installation contractors are increasingly called on to as surrogate facilities staff, especially for small to mid-sized business customers, which means these contractors also need the ability to come back in for changes/troubleshooting within active network environments.

Within active networks, these testers automatically connect to available network devices, identify available services, negotiate DHCP node assignments, and offer the ability to selectively ping remote devices. Upon power-up, the tester should immediately check for voltage on the line and connect to an active port on any hub, switch or NIC if available. The device should be able to identify the specific types of service on the link, such as Ethernet, Token Ring, ISDN or POTS, as well as reporting current and voltage capabilities for analog telephone lines.

Picture 4: PING an IP device with NAVITEK

If no connection is available upon power-up, the tester should have an automatic tone generator function to put a tone on the line. This makes it possible to quickly find the link with a tone tracer on the other end. The ability to different types of tones also can be a big help in line tracing within complex networks.

One example of such a multi-function handheld for active networks is the NAVITEK, which provides flexibility for a variety of tests and seamless navigation of multi-service network topologies. In many ways, such capabilities are equivalent to what could be achieved by connecting a laptop or other computing platform but with the ease-of-use and simplicity of a field-optimized handheld device.

For instance, such a tester can ping remote devices, either by automatically obtaining a dynamic IP address from an existing DHCP service or by directly entering a static IP address for the remote device. This feature can be very helpful for rapid troubleshooting by verifying connections from the user-end location. Most problem reports begin with a general complain such as "I can't get on the network" that could actually result from a variety of root causes. By simply connecting the handheld tester in place of the end-user platform, a field technician can access the DHCP server or directly ping a predetermined remote static IP address inside or outside of the local network, thereby screening out or isolating any problems that might be associated with the end user's computing platform or NIC card.

The Bottom Line

As multi-service network environments become more prevalent within both residential and commercial market segments, installers are faced with what seems like a difficult proliferation of choices and the need to quickly learn to deal with new challenges. Technicians who are most familiar with data-oriented structured networks may have to

quickly learn to deal with voice and video requirements. Likewise, residential construction staff or electricians may want to expand their market reach by learning to install and test multimedia networks for home environments. In addition, network maintenance and administration staff need to expand their knowledge and capabilities to handle voice, data and video within active networks.

Fortunately, the newest generations of handheld testers are designed to accommodate the convergence of voice, data and video services by providing easy-to-use automated capabilities. In many cases, these devices are able to guide relatively unsophisticated users through the test processes and in other cases they provide the professional user with sophisticated in-depth test, diagnostic and certification functions. For contract installers serving multiple market segments, this choice between types of devices also makes it convenient to tailor their field testing capabilities for different teams (e.g. installers, certifiers, troubleshooters, etc.).

The bottom line, as in most instances where the right tools need to be matched with specific challenges, it is always a benefit to have a number of choices and to be armed with a level of understanding that allows you to make the right selections.