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ANOTHER NEW AND GROWING OPPORTUNITY.

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Specialty systems include many of the low-voltage systems that comprise the tools necessary for information professionals to produce work. Many applications such as e-mail, messaging, telephony, security systems and building environmental controls depend on the LAN and WAN and require a robust combination of physical hardware and logical configuration to operate correctly. As we learned by watching the heating, ventilating and air conditioning (HVAC) industry, benefits can be realized by more closely involving the design team, the contractor and the owner during the implementation phase to ensure that systems operate as intended and can prove themselves fully during a performance evaluation.

Specialty Systems Commissioning

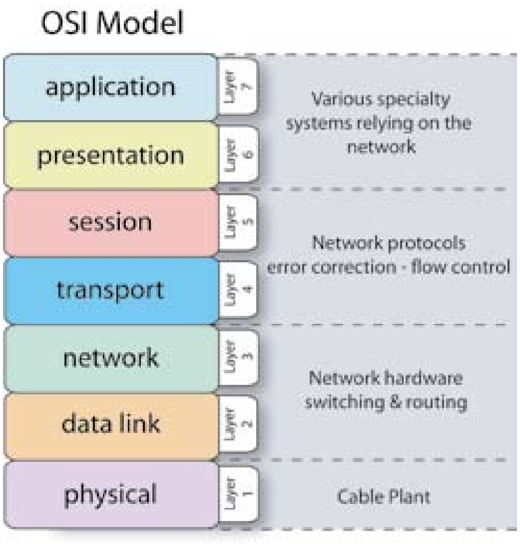
A layered approach for streamlining performance verification.

BY C. DONALD LATHAM JR., RCDD

Using a Layered Approach

We may remember the Open Systems Interconnection (OSI) Reference Model from some of our classes. The model defines requirements for open communications in internetworking environments and breaks down the architecture into the following seven layers:

- Layer 7 – Application
- Layer 6 – Presentation
- Layer 5 – Session
- Layer 4 – Transport
- Layer 3 – Network
- Layer 2 – Data Link
- Layer 1 – Physical



Because specialty systems build on each other using the OSI Model, we also use this model to approach commissioning services by building our performance verification testing from Layer 1 (Physical layer cable testing) all the way through any application-level systems on which we may be relying.

LAYER 0

With apologies to the International Organization for Standardization (ISO), we define a Layer 0 as the physical spaces and electrical power needs of our specialty systems. It is here that we confirm that our power, uninterrupted power supplies (UPS), HVAC and physical spaces meet the requirements of the project. We check with our fellow design professionals to confirm that we have space conforming to the requirements defined in applicable standards, and ensure that our power needs are met for type, capacity and redundancy.

LAYER 1

The electronic components ultimately are at the mercy of the physical plant. Structured cabling certification is the foundation of our electronic systems. Therefore, it is critical to ensure the system conforms to the requirements of the design.

There are multiple approaches to certification of the cable plant, but all should first rely on a reputable manufacturer certifying the cable installation and warranting the solution for multiple years. This is generally based on testing and installation performed by a certified contractor who has been qualified to implement the project based on past experience and the quality and training of their personnel.

- **Approach 1** is the simplest form. The contractor tests 100 percent of horizontal and backbone cabling and turns those test results over to the design team and owner for review and approval. The owner or owner representative should observe at least a portion of the testing.

- **Approach 2** supplements Approach 1 by adding third-party verification of some percentage of the cable plant. The third party tests the cables and then compares the results with the contractor's test to determine the validity of the contractor test.

- **Approach 3** is to have 100 percent of the cabling tested by a third party. This is recommended when Approach 2 has demonstrated that the first test results may be flawed or when the cable plant must have a very high assurance of reliability.

As you may have surmised by now, each of these approaches becomes more labor intensive and therefore more expensive. Ultimately, the manufacturer will be relied upon to repair any failures. The additional testing simply ensures that failures are discovered and repaired at a noncritical time.

The actual testing should be prescribed in the specification to conform to standard test procedures. The testers used also should conform. The calibration and software updates should be submitted with the tester results to ensure that the most current updates have been applied. The delivered test should be in both electronic form and printed data on each cable tested. These results should be reviewed carefully by persons who have operational knowledge of the tester. It is important to check the tester's setup parameters. If improperly configured, the tester may be returning incorrect results.

The industry has been struggling with the best way to field test category 6A cabling to prove that it can meet the alien crosstalk performance requirements as defined in the standards. To date, the victim cable test is complicated and extremely labor intensive. As a result, this method has not been widely accepted as a requirement. In an effort to eliminate the need for alien crosstalk field tests, manufacturers are recommending that category 6A be tested for all performance parameters except alien crosstalk in the field, and they are providing a performance/application level warranty for the system without the testing. We believe this method is consistent with the way that providers like AT&T formerly warranted its cable solution for 1000BASE-T as an application before we had a power sum field test. Given the potential for errors in identification of applicable bundled disturber cables, we are not convinced that the significant additional cost of field testing for alien crosstalk is worth the small additional assurance provided under normal circumstances.

LAYERS 2 & 3

For network hardware and its logical configuration, we are building on our model by now relying on the installation and testing procedures that have properly validated that Layer 1 hardware is fully functional. At this level, we are planning our hardware installation, phasing and IP schema and determining how the equipment will route data, how we will segment the LAN for the various applications and what quality of service (QoS) we will assign. The Layer 2 and 3 testing should involve a few steps:

- **Step 1** is to define and implement configuration workshops at predetermined times and that are reflected in the overall project schedule. In these workshops, the owner, the designer and the contractor work together as a team to determine the proper configuration requirements of the network. During these sessions, every aspect of IP schemes, segmentation, routing and QoS for the various applications will be determined. Here it is important to gather and implement any specialized routing, segmentation and QoS requirements that may be needed by the applications relying on the network. Similarly, this step will provide information to the various application contractors regarding configuration requirements they will need (such as IP ranges).

- **Step 2** is to define a performance verification test procedure. As a team, this document will be agreed upon before the implementation and will form the basis of the final acceptance test. Used like a checklist, the performance verification test procedure will demonstrate that the system has been physically and logically configured as prescribed in the workshops.

- **Step 3** is to demonstrate to the owner that the contractor is ready for the performance verification test. At this point, the contract has an operable system; it has been operating for a predetermined period of time, and the contractor has performed the verification test internally, which is demonstrated by presenting the pre-performance verification documents with the request for final acceptance.

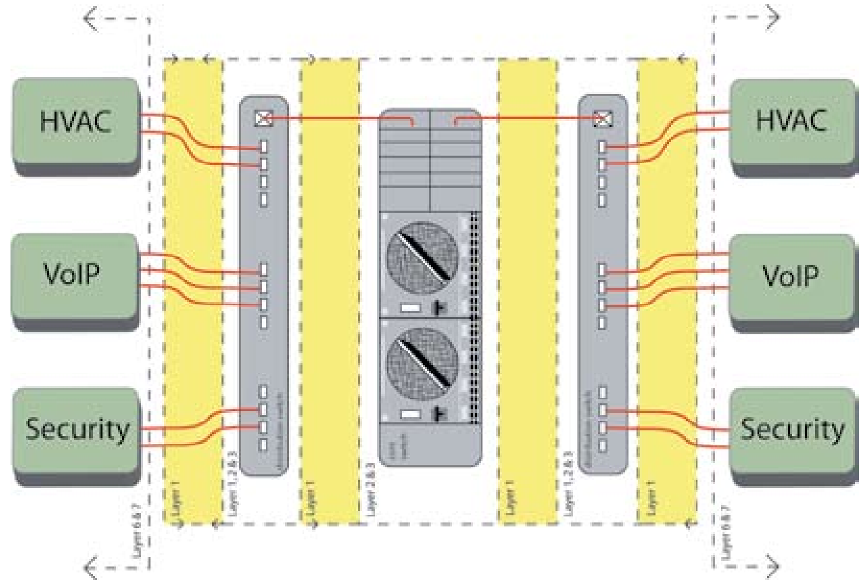
- **Step 4** is the performance verification test. The performance verification should be a simple matter of following the checklist to demonstrate proper operation. At the end, it is signed off on by the team, and the system is accepted.

LAYERS 4 & 5

These are the TCP/IP layers that handle various protocols such as AppleTalk. They do not necessarily require verification.

LAYERS 6 & 7

For applications and encryption layers, testing and commissioning can be performed on the various specialty systems that rely on the lower levels for proper operation. Here the team may break into separate groups. The IP-based video surveillance systems, the VoIP telephone system, the access control system, and the building automation and control system can each be individually tested for proper operation without having to troubleshoot lower level components. Experts in each application work with the appropriate vendors, the owner, the designer and a representative from the LAN implementation team to develop a performance verification test plan. The test plan is then used to demonstrate the proper operation of the systems.



Specialty systems building blocks

Conclusion

Specialty systems commissioning should utilize a layered approach to performance verification. Although they generally are viewed as large interoperable systems, they can be many separate and distinct systems that are installed and tested by many contractors. Many of these systems rely on and build on an underlying system. To properly test an application, it is important to have already verified that any underlying system is operating correctly. For example, for the security system contractor to test an IP-based surveillance camera, it is important that they have assurance that the cable and the LAN have been properly configured and tested, especially if those systems have been installed by a different contractor.

The layered approach to specialty commissioning streamlines the performance verification testing process for the many systems that rely on the proper operation of underlying systems. This approach assures the application-level contractor that those systems have been verified as operating correctly by performance testing. ■

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