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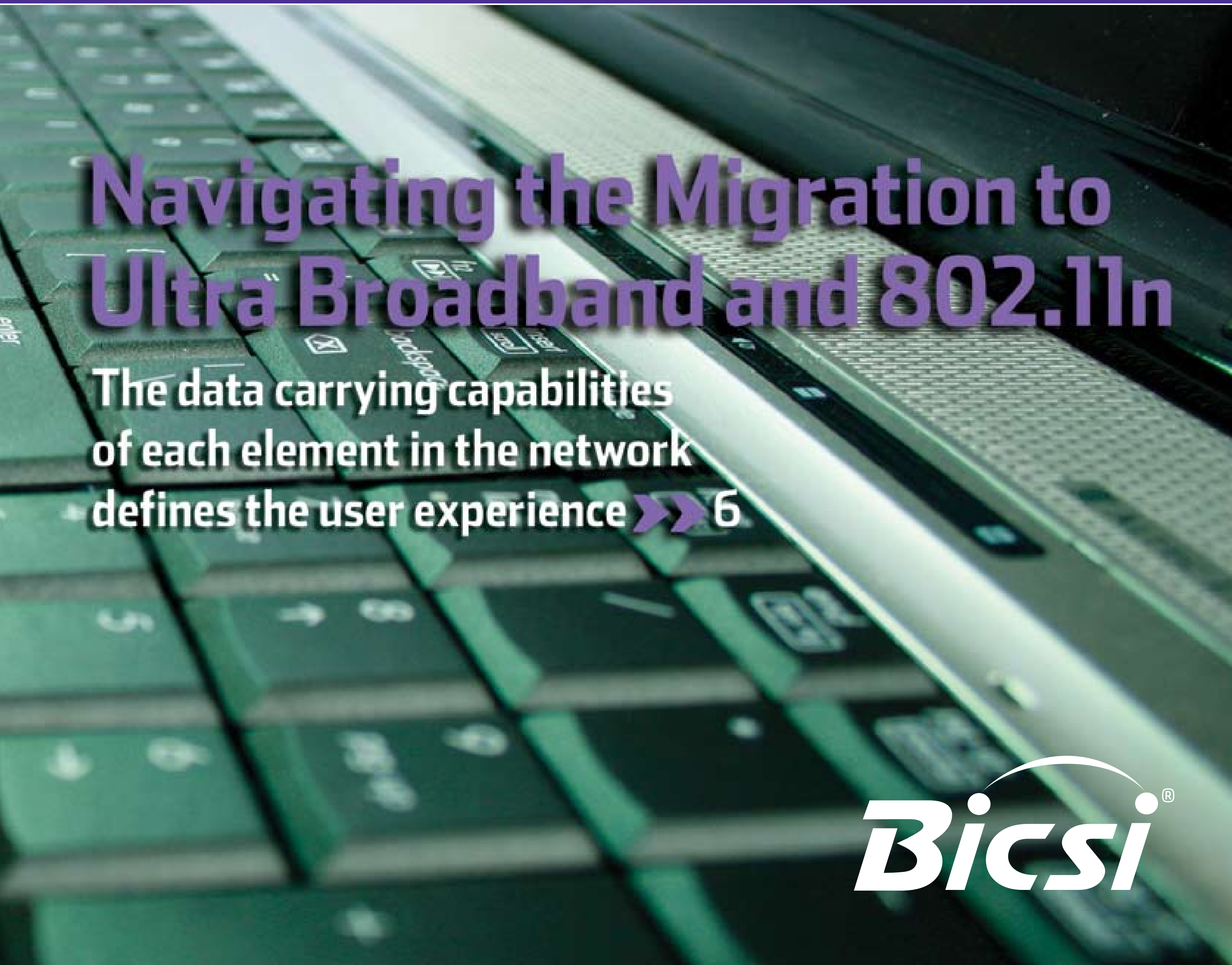

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Planning for Factory-Built Plug and Play Systems

Take steps to ensure the cabling plant has a longer service life at a lower cost. BY DAVE HARNEY

With most of the new technologies that continue to flood the world today, there is a myriad of accompanying "best practices" that also emerge. Not surprisingly, managing all of the change wrought from new technologies is a tremendous task. In the information transport systems (ITS) world, we face a level of change today that has not been seen since the advent of structured cabling, category solutions and the introduction of the ANSI/TIA/EIA-568 standard in the early 1990s. New cabling media, wireless media, factory-built cabling systems and changing standards are placing an enormous amount of stress on designers, installers and end users.

This stress comes in the form of new challenges. As new best practices around structure, planning and experience follow new technologies, the result is often increased pain for customers—pain that usually manifests in delays and increased or unexpected costs. Ultimately, customer pain is often traced to improper or inadequate planning, structural barriers or bottlenecks that prevent the use of technologies and inadequate metrics to evaluate the benefit of a technology.

A relatively new technology being widely deployed today is factory-built copper and optical fiber plug and play systems. For example, network equipment vendors are increasingly adopting plug and play connector systems such as multifiber ferrule solutions due to the advantages of high-density footprint and advanced optical performance achievable with the various connector styles available. The ITS world is adopting plug and play systems for similar reasons. However, many challenges must be addressed for these systems to fulfill their potential value for cabling infrastructures. This article addresses issues of design and planning, overcoming structural barriers and bottlenecks and viewing total cost of ownership. Each of these issues benefits factory-built copper and optical fiber plug and play systems but is equally applicable to all other structured cabling systems designs.

The basic components that should be included in planning for implementation and management of the plug and play structured cabling plant include the following:

Design Plan

- Develop a process and systems approach.
- Base designs on standards.
- Build capacity for expansion and change.
- Support multiple equipment generation upgrades.
- Develop a process for managing and monitoring the system.

Implementation, Management and Maintenance Plan

- Establish practices for initial installation and future moves, adds and changes.
- Develop practices for monitoring cabling outages, service delays and implementation errors.

Develop a Process and Systems Approach

The ISO 9000:2000 lists eight quality management principles that help minimize delays, reduce errors and avoid unexpected problems. Some vendors use these principles for the development of plug and play components. The two principles below are especially relevant for structured cabling implementations.

- ***Principle 4: Use a Process Approach***
  Organizations that use a process approach are more efficient and effective. An effective process approach manages activities and related resources. In application, imagine relying upon an individual for final quality of optical terminations. The rationale is that the person is an expert, has been trained and can be counted on. But what happens when that person is unavailable? Is there a process that can duplicate the speed and quality of the expert's work if the expert is unavailable?

- ***Principle 5: Take a Systems Approach***
  A broad systems approach results in efficient and effective organizations—as well as in efficient and effective projects. Interrelated processes must be identified and systemized. Much has been written in quality literature about managing constraints or bottlenecks in processes. Without a full understanding of interrelated systems (distributor supply chain, available technicians, competing or complimentary trades, and so on) it is impossible to prepare for bottlenecks. A systems approach prepares for the unknown and reduces delays, cost overruns and other inefficiencies.

Base Designs on Standards

Industry standards serve many very valuable purposes. They protect end users and installers from proprietary systems and interoperability problems, promote competition that ultimately benefits the customer, and enable a cabling system that survives vendors, design consultants and installation companies that dissolve or abandon product or service offerings. Of course, there are products and services that exceed industry standards compliance that are worthy of consideration. Nonetheless, it is essential that standards compliance be set as a minimum, nonnegotiable benchmark.

For example, there are copper cabling systems today that are viewed as state-of-the art, such as category 6a systems, which are not subject to a ratified standard. Unfortunately, these systems do not meet the threshold of manufacturer interoperability. As a result, specialized test methods have to be implemented, or you must trust the factory for verification that your new plug and play system will actually work with a nonstandard, leading edge cabling system.

Build Capacity for Expansion and Change

In dynamic environments, planning for capacity expansion and frequent change is essential. The data center is the prototype for dynamic environments. Consider a company that has completed construction of a new corporate data center. The company had suffered from power, cooling and space problems for several years. The old cabling plant was a mixture of add-ons as required and could not accurately be called “structured.” The expansion was completed late in 2006 and was built to a capacity utilization level of 40 percent. In fewer than 12 months, the data center was over 90 percent utilization. The expansion to cover any unanticipated contingencies quickly evaporated. Planners were not able to anticipate the full impact of two acquisitions, the scope of Sarbanes-Oxley regulatory compliance, and storage demands that grew faster than modeled.

Planners need to consider the client’s IT growth history and projections, growth plans and projections, and external factors such as regulatory changes. The client’s technology adoption plans, including the infrastructure and future cabling systems that may be required, are also important considerations. In addition, designers must also consider the impact of new cabling products such as category 6a with its larger outside diameter cable and patch cords, a change in cabling component technology that can greatly affect pathways, cable managers and equipment racks and enclosures.

Plug and play technology itself naturally supports a plan for building for capacity and change. It offers fast implementation, allowing quick rearrangement or additions of new network gear. Today, plug and play based optical fiber systems range from six to 48 individual optical fiber connections to support increased capacity and density requirements.

Support Multiple Equipment Generation Upgrades

In 1994, category 5 was defined by TSB-36. In 1999, category 5e was defined and ratified as the TIA/EIA-568-A.5. Considering only Ethernet applications, category 5 supports applications up to 100 Mb/s, which while in the decline of its life, remains viable 13 years after the definition of category 5. Gigabit Ethernet is in its growth phase and is projected to equal 100 Mbps Ethernet in ports shipped for the first time in 2007. It is projected to be the dominant technology in the enterprise for the next five to seven years or more. These are just two examples that demonstrate that if a cabling system and its supporting architecture are well designed, the end user can practically plan for a useful cabling system life of 10 or more years.

Multiple generation upgrades require media that will support future applications, pathways and spaces that efficiently facilitate moves, adds and changes and cabling components that can survive moves and reuse. Imagine the end user that throws away office cubicles because they rearrange the layout of an existing floor. It does not happen because modular furniture is designed to facilitate efficient moves, adds and changes. Cabling components such as plug and play copper and optical fiber systems exist to support growth and change efficiently and effectively, extending the useful service life of the cabling plant.

Develop a Process for Managing and Monitoring the System

Image a company preparing for updates and modernization of their facility, including the cabling plant. In preparation, the company conducted an audit of the facility that evaluated every work location, telecommunications room and equipment room serving over 200 end users. Two employees were dedicated to the project full time, and several others assisted throughout the audit. It took four days to complete. Suddenly, the project was delayed for over nine months. Once back on track, another audit was conducted and another four days were spent to complete it. Set aside for a minute that the combined labor of over a half of a month of productive hours of an employee were spent to conduct the audits. While it could be argued that this facility had a process, it can only be described as a poor process for managing and monitoring the cabling system.

Many options exist for effective management and monitoring that range from spreadsheets to cable management software to real-time intelligent infrastructure management. Unless an effective means is adopted, poor documentation will almost certainly result in inefficient use of resources and limiting the useful life of the cabling plant.

Establish a Standard for Initial Installation and Future Moves, Adds and Changes

There's not much to add here except to adopt a standard. BICSI did the how-to legwork in the *Information Transport Systems Installation Manual*, 4th edition, Chapter 2. The *Telecommunications Distribution Methods Manual* also succinctly sums up the reasons for adopting a standard and a plan: "Planning and project management are key to a successful information transport systems (ITS) cabling installation project. Taking time to develop a well-defined plan before a project starts will help deliver a proper installation on time, within budget, and ensure that the job can be performed and meets all customer requirements."

When creating MAC processes and plans, care must be taken to ensure they are compatible with the initial installation. Documentation and management processes and compatibility of materials selected need to be included as part of the implementation plan.

In the plug and play world, it is common to find a unique footprint for connector or cassette-based systems from each manufacturer. The connectors are standards-based, but the mounting hardware and fit for support hardware and frames can vary from manufacturer to manufacturer. You really need to pay attention because there is a high cost (materials, labor and downtime) for switching footprints in the future.

Take a Long-Term View of Costs

Relative to field-terminated products, there is a component price premium for plug and play cabling products that are reconfigurable and reusable. Factory made assemblies also come with manufacturing lead time and transportation time premiums, which further complicates the equation. Additionally, the convention is that factory assemblies need to be made to length, which requires an extra step in the installation process to determine precise length measurements.

Component costs need to be measured against labor costs to make a reasonable evaluation. Further, time costs should be included in the evaluation. The Fiber Optic LAN Section of TIA (www.fols.org) has developed an excellent cost model for evaluating optical fiber versus copper twisted-pair to the desk. This model can be modified to compare various options, including factory-terminated cabling components. The following model can be built to help gain a basic understanding of the financial impact of various options: (Total Cost of Components + Total Labor Hours) * Hourly Rate = Total Installed Cost.

At a minimum, the following factors should be used for a quick comparison: link lengths, number of ports, cabling materials, support hardware (e.g., optical fiber enclosure), time to complete each activity (cable installation, terminations, testing, labeling and others) and hourly labor rate.

The followup exercise is to compare the total costs if a move is required in the future. Compare the costs of moving the reusable factory-made plug and play systems with the cost of installing a whole new field-terminated link. Certain components of the field-terminated systems will survive, but much, especially in labor units, will need to be replaced or reterminated. There is almost no scenario where the field-terminated options net out at a cost advantage to plug and play systems when a move or change is involved. When time is a critical evaluation factor, the scale is tilted even further in favor of plug and play systems.

Slack Management and Lead Time

Time favors field-terminated systems when factory lead time exceeds the project implementation time line. Sometimes, coordination between trades and other delays make it difficult to rely on factory-made assemblies. However, good structure overcomes much of the precise length and factory lead time concerns for plug and play systems.

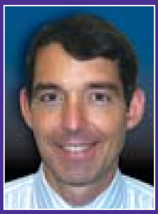
Starting with some basics for good structure, it is important to create separate pathways for different media and services. Pathways should be sized to accommodate future growth. Keep in mind that future growth could include larger outside diameter copper cables and preterminated copper or fiber trunk cables with protective pulling eye assemblies. It is also imperative to design pathways for easy access. *National Electrical Code*® (*NEC*®) Article 800.154 requires that abandoned communication cable circuits be removed from pathways. Access will impact the cost and practical application of that code requirement.

More sophisticated designs incorporate slack management and storage in the pathway design. Where codes permit, multiple layer tray systems and offset slack management sections can allow for practically long slack storage. Some slack storage designs allow trunk cables to be implemented in as much as 30 m (100 ft) increments. Multiple rows of cabinets can be supported in these environments by a single cable length because the slack management designs are so robust. Many vendor options exist today for storing slack above or attached to cable tray or runway, or in adjacent dedicated boxes and enclosures. Designers can select from a wide range of cable management racks and enclosures designed to accommodate dense installations and even slack storage. Options range from custom made solutions to field configured off the shelf.

When robust slack management is designed into the total architecture, standardized plug and play cable assembly lengths can be easily implemented. Standard lengths of these assemblies can be stored in inventory at the job site, in the end user's facilities inventory, in distributor warehouses and even in manufacturer's inventory. The result of well-designed pathways and generous slack management provisioning is dramatically reduced general project implementation time lines, the removal of cutover bottlenecks caused by cabling, and implementation of fast disaster recovery solutions.

Conclusion

Best practices cannot be achieved without planning, processes and good design. In the face of the changes we are experiencing as an industry, we can best mitigate our risks by following industry standards, identifying trends, technology changes and implementing controls that allow us to effectively manage our infrastructure. By dedicating resources to design robust pathways and spaces, we enable an infrastructure that can support a cabling system with a productive functional life of ten or more years and eliminate one source of pain for the user of the structured cabling system. ■



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