



How to Generate a Basic Bill of Materials in the LAN

by Matthew Miller, Enterprise Systems Engineer, Corning Cable Systems

Fusion Splicer

In network design and installation, there are often multiple solutions that meet the same specification or requirement. With many options available for similar applications, generating a bill of materials can sometimes pose a challenge. By understanding the basic optical components and the specific performance requirements, you will be able to generate an efficient bill of materials for your next project or opportunity.

APPLICATION

First, determine the application of the network. Before picking any products, you must ask the following questions:

- What is the intended long-term use of this network?
- Are you building a network from the ground up, or are you moving, adding, or changing an existing network?
- Are there constraints already in place that you must take into account?
- Are you planning to utilize resources you already have (splicers, toolkits, etc.), or are you willing to invest in a new technology?
- What are the budgetary restraints?
- What is the timeline for the project?
- Does the end user have specific requests concerning how the network is installed?
- What bandwidth does this network need to accommodate right now? What bandwidth does this network need to accommodate in the next ten years?

Your answers to these questions will guide your decision-making for each materials category.

FIBER TYPE

There are two basic fiber types: single-mode and multimode. TIA-568 C.3 recognizes only dispersion unshifted single-mode fiber, while multimode comes in both 50 μm and 62.5 μm core sizes. In addition, 50 μm multimode is available in both standard (OM2) as well as a laser-optimized version (OM3/OM4). A general rule for moves, adds and changes within existing infrastructures is to not mix new fiber types or performance grades into your "old" plant. To meet this guidance, consistency within your network is critical to long-term performance. New builds allow you to design a network from the ground up for current and future needs, making it important to consider higher-performance fibers. In both cases, system electronics (switches, media converters, etc.) may dictate optical fiber selection if they have already been purchased and should be fully understood at the inception of a project.

Multimode fiber is graded by OM (optical multimode) nomenclature as defined in TIA-568 C.3 to describe its bandwidth-carrying capacity. A 62.5 μm fiber runs at OM1, standard 50 μm fiber runs at OM2, and laser-optimized 50 μm fiber runs at OM3 and OM4. The higher the OM grade, the better bandwidth performance you can expect. Single-mode fibers are graded by OS (optical single-mode) and can run at OS1 or OS2, as described in

TIA-568 C.3. All TIA-568 ratings detail the maximum attenuation and maximum modal bandwidth for the fiber.

Next, consider cost. The transceivers associated with single-mode fiber are more expensive than those needed for multimode. Unless the electronics are already in place for single-mode, you will spend more when you choose single-mode fiber. The decision must be made to balance performance and cost. While single-mode systems will provide unlimited future expansion, multimode fibers typically provide the most cost-effective solution for today and the near future. Laser-optimized 50/125 μm multimode fibers, in particular, are designed to be used with inexpensive transceivers to provide high bandwidth.

Finally, consider the network reach. Single-mode fiber does better at longer distances, while multimode fiber is ideal for short runs. Depending on your network needs, you may need to use a combination of single-mode and multimode fibers to achieve your goals. In today's networks, single-mode is mostly used for campus backbones, and multimode is used for building backbones.

FIBER COUNT

To determine the number of fibers you need in a cable, first consider your network topology and the applications you will need to support. Where are the pathways and spaces? What are the redundancy requirements?

Along with current needs, think about what this network will need to be capable of in the future. A well designed system can last 20-25 years. Additional fibers can be easily and cost-effectively added to fiber counts and kept dark until expansion. In general, common fiber counts for cables are in multiples of 6 or 12, going up to 144 fibers (indoor cables) or 288 fibers (indoor/outdoor or outdoor cables). Rounding to common fiber counts is a wise decision. Custom cable configurations are available but often come with increased lead time and higher cost.

CABLE TYPE

The types of cables you have to choose from depend on where the cables will be run. There are three basic categories for cable: indoor, outdoor and indoor/outdoor. Indoor cables should not be run outdoors because they do not contain UV-blocking materials that prevent the cable jacket from degrading in sunlight over time. They also lack waterblocking components. If the cable jacket is breached, it has no way of preventing water from traveling down the cable through capillary action. Outdoor cable cannot be run more than 50 ft indoors due to National Electric Code (NEC®) guidelines and local building codes. These codes are in place because if an outdoor cable were to catch on fire, it would emit hazardous gases and smoke. Depending on whether your indoor/outdoor cable is riser or plenum flame rated, it

can be run indoors, into a riser or plenum space, without the need to transition splice, but may not be as cost effective. Consider the requirements of your network before choosing cable.

If you plan to use cable indoors, you will want to use a tight-buffered cable. Tight-buffering enables direct connectorization with a field-installable connector. If you will be running cable in shafts, you need cable that is riser rated. If you will be running cable in air handling spaces, you will need cable that is plenum rated. Plenum-rated cables can be installed in riser spaces, but riser-rated cables cannot be installed in plenum spaces.

You will need to take into consideration your conductivity requirements as well. Plenum and riser cables are both available in either conductive or non-conductive forms.

If you plan on using outdoor cable in your installation, keep in mind that you will have to transition to a flame-rated cable if you need bring it more than 50 ft indoors, as outlined in NEC® guidelines, unless the cable is non-conductive and is run in a raceway in compliance with any of the following articles from the NEC 770, edition 2011: 342, 344, 352, 358. Keep in mind, this does not mean you can install the unlisted OSP cable anywhere you want upon entering a building. The NEC, article 770, section II. Cables Outside and Raceways Entering Buildings, specifically

states “cables shall be permitted to be installed in building spaces, other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air.” Remember that your local codes may be more restrictive and most likely supersede NEC codes. All loose tube cable is comprised of 250 µm fibers, enabling easy fusion splicing in the field. If you are planning to field terminate loose tube cable with connectors, you will need a buffer tube fan-out kit. Buffer tube fan-out kits allow the 250 µm fiber to be slipped inside 900 µm jacketing, making the fiber more robust. Buffer tube fan-out kits differ for indoor and outdoor uses, so be sure you use the one appropriate for your environment.

If you prefer to eliminate the required transition from outdoor to indoor cable, indoor/outdoor cable is the most effective solution for your network, which is flame-rated and can be used in a wide range of environments. When using indoor/outdoor cable, you will need to choose one that suits both the indoor and outdoor environments it will be run through.

ALL-DIELECTRIC ARMORED CABLE

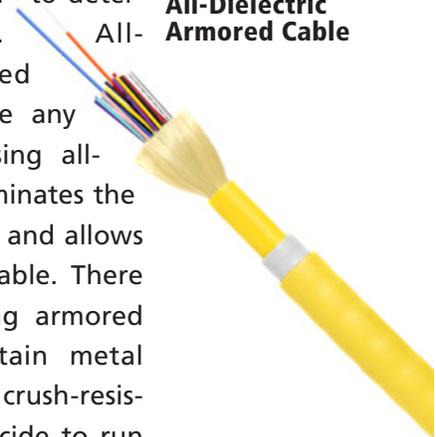
Based on where the cable is being run and the environment surrounding it, you need to decide if you will need armored cable. Armored cable is ideal in

spaces where cables might be exposed to harmful elements such as crushing or rodent interference, as well as providing additional security protection. If you do need armored cable, you will need to determine what type. All-dielectric armored cables do not have any metal in them. Using all-dielectric armor eliminates the need for grounding and allows for a lightweight cable. There are also interlocking armored cables, which contain metal and offer superior crush-resistance. If you do decide to run armored cable, it could eliminate your need to run a duct, so decide on your cable type before you plan further.

TERMINATION METHOD

Deciding on a termination method is influenced by many factors. If your biggest concern is cost, epoxy and polish connectors might be a good fit because of their low initial price. If you are prepared to replenish consumables regularly and have an experienced, well-trained crew, your results will be optimal. If, on the other hand, you have an inexperienced crew or you are working in very cramped conditions (under a floor, in a ceiling, on a ladder, etc.), epoxy and polish connectors may not be the best option for two important reasons. First, considerable time must be invested in order to learn how to properly hand-polish connectors that meet speci-

All-Dielectric Armored Cable

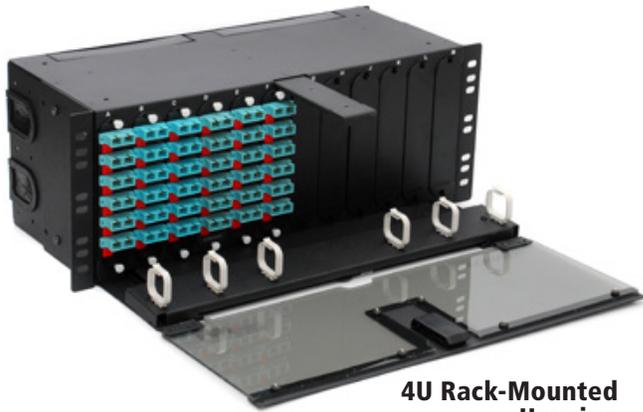




**No
Epoxy/No
Polish LC
Connector**

fications. Second, epoxy and polish connector kits require a large workspace to lay out the polishing papers, polishing pucks, epoxy, etc. necessary for termination.

If your biggest concern is time, no epoxy/no polish connectors are probably your best choice. The fiber end faces are factory polished and easily installed with a tool kit. The installation tool usually allows you to perform terminations quickly, and some vendors offer immediate visual confirmation of a good connection. The initial cost of no epoxy/no polish connectors is typically higher than that of epoxy and polish



**4U Rack-Mounted
Housing**

connectors, but requires almost no consumables that must be replenished and less time per connector to install.

FUSION SPLICER

If your company already owns a fusion splicer, fusion-spliced pigtailed might be the right choice for you. Fusion-spliced pigtailed allow an installer to connect a fiber to a factory-terminated and -polished connector. Because the connec-

tor is factory terminated, you can expect high quality results. Fusion-spliced pigtailed are easy to use in areas where there is expansive room to set up and few environmental disturbances.

If you are terminating in a cramped area or somewhere without an electrical outlet, fusion splicing becomes very difficult. If you do not already own a fusion splicer, it can be a large investment to make, though there are rental services of fusion splicers and other high-capital equipment. Also, keep in mind that when utilizing fusion-spliced pigtailed you will need to order the correct splice trays for your hardware and heat-shrinks to keep your splices intact. If your standard installation procedures call for leaving slack in the splice tray, think about ordering larger-width trays to accommodate the tight-buffered fiber. Fusion splicers require adequate training and are best used by experienced installers.

CONNECTOR TYPE

The most common connector types are SC, LC and ST® Compatible Connectors. Specifications, density, electronics interfaces and existing plant often drive connector choices. If you are going for maximum density and want to save room, an LC connector is the right choice. The LC body is half the size of standard SC connectors. They are also available in duplex form, which allows you to manage polarity by sim-

ply reversing the connectors via a duplex clip.

NO EPOXY/NO POLISH LC CONNECTOR

If density is not a concern for your system, you can choose either SC or ST Compatible Connectors. SC connectors feature an easy push/pull locking mechanism and are available in simplex and duplex forms. ST Compatible Connectors have a spring-loaded bayonet locking system that helps them stay in place but are only available in simplex versions.

HARDWARE

To determine the type of hardware you need, take into consideration the space that will be utilized for the network. If you are installing inside of a closet or other cramped quarters and need low density, wall mountable hardware is the best selection because it does not take up a lot of room.

If racks are already in place, or if there is enough room to install them, rack-mount hardware is the best selection because it is sturdy and easy to access. Rack-mount hardware is available in 1U, 2U, 3U and 4U versions. 1U, also known as a rack unit, is equal to 1.75 inches. A standard-sized rack contains 44 rack units (44U). Rack mounted hardware can be connector only, splice only or compatible with both connectors and splices. Fiber counts supported in rack-mount hardware range anywhere from six to 288 fibers. Keep in mind that

rack-mount hardware does not protect against environmental conditions.

Whichever option you choose, don't forget to take into consideration the way the cables inside the hardware will be strain-relieved, or the way armored cables will be grounded.

KEY QUESTIONS

In closing, here is a condensed list of questions to consider before generating a bill of materials.

- First and most importantly, what are you trying to do?
- What is your application?
- What type of bandwidth performance are you looking for? How long will your system be?
- What fiber type do you need?
- What fiber count do you need?
- Indoor/outdoor, outdoor or indoor cable?
- Dielectric, metal armor, non-metal armor or no armor at all?
- What is your preferred termination method? No epoxy/ no polish connectors, fusion-spliced pigtailed, or epoxy/ polish connectors?
- Do you prefer rack-mounted or wall-mounted hardware?
- Where will the hardware be installed? Does it have unique environmental requirements? ■

article by Matthew Miller, Enterprise Systems Engineer, Corning Cable Systems. For more information, go to <http://offers.corning.com/1-Elements>

SURVEY FINDS COMMUNICATION SERVICE PROVIDERS IN NEED OF PRODUCTIVITY IMPROVEMENTS

Despite assigning high importance to increasing productivity in field operations, 48% of survey respondents reveal that productivity improvement initiatives are lacking, and that methods to measure and track productivity are insufficient.

In a survey by Sunrise Telecom® Incorporated, CSPs acknowledge a strong link between field productivity and subscriber satisfaction and retention. While 100 percent of survey participants confirm the importance of subscriber satisfaction and retention, 81 percent of them also state that improving field productivity is very or extremely important to their organization.

Polling communication service provider (CSP) decision-makers, highlights the importance of improving productivity across field operations to increase subscriber satisfaction and retention, reduce

costs, and create competitive advantage.

While the survey highlights CSPs understanding of the value behind raising productivity to achieve both subscriber and business success, it also reveals that the industry is lacking in both the techniques and processes to improve productivity. Fifty percent of respondents said their organization has not implemented a productivity initiative for field operations within the last 12 months. In addition, 48 percent of participants said that productivity metrics in their organization are either non-existent or need vast improvement.

In regards to the issues most impacting productivity in field operations, the survey identified the top two issues as (1) eliminating repeat service calls by getting them done right the first time, and (2) providing field staff with additional

skills and training. Other issues that rated high in impacting productivity include:

- Technicians need smarter field tools and platforms to help increase productivity
- Managers need better metrics and ways to track their team's productivity status
- Field operations' processes need to be streamlined

"The findings reveal a dire need for raising productivity in the industry, particularly in field operations," said Bahaa Moukadam, Sunrise Telecom CEO. "These survey results provide a strong validation of our relentless focus on helping our customers raise the productivity of their workforce, reduce their costs and retain more of their customers."

For more information, visit <http://www.sunrisetelecom.com>.