SBC-002-316-076
SBC LOCAL EXCHANGE companies Ethernet Architecture Standards

Abstract

Presented in this document are the methods and procedures to implement Electrical & Optical Ethernet Services in the SBC LOCAL EXCHANGE companies Central Offices, CEVs, Huts, Customer Premises and other SBC Locations.

Audience: The primary audience for this document are SBC LOCAL EXCHANGE company personnel in the following disciplines, Information Technology Operations, Switch Capacity Planner/Engineer, Transport Equipment Engineer (TEE), Facility Equipment Engineer (FEE), Digital Transport Engineer (DTE), Maintenance Engineer, Space Planner, Frame Planner, Long Range Technical Planners, Outside Plant Engineering, Fundamental Network Planning and Special Services I/M. This document is to be used internally within SBC LOCAL EXCHANGE companies and their Authorized Vendors and has a limited distribution subject to the header/footer information.

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1. Copyright Page

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Global Engineering Documents
15 Inverness Way East
Englewood, CO 80112-5704 or call
U.S.A. and Canada (1-800-854-7179), International (303) 397-7956

2. Reasons for Reissue

This section reserved for future issues.

3. Introduction

This document represents the combined efforts of the best experts in SBC Technical Staff in support of the most cost effective and efficient means of providing Ethernet Services both for the SBC LOCAL EXCHANGE companies and our customers through several product lines. SBC Services Inc, Network Planning & Engineering (NP&E) and Outside Plant Construction will incorporate all previously established Electrical and Optical Ethernet programs within this document and SBC-TP76412MP-000, *SBC-Electrical & Optical Ethernet Telco Cat 5t & Cat 6t Transmission Standards,* Issue 1, dated March 2003.

SBC Services NP&E/OSP will be working with SBC Services-Procurement to establish corporate agreements with regard to manufacturer products on Common Systems items such as data panels, jumpers, cables, placement standards and supporting documentation regarding applicability and use in accordance with established Network standards. Sub-tending organizations such as Information Technology may elect to provide more stringent standards for Computer and Network Technology support services.

This document specifically supports all common systems connectivity, standards and products used. It does not cover Network Elements or Network Equipment transceivers and intelligent devices such as routers, bridges, computers, servers or the cabling of administrative office areas associated with Telecommunications Outlets (TO). Refer to the internal Information Technology Operations (ITO) document *ITO Structured Cabling System Standards,* Version 3.3.1, dated September 6, 2002 for more details on administrative layouts.

The information in this document is primarily based upon SBC NP&E Transmission Standards. Where internal standards have not been developed, the default standards will be based upon TIA/EIA standards as follows, with subtending supporting documents being identified in the Reference Section of this document:

- SBC-TP76200MP-000, *SBC-Network Equipment, Power, Grounding, Environmental and Physical Design Requirements (primary document over TIA/EIA J-STD-607-A and Telcordia GR-63-CORE)*
- SBC-TP76300MP-000, *SBC-Installation Requirements for Central Offices (may be used throughout the SBC Network)*
- SBC-TP76400MP-000, *SBC-Detail Engineering Requirements for the Central Office (may be used throughout the SBC Network)*
- **SBC-TP76412MP-000, *SBC-Electrical & Optical Ethernet Cat 5t & Cat 6t Transmission Standards (primary document over TIA/EIA 568-B Series)***
- TIA/EIA 568-B Series, *Commercial Building Telecommunications Cabling Standards (Normal)*

- TIA/EIA 568-A Series, *Commercial Building Telecommunications Cabling Standards* (only used internally in SBC-Midwest (Information Technology), not customers.
- TIA/EIA 569-A, *Commercial Building Standards for Telecommunications Pathways & Spaces*
- TIA/EIA 606, *Administration Standard for the Telecommunications Infrastructure of Commercial Buildings*
- TIA/EIA J-STD-607-A, *Commercial Buildings Grounding (Earthing) & Bonding Requirements for Telecommunications*

This document has been created to reflect Network Planning & Engineering (Transport & Common Systems Standards) and OSP Construction for the following Incumbent Local Exchange Carriers, henceforth referred to as SBC LOCAL EXCHANGE companies:

SBC-Southern New England Telephone (Connecticut)
SBC-West operating companies (California, Nevada)
SBC-Southwest (Missouri, Texas, Arkansas, and Oklahoma, Kansas)
SBC-Midwest operating companies (Illinois, Wisconsin, Indiana, Ohio, and Michigan)

Any deviation from this document needs to be approved by SBC Services Inc, NP&E & OSP Engineering. Tighter parameters may be used in specific SBC LOCAL EXCHANGE company departments.

3A. Overview of Ethernet

The TIA/EIA (Telecommunications Industry Association) developed a set of specifications for Commercial Building Cabling Systems. The TIA/EIA-568-B Series that covers the use of Electrical and Optical Ethernet services is in the Campus/Building environment. SBC Communications Services (IT) uses this standard, except within SBC-Midwest for internal IT needs only due to the embedded base where they continue to use TIA/EIA-568-A Series. (SBC-Midwest will use this TIA/EIA-568-B standard for customers along with the other SBC LOCAL EXCHANGE companies.) This set of standards may be obtained and viewed on the TIA web Site: http://www.tiaonline.org. The standards are performance technology based and are equipment/facility independent. The performance systems concentrate upon the nature of LAN communications within a campus or computer environment within the Customer's Premises.

The SBC LOCAL EXCHANGE companies have developed a new set of facility based standards that are more stringent and hardened for a Telecommunications environment. This standard set is independent of the TIA/EIA Category 5 and 6 standards. SBC-TP76412MP-000, *SBC-Electrical & Optical Ethernet Telco Category 5t & 6t Transmission Standards*, Issue 1, dated March 2003 provides provisioning and test standards that will meet and exceed both TIA/EIA and overall telecommunications standards throughout the Network. This document will incorporate

the Category 5t and 6t into an Ethernet Topology that will provide both the level of reliability and the cost benefits of a telco based Ethernet Service.

The actual products used in the SBC LOCAL EXCHANGE companies will be determined by Network Engineering (Common Systems) working with the Frame Committee, Cross Functional Sourcing Team (Frame-CFST), each State organization and Engineering Center. Requests for modifications and improvement shall be forwarded to Network Engineering (Common Systems) for review.

The Electrical Ethernet Architecture begins with the Ethernet Distributing Frame henceforth referred to as the EDF. The EDF will support the interconnection needs for transport equipment, customers and other telecommunications providers in serving Wire Center (WC) Area. The EDF Frame supports Electrical Ethernet technology and applications based upon Electrical Ethernet standard requirements.

While it is recognized that the ANSI TIA/EIA designs and architecture supported Commercial Customer Premises, there was a concern over the applicability of the architecture if it was overlaid to the local exchange companies. The need to have a long-haul solution with performance based objectives is essential for the success of Ethernet beyond the customer's premises. This document along with others will provide details associated with the SBC LOCAL EXCHANGE companies entry into the Ethernet world.

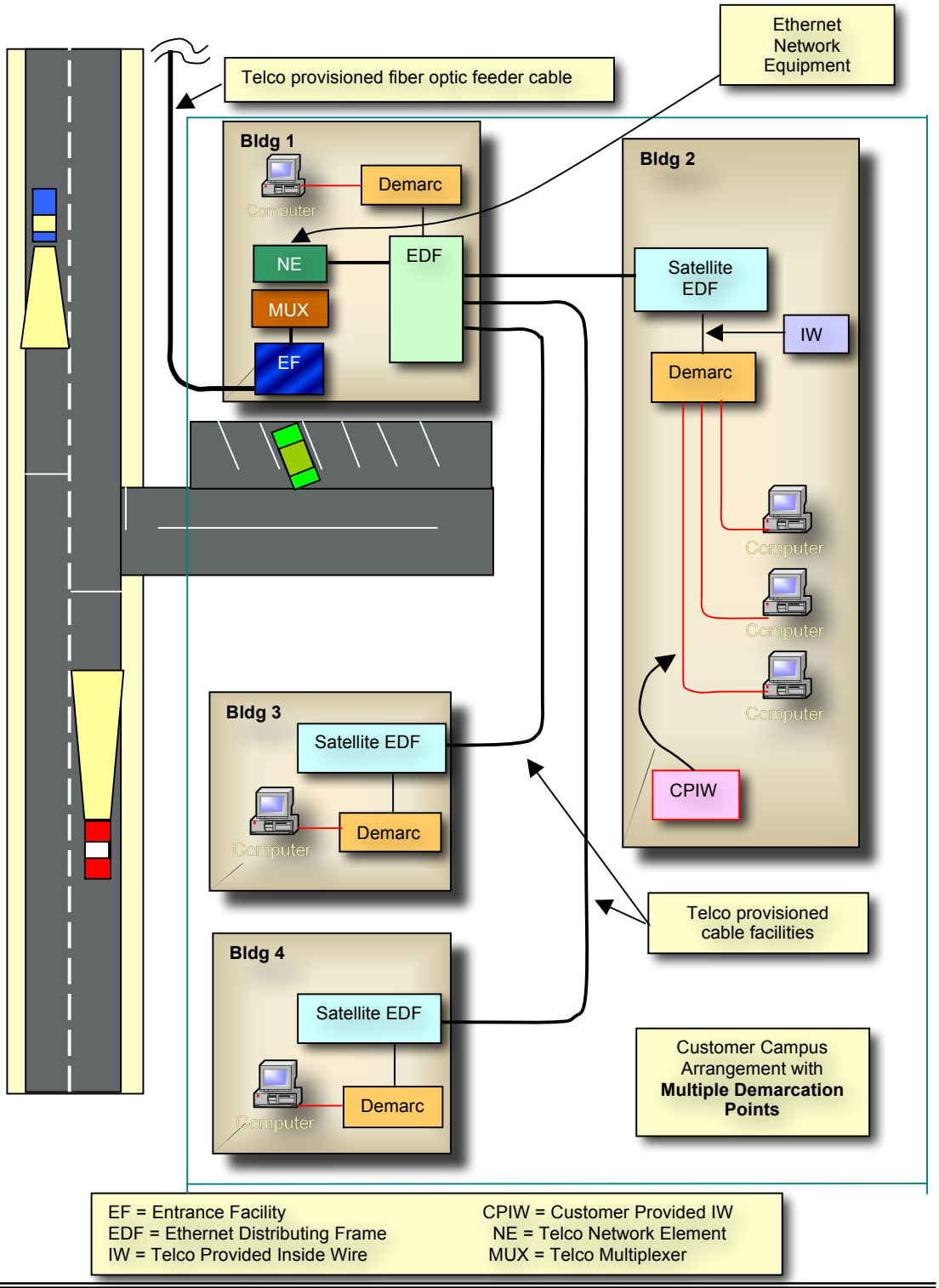
The following illustrations show the variances between a Single and Multi-Demarcation Point on the Customer's Premises as well as a Central Office layout. In every case and in every state, there are different regulatory requirements and stipulations regarding the product placement with one portion of the overall service from the Telco Network Equipment to the Customer Network Equipment. These variances and variables are frequently not a part of the Commercial Building and Customer Premises where the customer can generally have total end-to-end control on the placement and integration of their equipment.

In the first instance, the cable on the customer's premises is owned and managed by the local exchange carrier. The Multiple Demarcation points are highlighted and are determined by the Building/Property Manager. In addition, this is only applicable in certain states.

In the second illustration, the SBC LOCAL EXCHANGE company terminates at one demarcation point (as specified by the building owner and/or regulatory policy) with all cable, wiring and jumpers beyond this interface being the responsibility of the customer or building owner.

In the third illustration, a sample layout of a typical LOCAL EXCHANGE company Central Office is shown reflecting fiber optic facilities. In this instance, the fiber cabling would originate within the SBC Ethernet Transport equipment, route through the Fiber Distribution Frame and terminate on the Collocation Area equipment where the handoff customer is located (follow the red line).

Typical Campus Environment for Ethernet
With Multiple Demarcation Points



Typical Campus Environment for Ethernet
With Single Demarcation Point

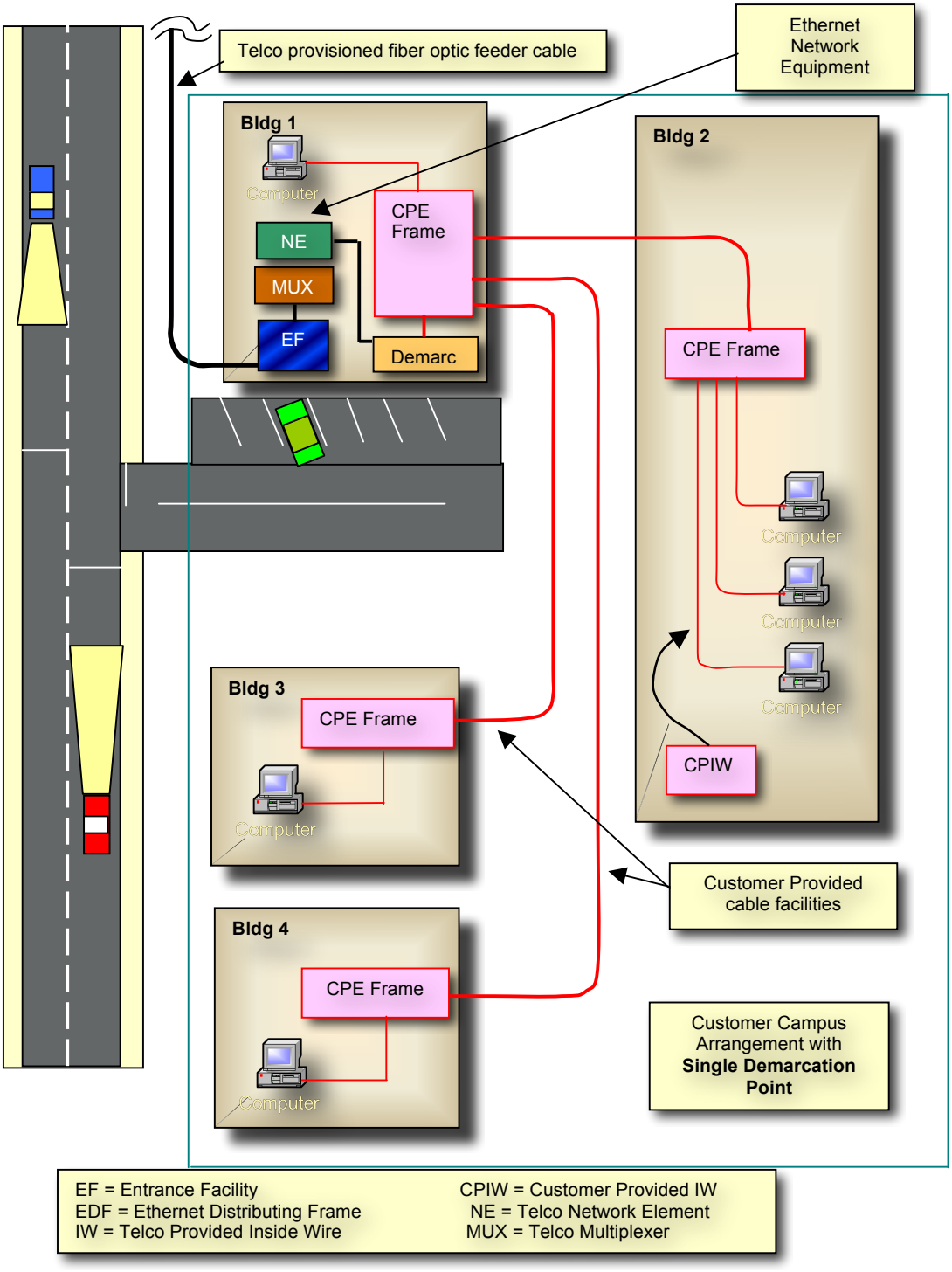
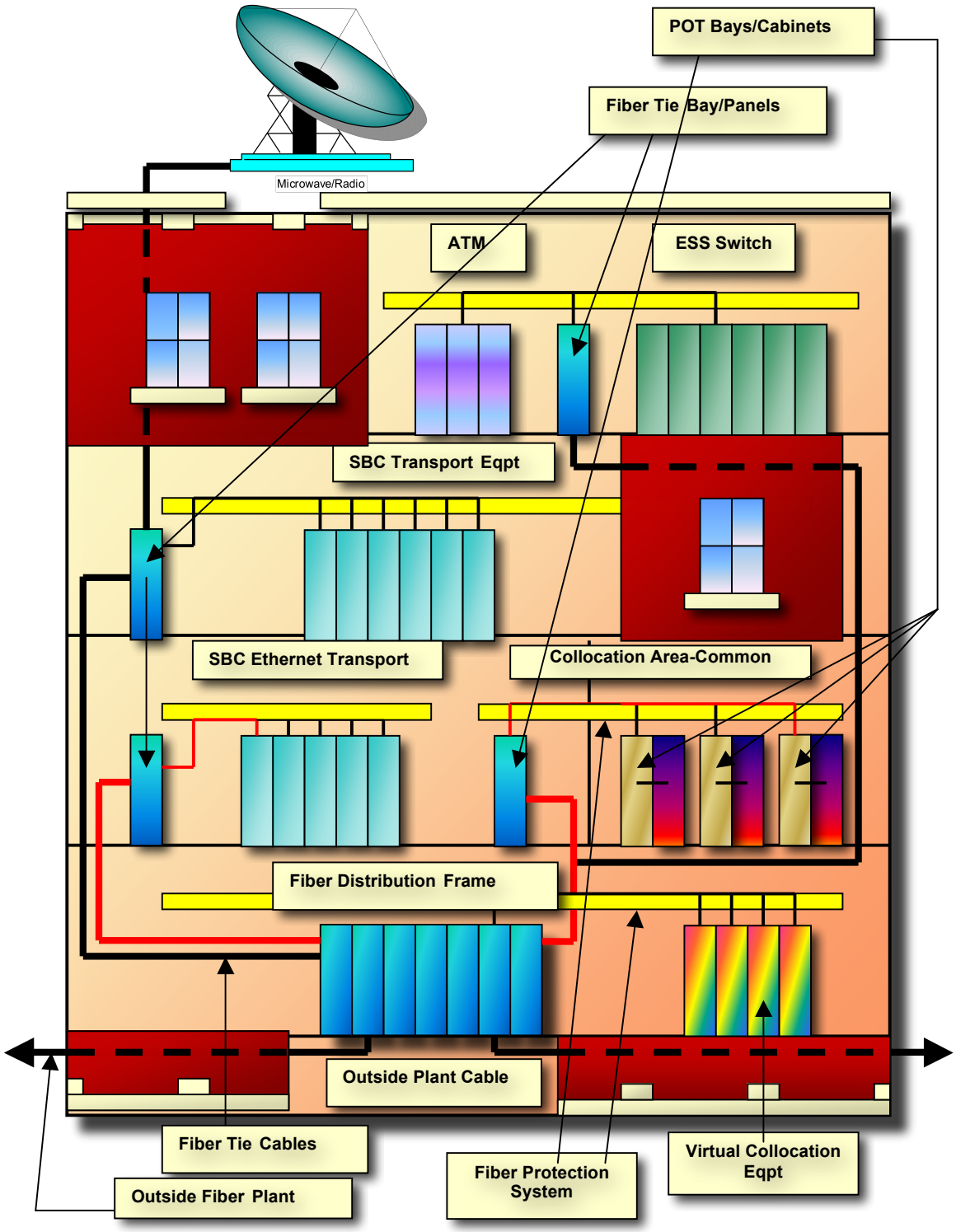


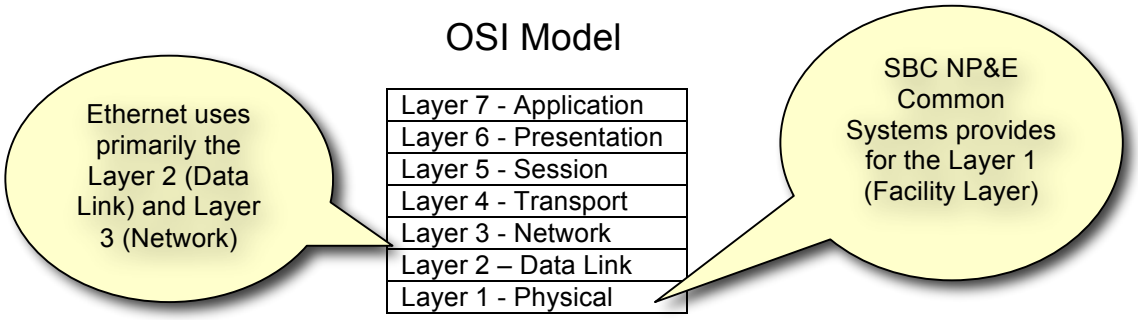
Illustration of SingleMode Fiber Optic Provisioning within the Central Office



3B. The OSI Model

In 1984, the International Standards Organization (ISO) created a layered model called the OSI (Open Systems Interconnect) model, to describe defined layers in a network operating system. This model is composed of seven layers, each specifying unique and specific network functions. A task or group of tasks are grouped to one of these layers which is reasonably self-contained and such that it can be implemented independently. This system has been used as a deployment model for services such as SONET, ATM and Ethernet providing the capability to permit one function to be transported within another layer.

The seven layers of the OSI model are unique and operate somewhat independently although they are dependent. If the facility layer of the service is not provisioned properly, then the data will not be transmitted or received correctly. Ethernet is generally placed in Layers 2-3. This document covers Layer 1, the facility layer. The deployment of Intelligent Network Elements and their standardization will dictate a set of consistent standards at the Facility Layer for their optimum operation. This document is an effort to maximize these Ethernet opportunities.



4. Electrical Ethernet Architecture Overview and Definition

4A. Definition

The Electrical Ethernet Distributing Frame (EDF) architecture serves as the primary interface between SBC's Ethernet network element bay and the far end termination point receiving the electrical ethernet signal within the central office or at a customer premise. The EDF provides a centralized point for the organization and administration of the Ethernet facility and intrabuilding Ethernet equipment cables and provides re-arrangeable connections between any two terminations or appearances. All electrical Ethernet circuits passing through SBC LOCAL EXCHANGE companies Central Offices will require termination on the EDF.

Electrical Ethernet Deployment within SBC LOCAL EXCHANGE companies Central Offices and Customer Premises locations shall adhere to the industry standards set forth in the SBC-TP76412MP-000, Electrical Ethernet Telco Standards, Issue 1, dated February 2003 and Telcordia GR-3111-CORE Document as an expected deliverable October 2003.

4B. Network Role

EDF design is suitable for use in both large and small central offices and customer premises. The system serves as centralized termination, test access, cross-connection points and distribution frames for all electrical ethernet network elements.

4C. Strategic Direction

The EDF will be the primary interface and cross-connect point for all Electrical Ethernet products, cabling and equipment as well as a pivotal part of the telecommunications infrastructure. This frame will be the primary cross-connect point with Intelligent Network Elements such as the Fujitsu 4300 and 4500 series and the Nortel 3400 and 3500 series. The EDF is the direct cable cross-connect point for all SBC Ethernet Network Elements to one another.

4D. Electrical Ethernet Guidelines

All new Electrical Ethernet installations shall conform to NEBS requirements as described in SBC-TP76200MP-000.

Electrical Ethernet signals operate at 10/100/1000 Base-T speeds i.e. 10, 100 or 1000 MBPS (1 Gigabit). Therefore, Electrical Ethernet provisioning will be bound by Category 5t and 6t cable restrictions and length limitations. **The EDF cross-connect architecture will be used in the SBC LOCAL EXCHANGE companies.**

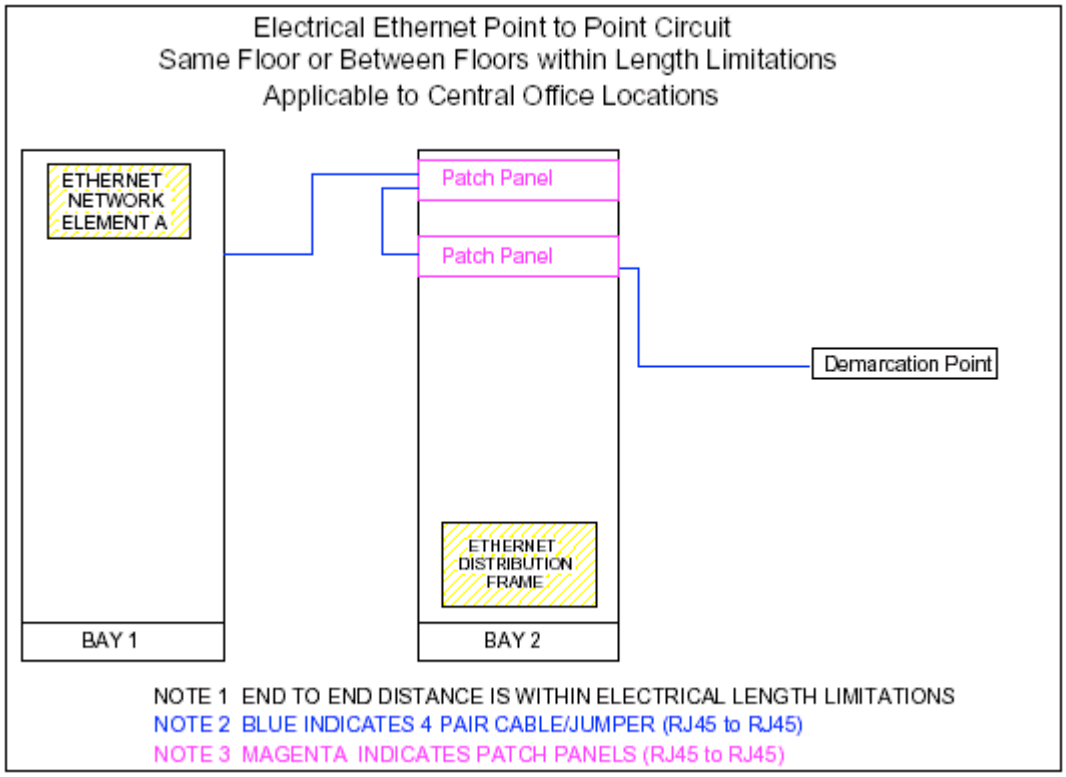
Ethernet interconnection between network transmission equipment and the EDF will be terminated on the rear of an Ethernet Termination shelf (Patch Panel). This connection will be made using RJ-45 type connectors and Category 5t or 6t type cable. The cross-connect termination between the originating C.O. transmission equipment and the customer's far end receiving equipment will be connected via cross-connect jumpers at the time a service request is initiated. The cross-connect between the originating C.O. transmission equipment and the customer's far end receiving equipment will be made in a front to front arrangement via RJ-45 type connectors and Category 5t or 6t cable at the EDF. **The EDF shall always utilize the cross-connect methodology.** The interconnection of originating Ethernet equipment to the far end termination point within the Central Office will be through the full cross-connect design of the Ethernet Distribution Frame. In other words, under no circumstances will C.O. Ethernet equipment be directly terminated on the front access ports of the customer's far end termination panels but, will be terminated on the rear of said panels and will be subsequently cross-connected via a patch panel at the EDF.

Due to restrictive length limitations of Cat 5/5e and Cat 6 twisted pair cable, when the placement of Ethernet Equipment is such that the end to end distance between the termination points is greater than 100 meters (328ft), the use of Media Converters should be employed. Media Converters are necessary in order to convert an electrical Ethernet signal to an optical signal and back again in order to extend the Ethernet signal between termination points greater than the 100 meters in length. 10/100 Base-T Ethernet circuits require the use of Cat5T cable in order to meet satisfactory transmission levels at 100 meters. 1000 Base-T (1Gig) circuits require the use of Cat6T cable in order to meet satisfactory transmission levels at 100 meters. The use of 1000 Base-T (1 Gb/s) services will dictate the use of Media Converters more extensively. Refer to Section 6.E.1, *Electrical Cable and Jumper Placement Expectations and Limitations* for more information on the subject.

When the equipment placement is located on another floor or a non-contiguous equipment area, a Fiber optic tie cable terminated on OSP panels will be placed from the FDF to that remote area and terminated on a **satellite FDF** in its own bay. From this satellite location, Fiber Protection Systems will be placed in a logical layout to support the eligible area for each Network Element. The remote area will be supported through Fiber patch cords to the Network Element allowing for rapid fiber deployments at minimal dedicated long-term costs. Ethernet Distributing Frames (EDF) will use the same satellite topology when traversing building structures within the Central Office.

For more information concerning Administrative Office Environments, refer to the internal SBC document, *ITO Structured Cabling System Standards*, Version 3.3.1, issued September 2002. This document covers the internal SBC LOCAL EXCHANGE companies plan to provide interconnection within their own structures. It does not support the placement of customer facilities whether at the SBC LOCAL EXCHANGE companies Central Office or at the Customer Premises/Building Owner locations.

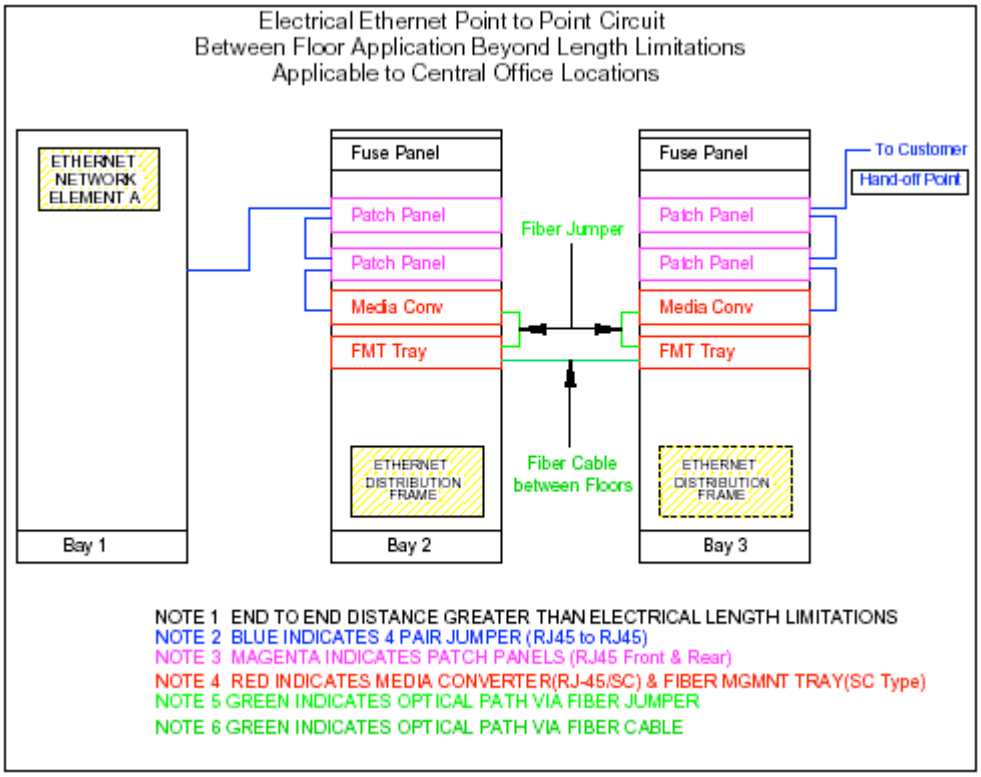
4E. Electrical Ethernet Architecture for the Central Office



This Central Office solution requires the use of an Ethernet Distributing Frame (EDF) for all cross-connects for the electrical Ethernet services between the Network Elements and the subtending customers located within the office. Typically, the customer will be a Competitive Local Exchange Carrier (CLEC) that will order this service to their Physical or Virtual Collocation Site. In this instance, Bay 1 would represent the Telco provided Network Element that would be cabled to the EDF, Bay 2. Depending upon the CLEC, Tariff, Interconnection Arrangement (ICA) or the Memorandum of Understanding (MOU) between the CLEC and the ILEC (Telco), the CLEC may request or perform one of two termination methods:

1. Request the Telco to cable using Cat 5t/6t electrical cabling from the EDF located at Bay 2 to the CLEC's Collocation Site.
2. Request assignment locations for the CLEC to terminate their cable on the cable termination (backside) of the EDF data panel and terminate the distant end within their collocation site and equipment.

Note: Based upon the responsible party, the use of optical Media Converters may be warranted and paid by the responsible party for the placement of cabling between these two sites.

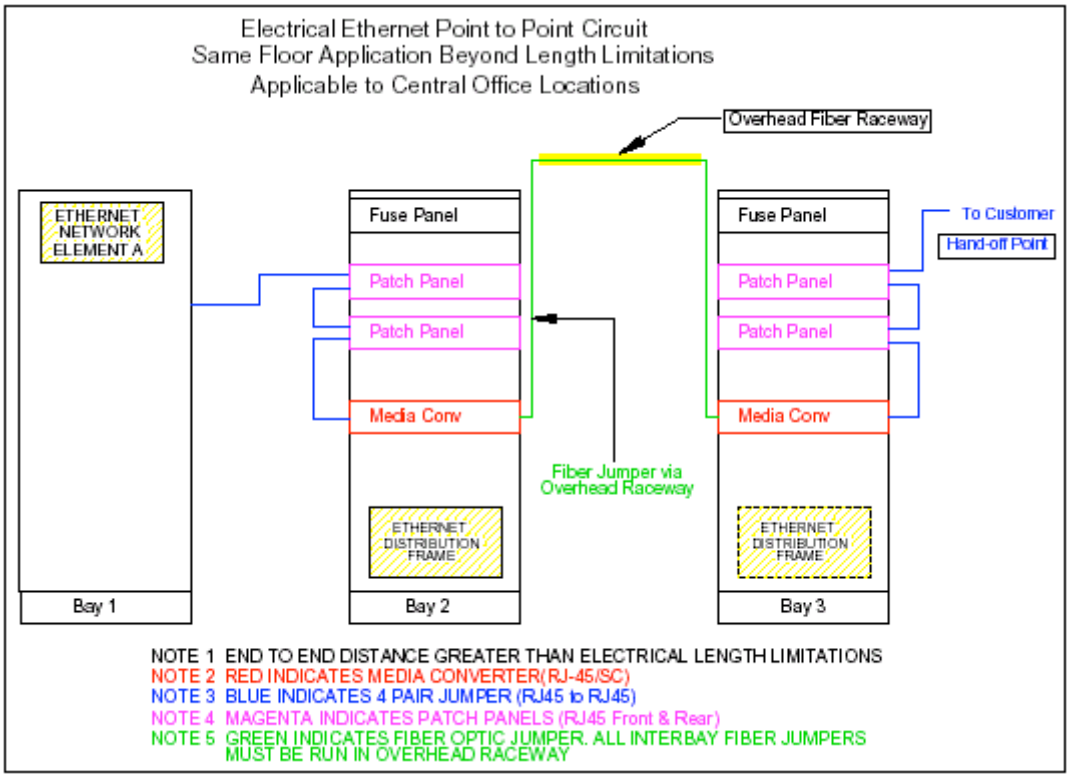


This Central Office solution requires the use of an Ethernet Distributing Frame (EDF) for all cross-connects for the electrical Ethernet services between the Network Elements and the subtending customers located within the office. Typically, the customer will be a Competitive Local Exchange Carrier (CLEC) that will order this service to their Physical or Virtual Collocation Site. In this instance, Bay 1 would represent the Telco provided Network Element that would be cabled to a satellite EDF located in Bay 3 via Fiber optic cable. Depending upon the CLEC, Tariff, Interconnection Arrangement (ICA) or the Memorandum of Understanding (MOU) between the CLEC and the ILEC (Telco), the CLEC may request or perform one of two termination methods:

1. Request the Telco to cable using Cat 5t/6t electrical cabling from the EDF located at Bay 3 to the CLEC's Collocation Site.
2. Request assignment locations for the CLEC to terminate their cable on the cable termination (backside) of the EDF data panel and terminate the distant end within their collocation site and equipment.

Note: Based upon the responsible party, the use of optical Media Converters may be warranted and paid by the responsible party for the placement of cabling between these two sites.

Recognizing that the average distance between the CLEC and the normal Distributing Frame is 180 feet, the need for Media Converters/Ethernet Extenders could be needed in as many as 50% of the service instances. Be wary to place Network Elements close to the EDF to mitigate the need for these extenders on the other side between Bay 1 and Bay 2 as well.



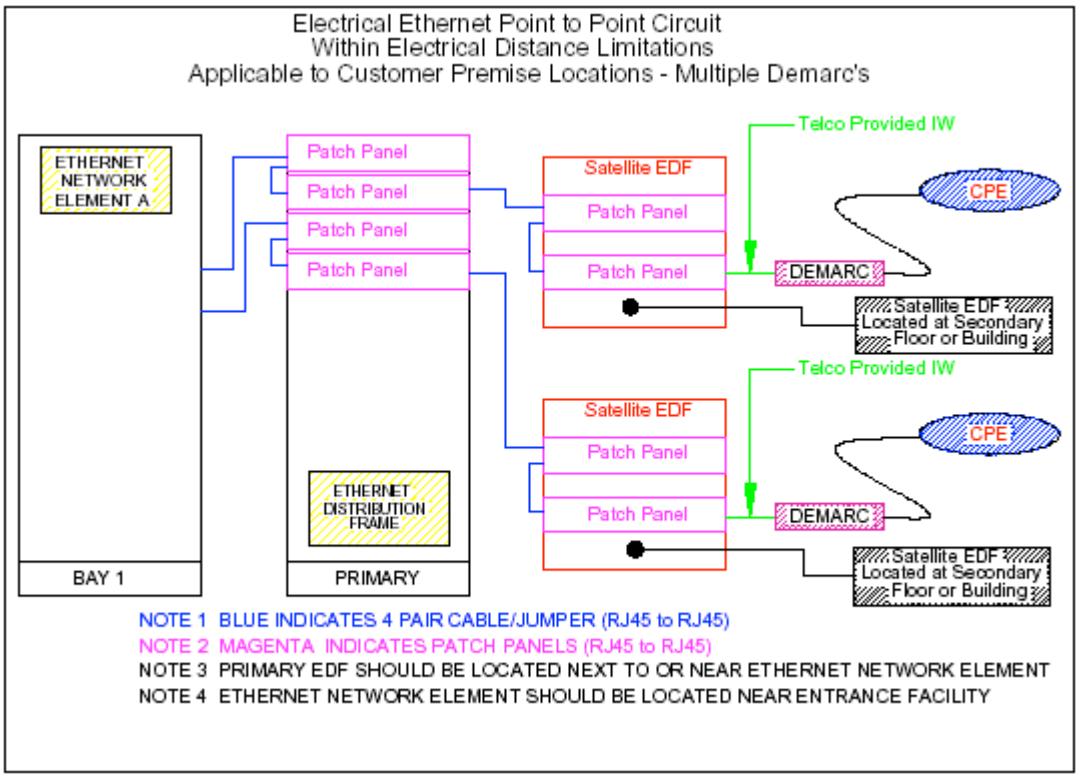
This Central Office solution requires the use of an Ethernet Distributing Frame (EDF) for all cross-connects for the electrical Ethernet services between the Network Elements and the subtending customers located within the office. Typically, the customer will be a Competitive Local Exchange Carrier (CLEC) that will order this service to their Physical or Virtual Collocation Site.. In this instance, Bay 1 would represent the Telco provided Network Element that would be cabled to a satellite EDF located in Bay 3 via Fiber Jumpers. Depending upon the CLEC, Tariff, Interconnection Arrangement (ICA) or the Memorandum of Understanding (MOU) between the CLEC and the ILEC (Telco), the CLEC may request or perform one of two termination methods:

1. Request the Telco to cable using Cat 5t/6t electrical cabling from the EDF located at Bay 3 to the CLEC's Collocation Site.
2. Request assignment locations for the CLEC to terminate their cable on the cable termination (backside) of the EDF data panel and terminate the distant end within their collocation site and equipment.

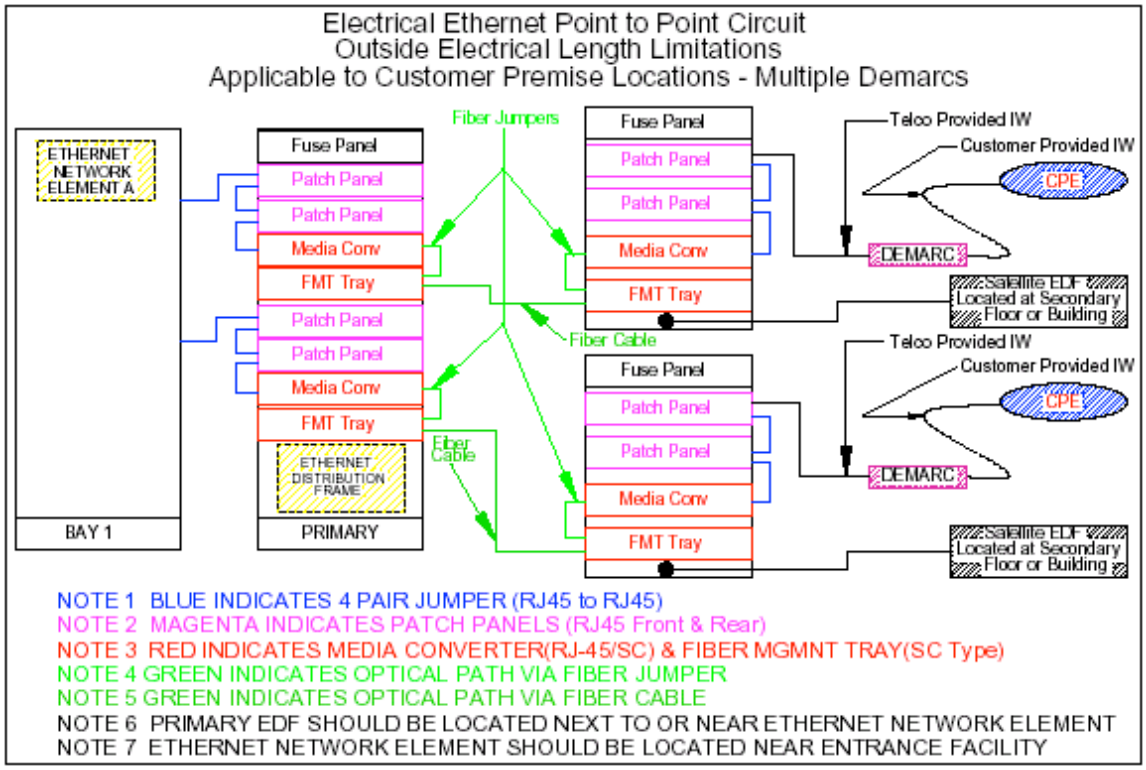
Note: Based upon the responsible party, the use of optical Media Converters may be warranted and paid by the responsible party for the placement of cabling between these two sites.

Recognizing that the average distance between the CLEC and the normal Distributing Frame is 180 feet, the need for Media Converters/Ethernet Extenders could be needed in as many as 50% of the service instances. Be wary to place Network Elements close to the EDF to mitigate the need for these extenders on the other side between Bay 1 and Bay 2 as well.

4F. Electrical Ethernet Architecture for the Customer Premises

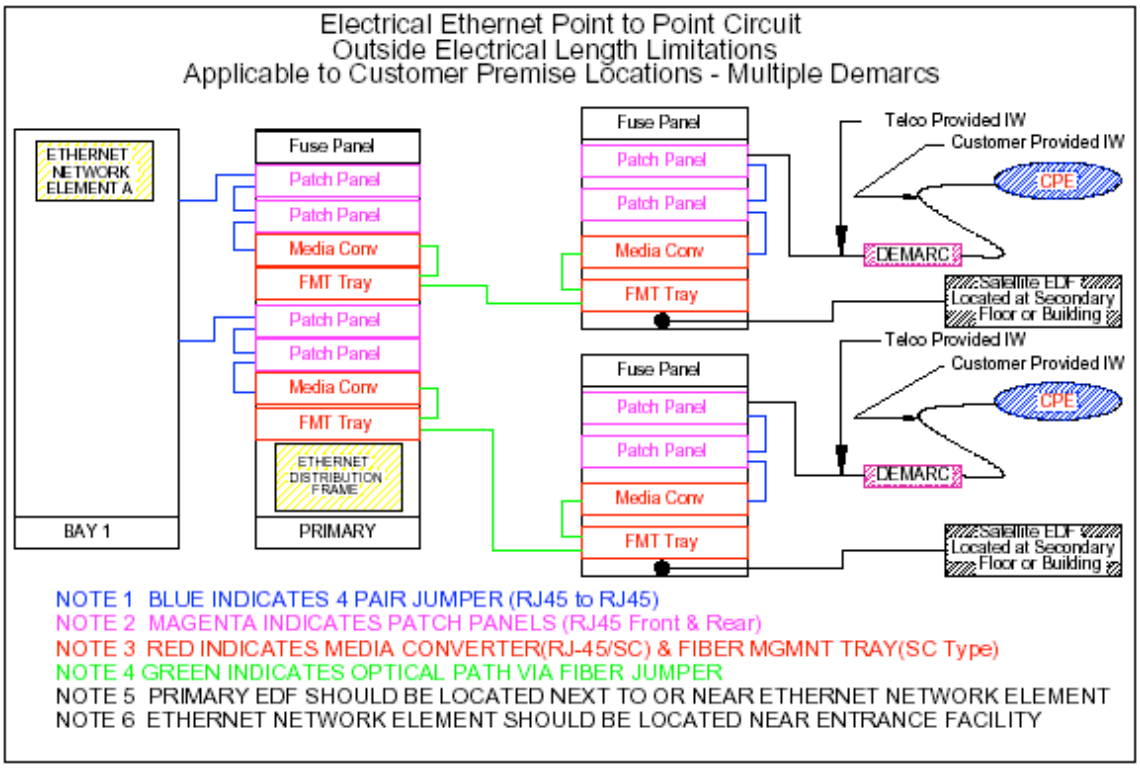


This is the best and most cost-effective solution for a single or multiple Demarcation Point location (multiple versions shown). This illustration shows a large customer on a campus or large hi-rise building, yet the distances are within reach of an electrical Ethernet signal. In this instance, Bay 1 would be placed near the cable head at the primary entrance facility. Bay 2 represents the cross-connect frame that will connect the copper-based terminations and the Network Element Bay 1 with the house riser facilities. From Bay 3, the Telco can hand off a non-converted electrical signal as requested by the customer. Additional Note: SBC LOCAL EXCHANGE companies will not place Media Converters beyond the Demarcation Point.



This illustration shows a large customer on a campus or large hi-rise building. In this instance, Bay 1 would be placed near the cable head at the primary entrance facility. Bay 2 represents the cross-connect frame that will connect the copper-based terminations and the Network Element Bay 1 with the house riser facilities. In this instance, we have knowledge that the distance between the entrance facility and the customer premises at a remote location will exceed our distance limitation and will necessitate the use of a Media Converter/Ethernet Extender to Bay 3 on the Customer Premises using SingleMode Fiber optic cable being placed between Bay 2 and 3. From Bay 3, SBC can convert the signal back to an electrical service as requested by the customer. Additional Note: SBC LOCAL EXCHANGE companies will not place Media Converters beyond the Demarcation Point.

This is one of the least desirable and most costly solutions. It will require advanced planning and will have necessitate the pre-provisioning of cable and FMT panels in advance in order to meet service order intervals.



This illustration shows a large customer on a campus or large hi-rise building. In this instance, Bay 1 would be placed near the cable head at the primary entrance facility. Bay 2 represents the cross-connect frame that will connect the copper-based terminations and the Network Element Bay 1 with the house riser facilities. In this instance, we have knowledge that the distance between the entrance facility and the customer premises at a remote location will exceed our distance limitation and will necessitate the use of a Media Converter/Ethernet Extender to Bay 3 on the Customer Premises. The use of Fiber Jumpers to connect Bay 2 with Bay 3 can be performed only if the use of Customer Provided Fiber Protection (Raceway) troughs are placed between these two locations. Otherwise, the Telco will need to place fiber cable and associated end-panels.

This solution is expensive and requires the Telco to measure and order a specific long length of Fiber Jumpers to connect between the two bays and place the Bay 3 at additional cost. It will require advanced planning and will necessitate the pre-provisioning of cable and FMT panels in advance in order to meet service order intervals.

Important Note: Fiber Jumpers will not be placed in exposed, non-protected above or below floor standard cable racks.

4G. EDF Components for the Central Office

4G.1 General

The EDF shall consist of the following components as required, Power Supply Fuse Panel, Patch Panels, Fiber Optic Management Tray and Media Converter. See **Figure 1** for an illustration.

Note: The use of the fuse panel, the fiber optic splice tray and the media converter will only be required when an Electrical Ethernet circuit is required and the point to point termination distance is beyond the reach of the Ethernet Network Equipment. This would require the use of a Media Converter to convert the circuit from electrical to optical and back again in order to meet the length limitation requirements of an electrical Ethernet signal.

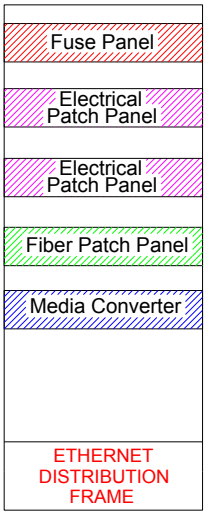


FIGURE 1

4G.2 Power Distribution Unit (Fuse Panel)

A power distribution unit (PDU) is a single frame-mounted panel, self-contained unit. It shall accommodate single or dual (A/B) input power feeds and internally distribute each input into multiple protected DC power outputs (fuses or breakers). In most applications, PDU's are typically mounted at the top of a relay rack and take up less that 8% (approximately 6 in.) of the total available space. PDU's have limited capacities, utilized for same-bay or adjacent-bay loads, and are generally fed from the secondary (Battery Distribution Fuse Bay) power distribution network. Single feed PDU's may accommodate between 10 to 30 individual loads, where a dual-feed PDU may accommodate from 4 to 20 loads per feed.

Input protection for PDU's is limited by the rating of the PDU panel and the maximum size of the serving fuse at the source (BDFB). PDU's should never be fused at the BDFB with protectors larger than the rating of the panel. Exceeding the panel limitation may allow the PDU to be over-utilized causing permanent damage to the panel as well as a loss of service to the distributed loads.

A PDU will be required at the EDF whenever there is need for a Media Converter. Refer to technical drawing SBC-E-00151-E for appropriate panel selection.

4G.3 Electrical Ethernet Patch Panel

Electrical Ethernet Patch Panels will be available in several different configurations. The first is the straight pass through RJ-45 type connector on the rear of the panel going to a RJ-45 type connector on the front of the panel. The RJ-45 to RJ-45 type of patch panel is available in either 24 or 48 port configurations and is capable of handling electrical Ethernet circuits of speeds up to and including 1000Mbps. This application would only allow individual circuit feeds from the network element to the rear of the patch panel located at the EDF. **See Figures 2 and 3.**

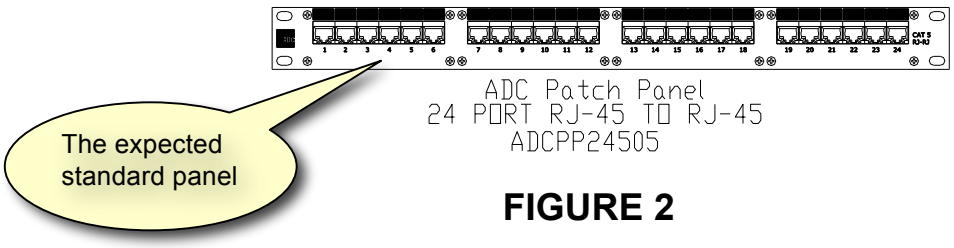


FIGURE 2

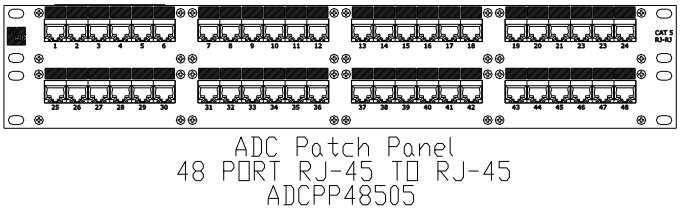


FIGURE 3

4G.4 Fiber Management Tray

A Fiber Management Tray or panel within the EDF will be necessary when there is a need to run fiber between floors. ADC will manufacture the Fiber Management Tray or FMT panel. It will be available in a couple of different configurations and should be applied according to particular needs. The most common application will be a termination/storage type panel. This allows for individual fiber leads to terminate at the panel for breakout application as well as fiber management due to the storage spools within the panel itself. FMT panels are available in 12 or 24 position configurations. **See figure 4.**

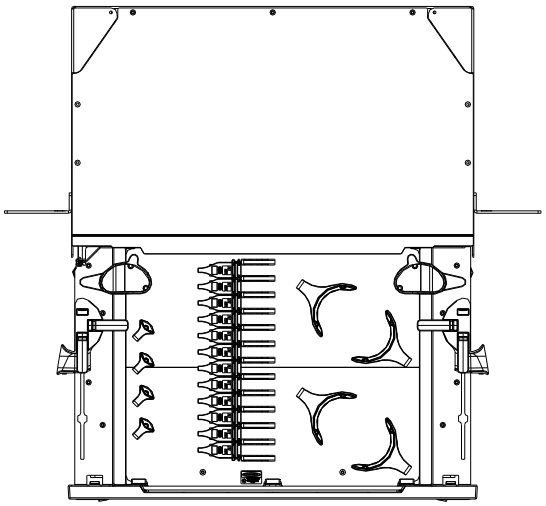


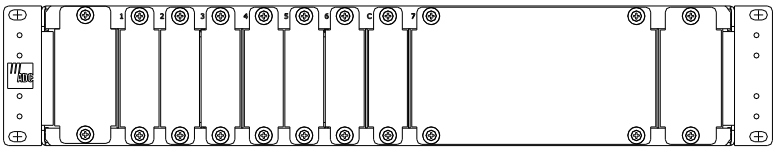
FIGURE 4
(Top View)

This tray will come in two flavors, MultiMode and SingleMode with varied cable tail lengths to match requirements for IFNR cabling. Each panel will be labeled as to the type of facilities used. The MultiMode and SingleMode cables and terminations will not be intermixed within the same panel.

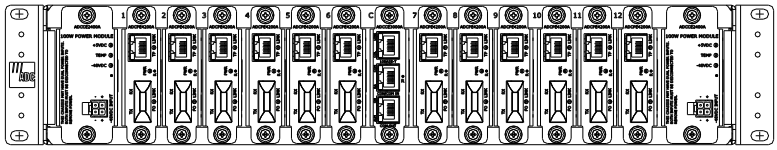
4G.5 Media Converter Overview

A media converter will be required at the EDF when an electrical circuit is to be provided and the end to end distance of the circuit exceeds the Ethernet Network Equipment reach specifications on the Telco side of the Demarcation Point. In this application the circuit will need to be converted from an electrical signal to an optical signal and back again in order to meet length limitation requirements. Placing media converter at each end of the circuit increases the maximum distance of the circuit up to 12.4 miles or 20 Kilometers. The media converter chassis provides electrical power and communications to converter modules, an alarm or SNMP CPU through the back plane. All media converter modules are installed from the front of the chassis. The media converter chassis is a two rack unit (2RU) high chassis. Single slot blank panels are available and may be used to fill any unused slots in the chassis.

The chassis holds up to 12 media converter modules. The converter modules will be configured with RJ-45 connectors for the electrical I/O and SC type connectors for the optical I/O. The chassis, will be equipped with 2 power supply modules that provide redundant -48Vdc power to the chassis back plane. The power modules will be located on each end of the chassis. The alarm or SNMP module will be located in the center slot of the chassis. Converter module slots count 1 through 12 starting at the left side of the chassis if you are facing the front of the unit. The power modules and SNMP CPU module are not counted. **See Figure 5.**



ADC MEDIA CONVERTER
12 PORT CHASSIS W/BLANK CARDS
ADCCE1100A



ADC MEDIA CONVERTER
12 PORT CHASSIS EQUIPPED WITH
(2) POWER, (1) SNMP CPU AND (12) CONVERTER MODS

FIGURE 5

4G.6 Signal Enhancement Responsibilities

The use of Media Converters or Extenders described in this document are for use only between the Telco provided Ethernet Network Equipment and the Handoff or Demarcation Point. The effort will be to provide the best signal possible at the Demarcation Point with annotation of the loss distances present. Telco provisioned range extension devices are not intended to provide additional circuit reach beyond the Demarcation Point through Customer facilities.

It must be officially noted that the distance between the Demarcation Point and the Customer Premises Equipment (CPE) reflects Customer Owned and Maintained (COAM) facilities. The Customer is responsible for any facility and/or extension devices necessary to extend the reach of the service from the designated Demarcation Point to a remote CPE location through his COAM. The customer will want to test their facilities on their side of the Demarcation Point to assure themselves that the CPE is not too distant to provide good circuit performance.

If the distance is too great between these points, the customer might want to either provide their own enhanced range extension devices or request an Optical Ethernet Service from the Telco to the Demarcation Point that will not be a susceptible to electrical and subsequent distance limitations to their Ethernet Network Equipment. The SBC LOCAL EXCHANGE companies will not place Media Converters beyond the Demarcation Point. The customer may use a non-local exchange telco to provide this arrangement.

4H. EDF Components for Customers Premise

The Ethernet Distributing Frame (EDF) components will be the same on the Customer's Premises. The only difference will be the relaxed standard permitting the use of field formed RJ-45 connectors on the Customer's Premises between the Ethernet Network Equipment and the Demarcation Point.

The EDF is intended to be placed in close proximity to the Network Equipment at a point of the Entrance Facility and Single Demarcation Point (if applicable). The star topology of cabling will be used from the EDF to the customer Demarcation Sites within the premises. The EDF is the termination point for both electrical and optical Ethernet signal traffic. It is not the termination point for other regulated services such as Cat 3t twisted pair services or riser cable. In addition, customer owned and Maintained (COAM) is not intended to be terminated on this frame.

The cross-connect methodology is the expected standard for maximum flexibility of assignments and maintenance needs.

5. Optical Ethernet Architecture Overview and Definition

5A. Definition

The Optical Ethernet Architecture will use the "Star Topology" where the customer or subtending devices will be home run (a direct route from one device or point to another) from the Fiber Distributing Frame located either on the SBC LOCAL EXCHANGE companies Central Office or the primary entrance facility to the building or campus structure. The Fiber Distributing Frame (FDF) will serve as the primary interface between SBC LOCAL EXCHANGE companies Ethernet network element bay and the far end termination point receiving the optical ethernet signal within the central office or at a customer premise. The FDF provides a centralized point for the organization and administration of the ethernet facility and intrabuilding ethernet equipment cables and provides re-arrangeable connections between any two terminations or appearances. All optical ethernet circuits passing through SBC LOCAL EXCHANGE companies Central Offices will require termination on the FDF.

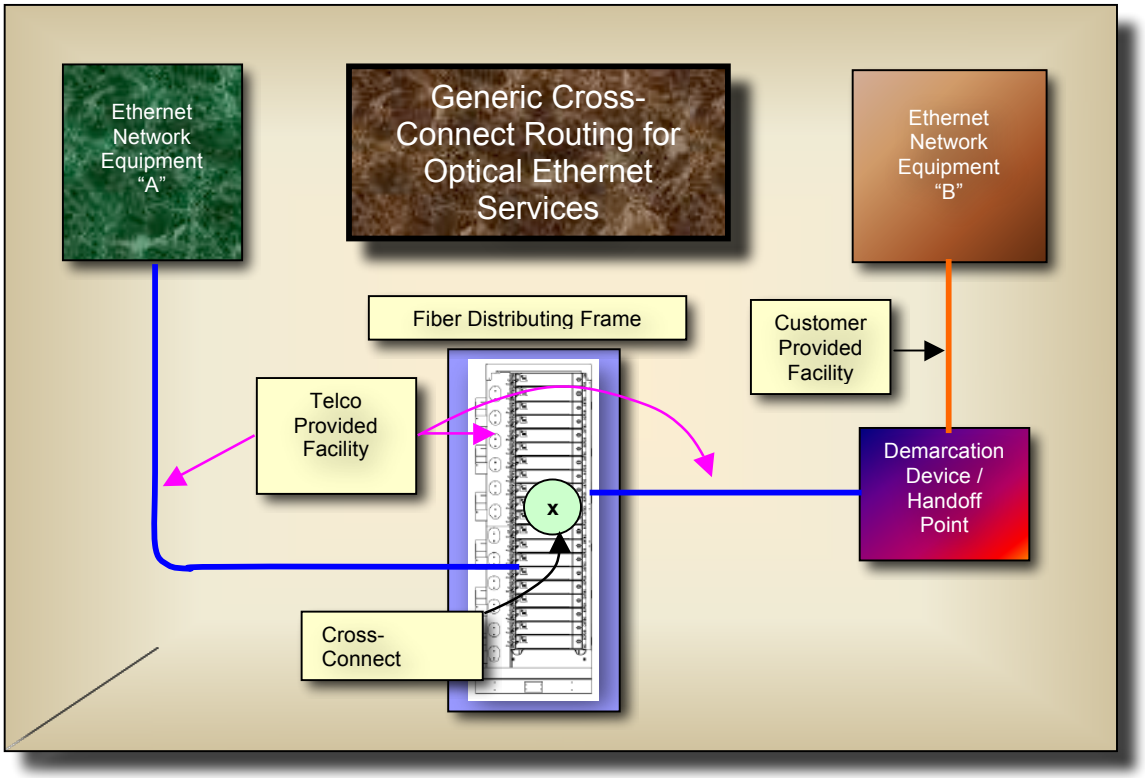
Optical Ethernet Deployment within SBC LOCAL EXCHANGE companies Central Offices and Customer Premises locations shall adhere to the industry standards set forth in the SBC-TP76412-000, *Ethernet Standards for the SBC LOCAL EXCHANGE companies*, Issue 1, dated March 2003 and Telcordia GR-3111-CORE Document as an expected deliverable October 15, 2003.

Optical Ethernet services will be transported via other OSI Model, Network Layer 2 services such as Synchronous Optical Network (SONET) rings. The Ethernet circuit will be encapsulated within the SONET signal in the same way that a car uses the Interstate Highway system. At such time that the Ethernet signal is demultiplexed through Ethernet Network Equipment, the signal takes the off ramp off the highway and is routed through the core intersection. The signal will be a stand-alone optical circuit from the Network Equipment routed through the FDF to the next Network Equipment element expected to be owned and managed by the customer and/or CLEC. At some point on the drop side of the FDF toward the customer, the Demarcation Point will be placed depending upon the Demarcation rules established by the customer/building owner and the respective state Public Utility Regulations. See Section 3 for some illustrations.

Notice: As of the writing of this document, MultiMode Services are not authorized in SBC LOCAL EXCHANGE companies per SBC-002-316-078, SBC Fiber optic /Mode Policy, issue 1, dated Jan 2003.

5B. Network Role

Fiber Distribution Frame hub design is suitable for use in both large and small central offices and customer premises. The system serves as centralized termination, test access, cross-connection points and distribution frames for all Optical Ethernet network elements. See the illustration below:



5C. Strategic Direction

The FDF is planned to be the primary interface and cross-connect point for all Fiber Optic products, cabling and equipment on the telecommunications horizon, including optical Ethernet services. This frame will continue to be the primary cross-connect point with Intelligent Network Elements such as Optical Multiplexers, DWDM, FTM, and Optical Amplifiers. *The FDF is the direct cable cross-connect point for all SBC LOCAL EXCHANGE companies Network Elements to one another.*

Optical Ethernet services will traverse this FDF system for cross-connects to other Network Elements and Outside Plant (OSP) facilities. The best approach for connectivity will be the use of Fiber optic jumpers between all connection points within the Central Office. Both SingleMode and MultiMode jumpers may used in the same Fiber Protection System.

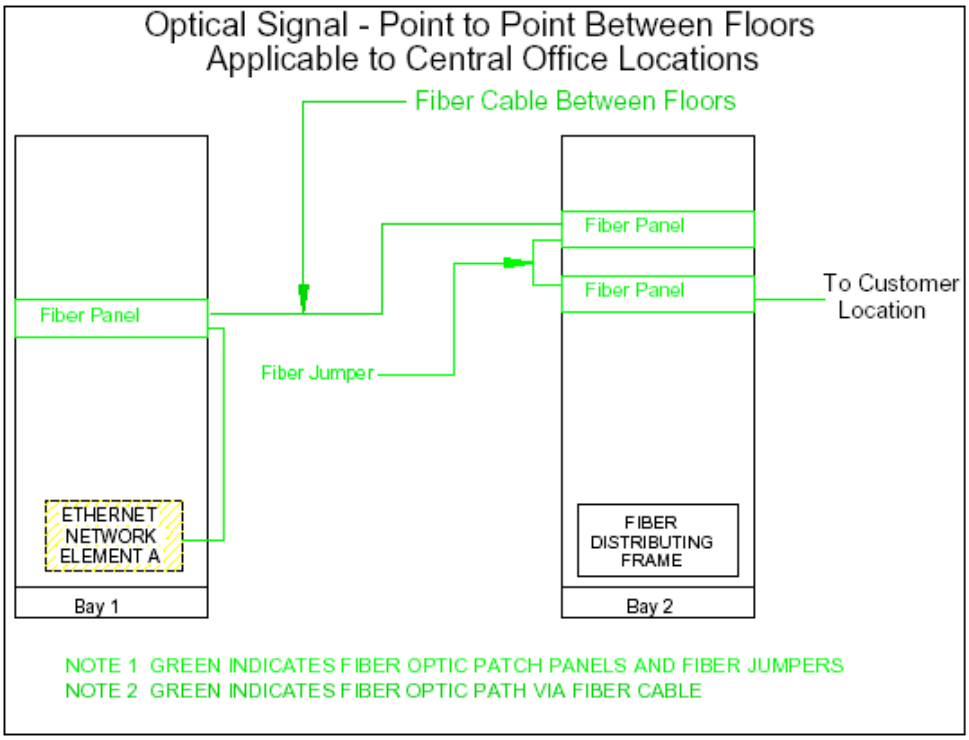
The only exception to the FDF cross-connect philosophy will be in the instance where Media Converters are used to extend the range of the Electrical Ethernet and thereby converting the signal to an optical path to the distant converter. It is expected that one Media Converter would be placed within or adjacent to the Telco Network Equipment location and the other in the Ethernet Distributing Frame (EDF).

The Fiber Protection System represents a separate and unique fiber optic protection system used only for fiber optic patchcords between Transmission and Switch equipment and the FDF**.** All equipment which uses fiber optic connectivity will hub to the FDF for all connections. This protection system will provide both separation from all other cable racks and will provide a protection of the fiber optic patchcords from installation activity in a Central Office. The Protection System will provide a diverse route capability for the SONET ring paths for primary routes from the Transport/Switch equipment to the FDF. The fiber pairs will be cross-connected at the FDF to either diverse OSP facilities or to other intraoffice equipment. The Protection System will be provided to within 2 inches of the Fiber Distribution Frame (FDF) and located to the adjacent vertical trough and at the same level horizontally as the Transport/Switching equipment termination point on the primary route. The Protect jumper will be routed differently through a parallel Fiber Protection System to the FDF. **Fiber Optic Cables will not be placed in the raceway/duct work of the Fiber Protection System.**

The FDF shall be the primary hub for the Local Exchange Company Central Office. The Fiber Protection System will be the primary tool for fiber optic cabling on each floor. The FDF will be treated as the common cable entrance and cross-connect point. When there is a need for fiber optic cabling to equipment on another floor, a tie cable will be terminated in a shelf on the FDF and will be directly terminated on a new satellite FDF bay on that other floor using a FOT shelf. The Fiber Protection Shelf will be extended from the FDF's to the equipment involved within the Central Office.

Do not place any jumper slack or in-line attenuators in the Fiber Raceways. All attenuators will be affixed to the faceplate of FOT panels located within the FDF. All slack will be stored within the slack containment areas of the FDF.

5D. Optical Ethernet Architecture for the Central Office



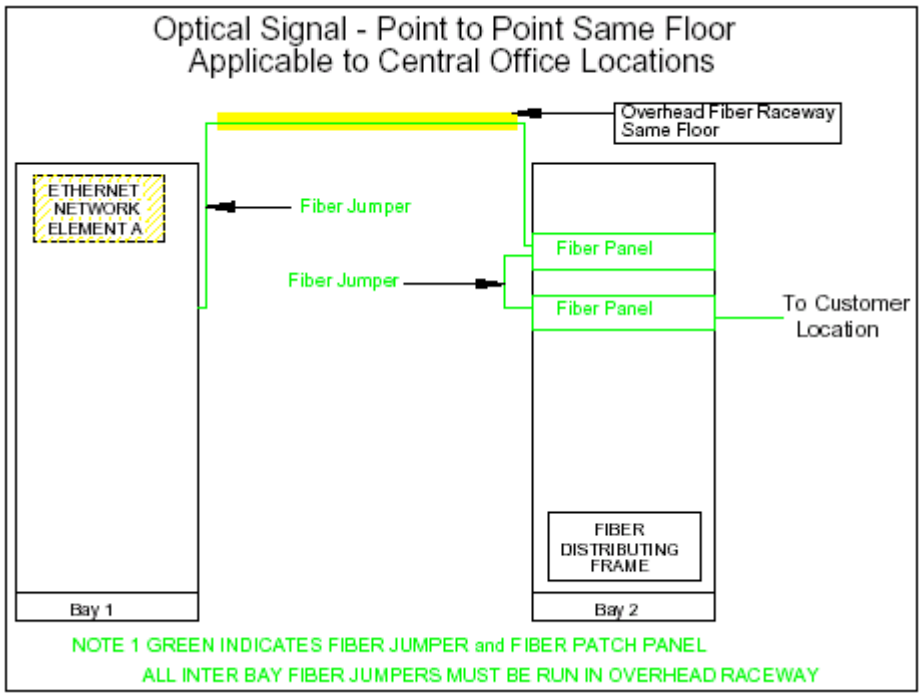
In this illustration, The Ethernet circuit is provided between floors and requires the use of Fiber optic cable instead of non-protected jumpers. Fiber provisioning within one Central Office floor not separated by a firewall, floor or ceiling can use Fiber Raceways and Jumpers for interconnection. Network Elements placed outside of this area that need to be connected to another area will require the use of fiber cable run to the FDF, not jumpers terminated to the FDF.

The cabling will extend from the Network Element bay to the left through the walls of the Central Office to the FDF to the back of the Fiber optic Terminal (FOT). From that point, the service will be cross-connected via Fiber optic jumpers within the FDF to another FOT panel supporting the customer/CLEC. Based upon Collocation requirements and the selection of provisioning by the CLEC, the cabling from the back of the second FOT to the customer may be provided by either the CLEC or the ILEC to the customers location (with certain limitations covered in another section of this document) for a handoff. The customer/CLEC will terminate the fiber optic facility to their Ethernet Network Equipment.

TMXT/RCV turnover rules apply.

No attenuators are needed.

Fiber optic jumpers will be the normal method of connection except where floor/wall boundaries exist between elements.



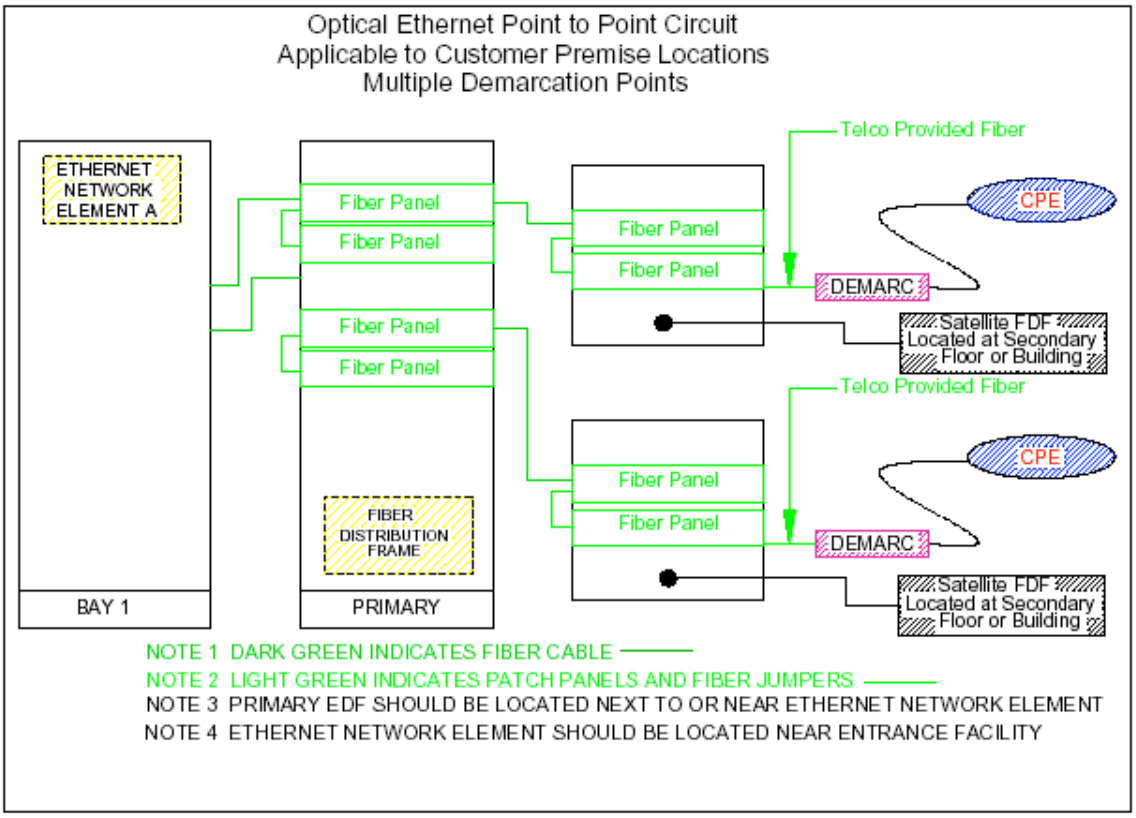
In this illustration, The Ethernet circuit is provided on the same floor and uses the standard arrangement of non-protected jumpers placed within a Fiber Protection Raceway or FiberGuide. The jumpers will extend from the Network Element bay to the left through the Fiber Raceway of the Central Office to the FDF to the back of the Fiber optic Terminal (FOT). From that point, the service will be cross-connected via Fiber optic jumpers within the FDF to another FOT panel supporting the customer/CLEC. Based upon Collocation requirements and the selection of provisioning by the CLEC, the cabling from the back of the second FOT to the customer may be provided by either the CLEC or the ILEC to the customers location (with certain limitations covered in another section of this document) for a handoff. The customer/CLEC will terminate the fiber optic facility to their Ethernet Network Equipment.

TMXT/RCV turnover rules apply.

No attenuators are needed.

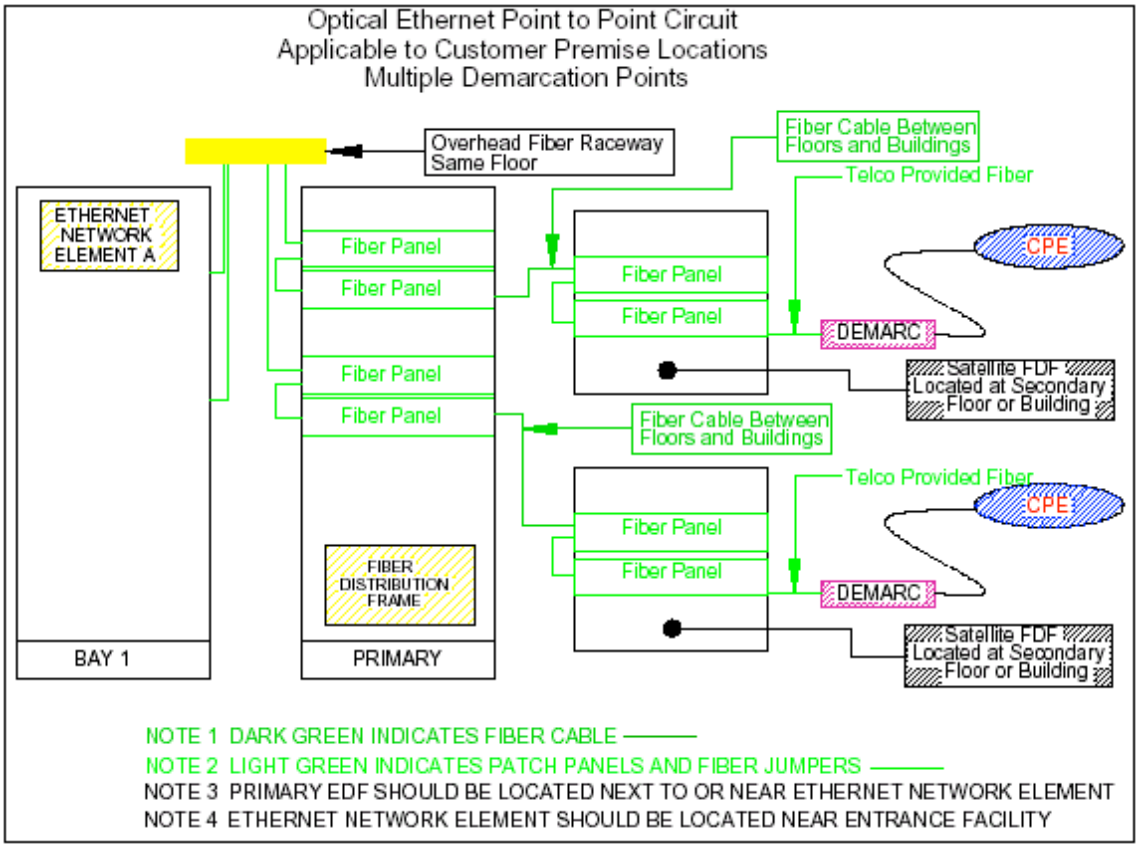
Fiber optic jumpers will be the normal method of connection except where floor/wall boundaries exist between elements.

5E. Optical Ethernet Architecture for the Customer Premises



This illustration shows an average customer location that might be within the distance limitations but may have some egress issues such as traversing a wall or floor. In this instance, Bay 1 would be placed near the cable head at the primary entrance facility. Bay 2 represents the customer premises location, which is at a different location from the entrance facility. The Telco will need to place fiber cable and associated end-panels and place a remote bay.

This solution is time consuming and requires the Telco to measure and order a specific length of Fiber Cable to connect between the two bays. It will require advanced planning and will necessitate the pre-provisioning of cable and FMT panels in advance in order to meet service order intervals.



This is ideal for customer delivery of service on the customer premises if Fiber delivery is required. In this instance, Bay 1 would be placed near the cable head at the primary entrance facility. We know the distance between the entrance facility and the demarcation point is within close proximity and one of two functions has occurred:

1. Bay 2 is within our Single Point of Demarcation therefore, SBC will place their own Fiber Jumper Raceway between bays within the SBC assigned area.

2. The other option dictates the customer provide a Fiber Raceway to the location of Bay 2.

Important Note: Fiber Jumpers will not be placed in exposed, non-protected above or below floor standard cable racks.

6. Cable Requirements

6A. Standard and High Twisted Pair Provisioning

The standard twisted pair arrangements used within the Telco environment are **not** suitable for any Ethernet Signals. Ethernet cabling will be handled independently of existing Frame Management Systems and physical Distributing Frame and cabling plant. The standard twist jumpers and cable will characteristically support Narrowband services of voice and data traffic with speeds less than 1.544 Mb/s. SBC LOCAL EXCHANGE companies has introduced the use of separate unshielded high twist jumper pair (UTP) cable for use with 1.544 Mb/s and xDSL services, each with a separate twist ratio from each other that can continue to use the existing frame topology.

The Ethernet Services when provided electrically will be routed through an Ethernet Distributing Frame (EDF) independent of the Main Distributing Frame. On the other hand, Fiber Optic Ethernet services will continue to use the Fiber Distributing Frames (both within the Central Office and at Customer Premises) with special accommodations.

6B. Category 5t (Telco) Standards

Electrical Ethernet signals operate at 10/100/1000 Base-T speeds i.e. 10, 100 or 1000 MBPS (1 Gigabit/sec) with the future of 10 Gb/s. Electrical Ethernet provisioning is currently bound by Category 5e cable restrictions and length limitations for the Commercial Building Systems as described in TIA/EIA standards. SBC LOCAL EXCHANGE companies has developed a stricter set of standards for Ethernet provisioning called the Category 5t standard in document SBC-TP76412MP-000, *SBC-Electrical & Optical Ethernet Telco Cat 5t & Cat 6t Transmission Standards*, Issue 1, dated March 2003 for use throughout the Telecommunications environment, including Commercial Building Systems. This new document breaks with the need to provide compatibility with existing Cat 5 and 5e embedded cabling arrangements and emphasizes service reliability and improved transmission characteristics with a farther footprint reach. This is shown by the attached chart by service and facility type:

Category	Service Provisioning	NE to NE reach[1]
5	10/100 Base-T	100 meters (328 feet)
5e	10/100 Base-T	100 meters (328 feet)
5t	10/100 Base-T	110 meters (361 feet)

If embedded cabling is used, the existing Cat 5/5e standards need to be used. New service provisioning from the telco to the Demarcation Point will meet or exceed Cat 5t standards.

[1] NE to NE reach represents the recommended distance between the transmitting Network Element/Equipment (NE) and the corresponding unit through all cable types and connections.

6C. Category 6t (Telco) Standards

SBC LOCAL EXCHANGE companies has developed a stricter set of standards for Ethernet provisioning that called the Category 6t standard in document SBC-TP76412MP-000, *SBC-Electrical & Optical Ethernet Telco Cat 5t & Cat 6t Transmission Standards*, Issue 1, dated February 2003 for use throughout the Telecommunications environment, including Commercial Building Systems. This new document breaks with the need to provide compatibility with existing Cat 6 embedded cabling arrangements and emphasizes service reliability and improved transmission characteristics with a farther footprint reach.

It is expected that 10 Base-T and 100 Base-T services will be able to use Category 5t cabling and jumpers, but may also use the Cat 6t standard, at a higher cost. It is strongly recommended that 1000 Base-T services be interconnected using a fiber optic medium (preferably SingleMode) over copper connectivity. In the event that copper connection is requested by the customer, the use of Cat 6t would represent the minimum standard that the Telco would provision for service reliability. This is shown by the attached chart by service and facility type:

Category	Service Provisioning	NE to NE reach[2]
6 (Electrical)	1000 Base-T (1 Gb/s)	25 meters[3] (82 feet)
6t (Electrical)	1000 Base-T (1 Gb/s)	110 meters[3] (361 feet)
MultiMode 62.5u	1000 Base-SX (1 Gb/s)	220 meters (656 feet)[4]
MultiMode 62.5u	1000 Base-SX (1 Gb/s)	275 meters (902 feet)[6]
MultiMode 50u	1000 Base-SX (1 Gb/s)	550 meters (1,804 feet)[5]
MultiMode 50 u	1000 Base-SX (1 Gb/s)	500 meters (1,640 feet)
MultiMode 62.5u	1000 Base-LX (1 Gb/s)	500 meters (1,640 feet)
MultiMode 50 u	1000 Base-LX (1 Gb/s)	550 meters (1,640 feet)
SingleMode 9 u	1000 Base-LX (1 Gb/s)	5 kilometers (3.1 miles)
MultiMode	10 Gb/s	Standard not established
SingleMode	10 Gb/s	Standard not established

[2] NE to NE reach represents the recommended distance between the transmitting Network Element/Equipment (NE) and the corresponding unit through all cable types and connections.
[3] This distance will vary by the Network Element transmitter, corresponding transmitter and the type of cabling used to interconnect the two.

[4] The TIA 568 building wiring standard specifies 160/500 MHz*km MultiMode fiber
[6] The international ISO/IEC 11801 building wiring standard specifies 200/500 MHz*km MultiMode fiber.
[5] The ANSI Fibre Channel specification specifies 500/500 MHz*km 50 micron MultiMode fiber and 500/500 fiber

1000 Base-T (1 Gb/s) will not be provisioned by the Telco with less than a Category 6t standard. New service provisioning from the telco to the Demarcation Point will meet or exceed Cat 6t standards. The customer is strongly requested to provision on their side of the Demarcation Point with Cat 6t or better facilities at the time of installation.

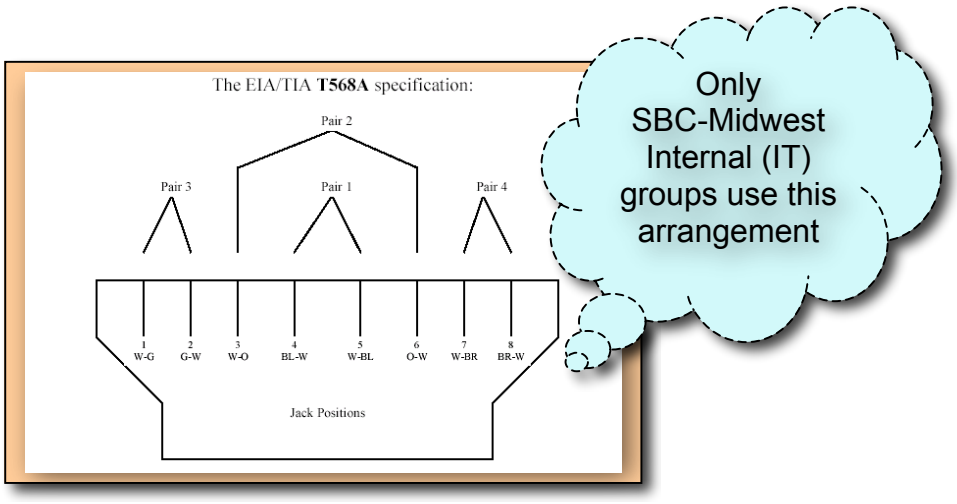
6D. Beyond Category 6t

Several Industry Standards Committees, such as the IEEE 802.3, are wrestling with the capabilities of existing cabling within Commercial Building Systems when a new and faster Ethernet technology is deployed. At present, the standards of 10 Gb/s systems are in the process of being launched. One of the key goals of these committees will be to permit these new services to use existing wiring and cabling topologies. SBC LOCAL EXCHANGE companies recognize the backward compatibility issues, but breaks with this philosophy and plans to use direct fiber optic provisioning at the facility layer of the OSI model between Network Elements using 10 Gb/s and higher speeds. SBC LOCAL EXCHANGE companies will be working with the standards committees to integrate a sufficient level of safety that will provide a service reliability of the 5 nines (99.999%).

6E. Cable and Jumper Placement Expectations and Limitations

6E.1. Electrical

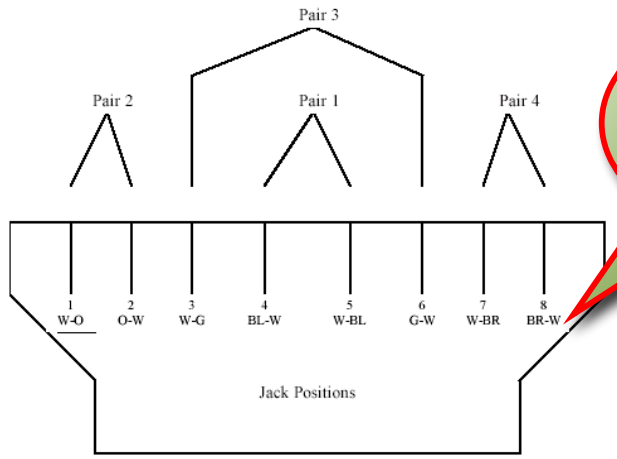
Electrical Patch cords will only be manufactured from the corporate approved manufacturer identified through a Product Approval Notice. Locally or field manufactured or crimped connectors will not be permitted. The minimum length of patch cable will not be less than one meter (3.28 feet) and will not exceed nine meters (29.52 feet). The standard electrical connection will be the RJ-45 for use in the Cat 5e/5t configuration. The termination standard is the TIA/EIA standard 568B pinout configuration in all areas except in the SBC-Midwest where the TIA/EIA 568A pinout arrangement is used for internal needs only (SBC-Midwest will provide the 658B standard to their customers).



This will result in the following pin/pair assignments

Application	Pairs	RJ-45 Pins
Token Ring	1,2	4-5, 3-6
Ethernet (10BASE-T)	3,2	1-2, 3-6
Ethernet (100BASE-T4)	3,2	1-2, 3-6
Ethernet (100BASE-T8)	1,2,3,4	4-5, 3-6, 1-2, 7-8
100VG-AnyLAN	1,2,3,4	4-5, 3-6, 1-2, 7-8
RS-423 (RS-232 w/RJ-45)	1,2,3,4	4-5, 3-6, 1-2, 7-8

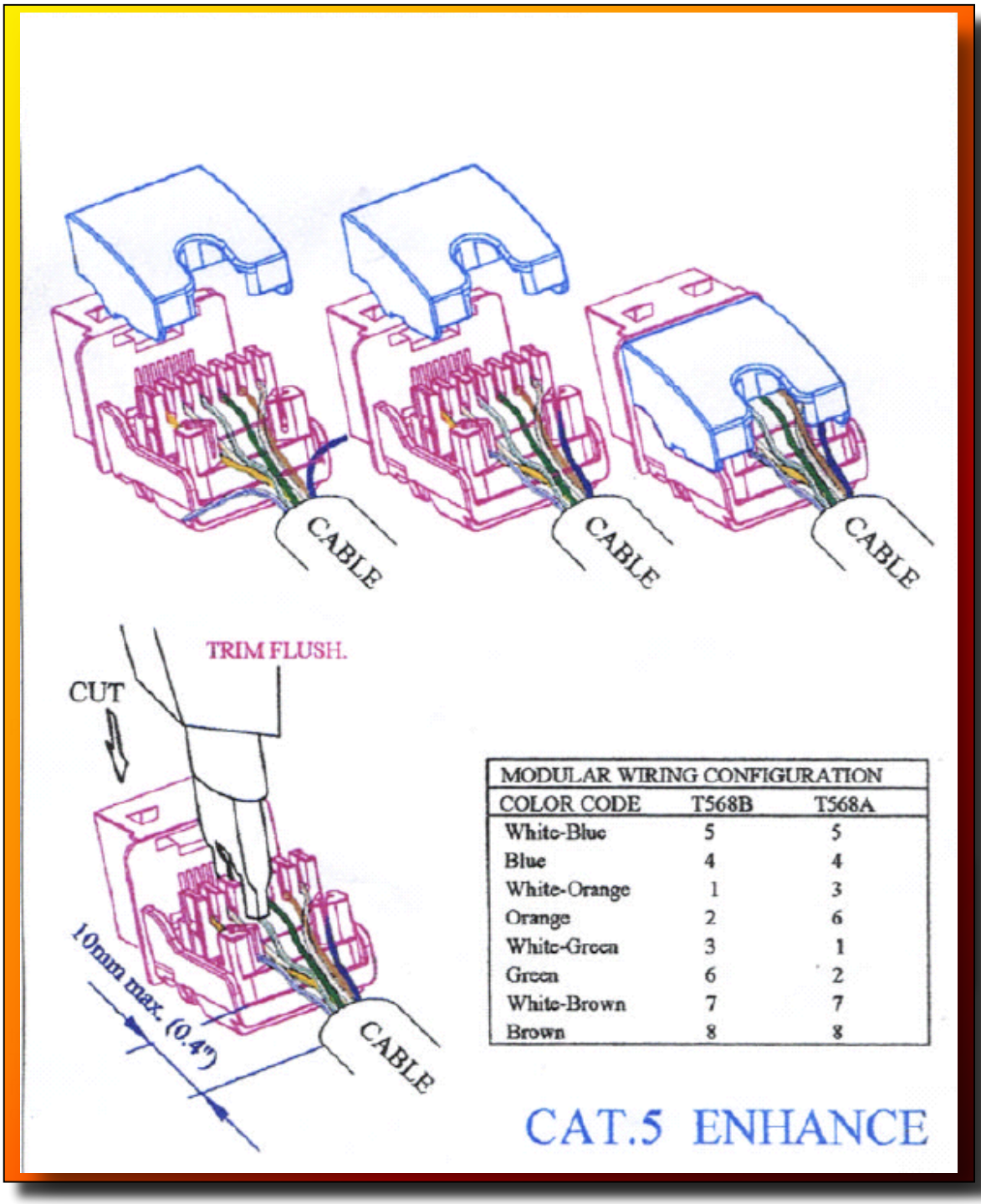
The EIA/TIA **T568B** specification:



SBC Standard Arrangement except as noted

This will result in the following pin/pair assignments

Application	Pairs	RJ-45 Pins
Token Ring	1,3	4-5, 3-6
Ethernet (10BASE-T)	2,3	1-2, 3-6
Ethernet (100BASE-T4)	2,3	1-2, 3-6
Ethernet (100BASE-T8)	1,2,3,4	4-5, 1-2, 3-6, 7-8
100VG-AnyLAN	1,2,3,4	4-5, 1-2, 3-6, 7-8
RS-423 (RS-232 w/RJ-45)	1,2,3,4	4-5, 1-2, 3-6, 7-8



MODULAR WIRING CONFIGURATION		
COLOR CODE	T568B	T568A
White-Blue	5	5
Blue	4	4
White-Orange	1	3
Orange	2	6
White-Green	3	1
Green	6	2
White-Brown	7	7
Brown	8	8

Frame to another Network Element will use either the RJ-21 25 twisted pair cable or the 8-wire twisted (4-pair) cable for the RJ-45 that is specified in the SBC Product Approval Notices. Do not place twisted pair jumpers or single/dual pair Inside Wire (IW) cabling within standard cable rack systems.

SBC Ethernet Electrical Operational Standards

Function	***Applicability***	***Reason***
Electrical Cable type	Category 5t Standards	SBC-TP-76412MP-000
Connector	RJ-45 (single) or RJ-21 (multiple) (110-type embedded only for internal use)	Interoperability
Service Provisioning	10 Base-T, 100-Base-T and 1000 Base-T (1 Gb/s)	Types of services
Overall Distance Limitations for Cable Only Cat 5t & Cat 6t	10 Base-T = 361 Feet 100 Base-T= 361 feet 1 Gb/s Base-T = 82 feet	Includes all cross-connect fields between one Network Element and another
Overall Distance Limitations for Cat 5t & Cat 6t with SBC Media Converter	10 Base-T =12.5 mi (20 km) 100 Base-T = 12.5 mi (20 km) 1 Gb/s = 12.5 mi (20 km)	Includes all cross-connect fields between one Network Element and another. Uses two Media Converters.
Maximum length of just cable between any one Telco Network Element and the EDF	10 Base-T = 150 feet 100 Base-T = 150 feet 1 Gb/s = 35 feet	Add this to the other NE to EDF distance plus the cross-connect length not to exceed the max distance
Polarization	Not used, run strand 1 connector to strand 1 at distant location (no-turnovers)	The Network Elements provide the transmit/receive cross-over (turn-over) within the transceiver box
Overall Distance Limitations (MM)	2,000 meters between the main FDF and any remote cross-connect element	This is heavily dependent on the transceiver devices.
Cross-Connect Jumpers	Less than 30 feet for 10/100 Base-T, 10 feet for 1 Gb/s	Operational standards
When Terminated	All Ethernet cables will be terminated at the time of original installation into established panels (except for collocation where service will be properly tagged)	Termination protection
Ethernet Standard	SBC-TP76412MP-000	Higher standard than TIA/EIA 568-B.3
Bend Radius	Radius not less than 3-inches or 10 times the outer diameter of the cable	Meets Telcordia & SBC specifications that are more strict than TIA/EIA
Immediate Action	Do not permit kinks or short turns in the cable, or skinned cable due to a rough edge	Correct or replace cable after thorough testing

6E.2. Optical

All fiber optic cables, jumpers and connectors will meet or exceed the standards set forth in SBC-TP76412MP-000*, SBC- Electrical & Optical Ethernet Telco Cat 5t & Cat 6t Transmission Standards*, Issue 1, dated February 2003. Only one of the two types of cable/connectors will be authorized for use with the SingleMode being the preferred type[8]:

- SC-UPC, SingleMode 9 micron Fiber Cable/Jumpers, riser or plenum rated
- SC-UPC, MultiMode 50/125 micron Fiber Cable/Jumpers, riser or plenum rated

The use of other types of cable and connectors such as 62.5/125-micron cable or another connector type will cause incompatibilities to be present with subsequent service degradation or outage as a result. Only Factory manufactured fiber optic jumpers will be permitted through a SBC Product Approval Notice. Fiber Cable connectors may be fused to one end of fiber cable or stubs on an exception basis. Special care must be taken with field fusing of connectors on MultiMode Fiber optic facilities due to their high loss characteristics. The following chart shows the standards for SBC Optical Ethernet Provisioning:

SBC Ethernet Optical Operational Standards

Function	***Applicability***	***Reason***
Fiber Cable type (MM)	50/125 micron	Suitability with Network
Fiber Cable type (SM)	9 micron	Suitability with Network
Connector (MM & SM)	SC-UPC (Standard)	Interoperability
Operating Wavelengths (MM)	850 & 1300 nm	MultiMode as it exists today
Maximum Overall Attenuation (MM)	-3.75 dB/km at 850 nm -1.5 dB/km at 1300 nm	Loss per kilometer
Maximum Attenuation per connector (MM)	0.75 dB per pair of mated connectors using SC (or SFF)	Critical MM signal limitations
Maximum Attenuation per Splice (MM)	0.3 dB per splice	Critical MM signal limitations
Polarization	Not used, run strand 1 connector to strand 1 at distant location (no-turnovers)	The Network Elements provide the transmit/receive cross-over (turn-over) within the transceiver box
Overall Distance Limitations (MM)	2,000 meters between the main FDF and any remote cross-connect element	This is heavily dependent on the transceiver devices.
Cross-Connect Jumpers	Not less than 5 feet	Do not permit the placement of

[8] Information Technologies Operations uses the SFF connector in some areas for internal use only as an embedded device of interconnection.

		jumpers too short, may cause service issues.
When Terminated	All Fiber cable strands will be terminated at the time of original installation into established fiber panels	Termination protection
Ethernet Standard	SBC-TP76412MP-000	Higher standard than TIA/EIA 568-B.3
Bend Radius	Radius not less than 3-inches or 10 times the outer diameter of the cable	Meets Telcordia & SBC specifications that are more strict than TIA/EIA
Immediate Action	Do not permit kinks or short turns in the cable, or skinned cable due to a rough edge	Correct or replace cable after thorough testing
Ultimate Pass/Fail (MM)	Under no circumstances will the overall attenuation loss levels exceed 5.0 dB between Network Elements.	Testing is required

Optical Attenuation Coefficients

Cable Type	Wavelength (nm)	Attenuation Coefficient (dB/km)
62.5/125 um MultiMode	850 nm	3.50
	1300 nm	1.50
50/125 um MultiMode	850 nm	3.50
	1300 nm	1.50
SingleMode Inside Plant	850 nm	1.00
	1300 nm	1.00
SingleMode Outside Plant	850 nm	0.50
	1300 nm	0.50

6F. Do's and Don'ts of Cable/Jumper Placements and Terminations

- Don't have SingleMode or MultiMode jumpers bend tighter than 3.0 inches or ten times the diameter of the outer sheath of the cable.
- Do not place fiber jumpers in any above or below floor rack systems without protection using protective tubing or Fiber Raceways. (Fiber Raceways are the only option within SBC LOCAL EXCHANGE companies Central Offices.
- The standard Cat 5t/6t cabling in cable racks will be the 100 pair cable or the 4-pair cable that is specially protected.
- Do not place jumpers or cross-connect wire in cable rack systems.
- SingleMode Connectors will only be placed into matching connector sleeves with the same color. (SingleMode is blue, MultiMode is tan/gray).
- Electrical Cabling that is placed between two structures externally will be required to have electrical protection/grounding provided at both ends of the exposed cabling.
- All cables will be terminated at a cross-connect point in a panel intended for that purpose.
- When electrical cable jumpers exceed the overall distance expectations, use a Media Converter or Extender to extend the range of the Ethernet Network Equipment to the Telco side of the Demarcation Point only.
- Always validate the cable facilities meet Cat 5e/5t before service is provisioned.
- Always validate the circuit to the demarcation point where a Demarcation device has been placed (or to the nearest accessible test point if a POT is not provided by the SBC LOCAL EXCHANGE companies.
- All electrical and optical Ethernet cabling within the SBC LOCAL EXCHANGE companies Central Offices will use preformed, manufactured double ended to specified lengths.
- Electrical and optical Ethernet cabling within the SBC LOCAL EXCHANGE companies Customer Premises locations have the additional option to use field connectorized connectors that meet specifications.
- Cable/jumper slack must be managed within the EDF/FDF only, not in the Cable Racks or Network Equipment locations.

6G. Compensating for Circuit Loss Considerations

- Replace the cross-connect connection.
- Reterminate the connections at each Network Element.
- Place an Ethernet Extender or Optical Media Converter to correct distance issues on the Telco side of the Demarcation Point only.
- Replace cable connections and route the service directly between Network Elements.
- At each point test sectionalize using standard test criteria.

6H. The Telco Handoff/Demarcation Point

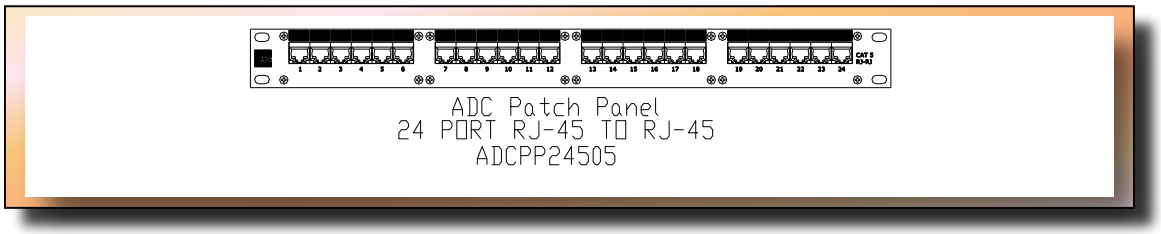
6H.1. Electrical-Facility Layer

Service	Connection	Comments
10 Base-T	RJ-45 (Unshielded UTP)	All Electrical Handoffs
100 Base-T	RJ-45 (Unshielded UTP)	All Electrical Handoffs
1000 Base-T (1 Gb/s)	RJ-45 (Shielded STP)	Not Offered Electrically at this time

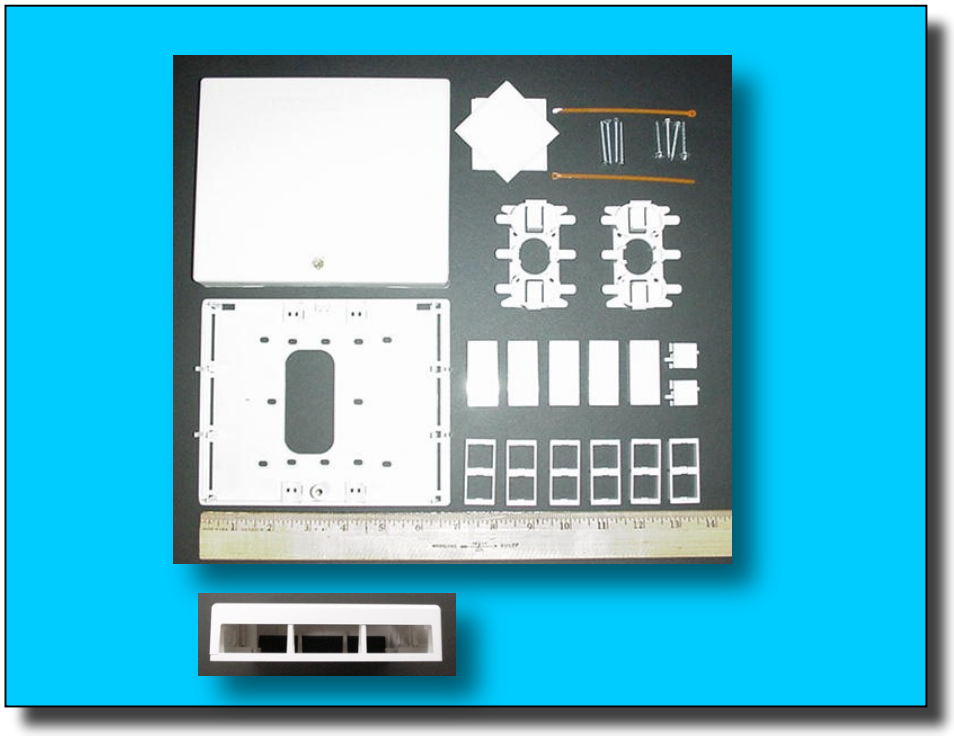
6H.2. Optical-Facility Layer

Service	Connection	Comments
1000 Base-SX (1 Gb/s)	SC-UPC, MultiMode 50/125 u	Short Haul
1000 Base-LX (1 Gb/s)	SC-UPC, SingleMode, 9 u, Standard	Ideal, Short & Long Haul
10 Gb/s	SC-UPC, SingleMode, 9 u, Standard	Ideal Method

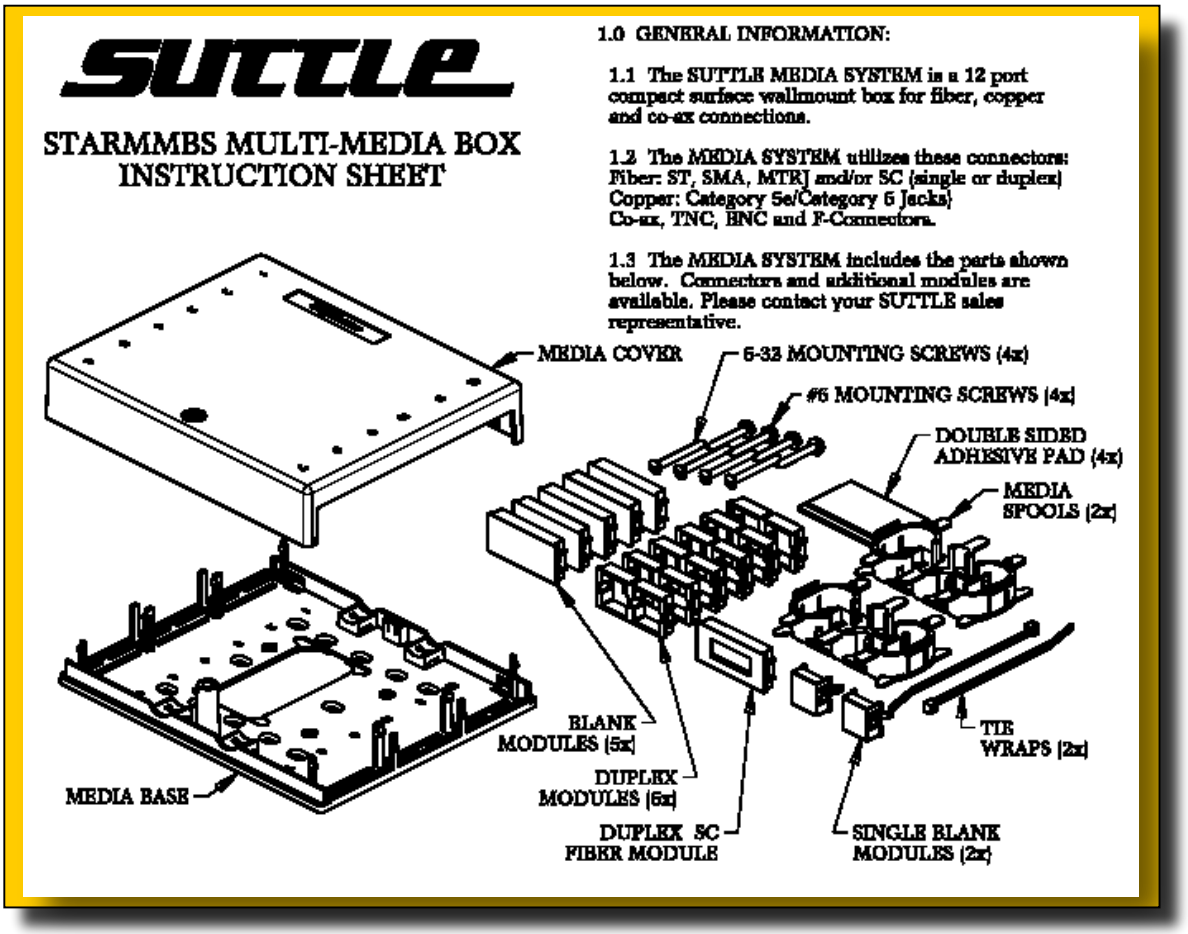
6H.3. Description of the Bay Mounted Electrical Demarcation Point

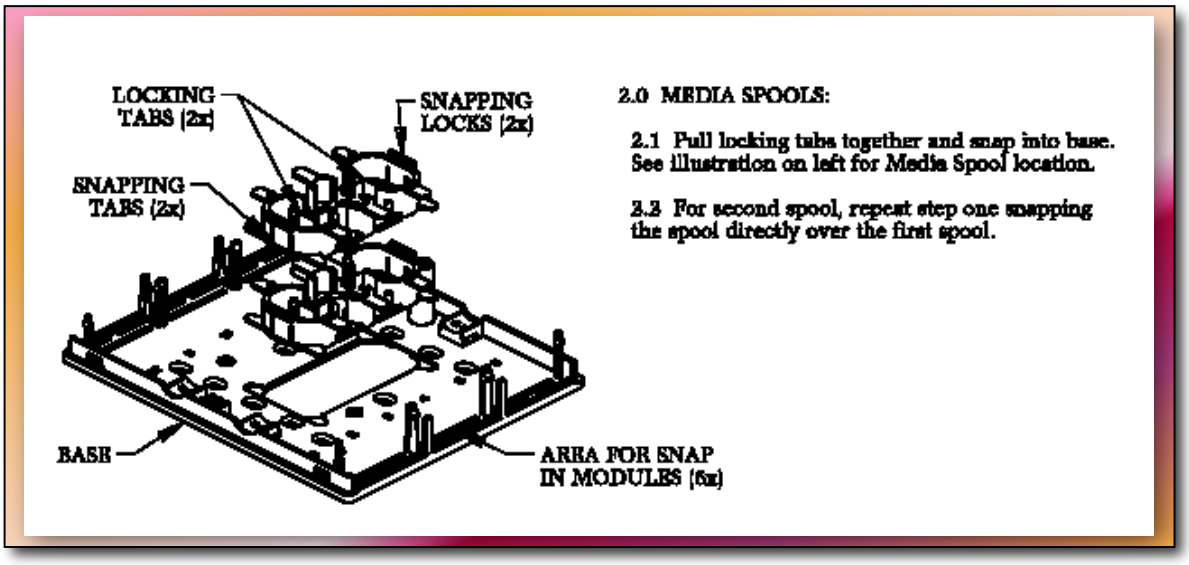


6H.4. Combination Electrical/Optical Wall Mounted Demarcation Jack Housing



1-12 Port Multimedia Housing Kit System





2.0 MEDIA SPOOLS:

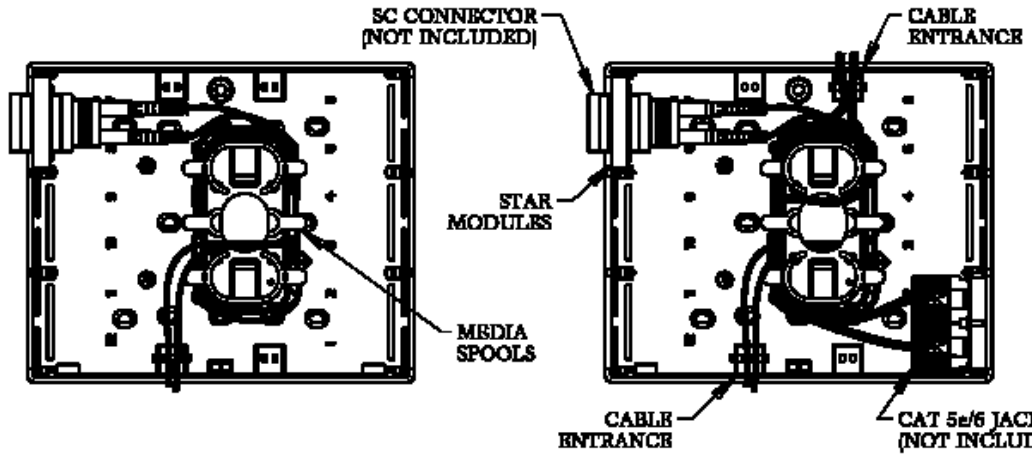
2.1 Pull locking tabs together and snap into base. See illustration on left for Media Spool location.

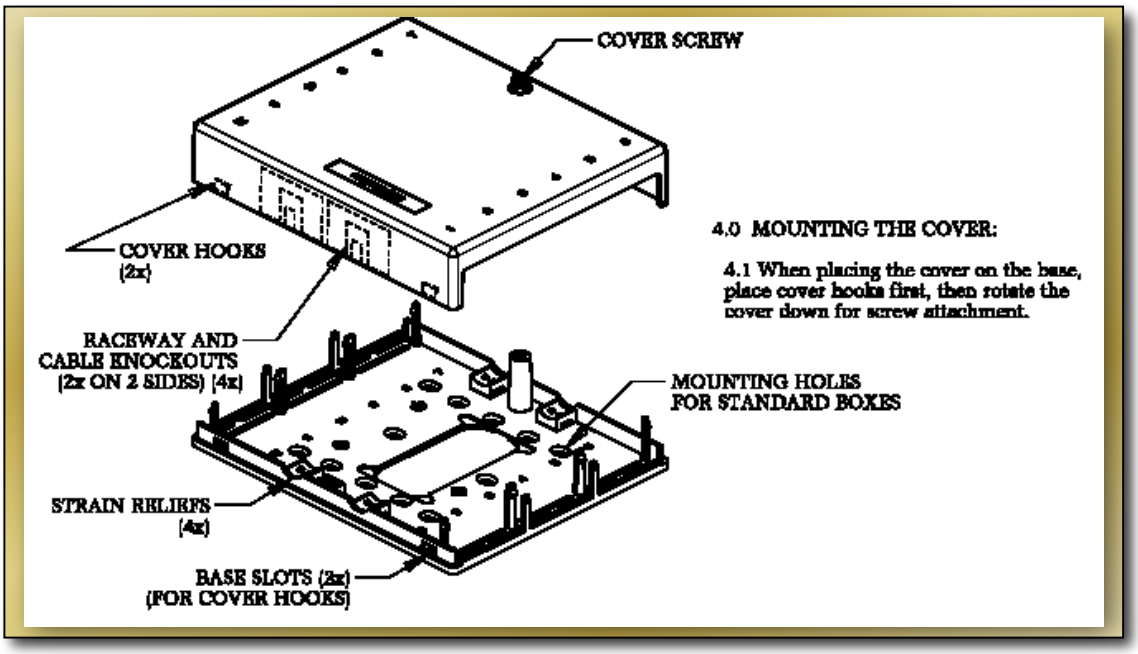
2.2 For second spool, repeat step one snapping the spool directly over the first spool.

3.0 MOUNTING THE BASE:

3.1 Secure the base to the desired location, using the screws or adhesive pads provided. After preparing the cables, place the cables as illustrated below, using the tie wraps to secure the cables to the strain reliefs.

3.2 Fiber and Copper routings (Examples);
If installing Fiber and Copper together, install the Fiber on the side designated 7, 8, 9, 10, 11 and 12 only. Install the Copper on the side designated 1, 2, 3, 4, 5 and 6. Use 1 MediaSpool for Fiber and 1 Media Spool for Copper. See the illustrations below for various options of dressing the Fiber and Copper cables.



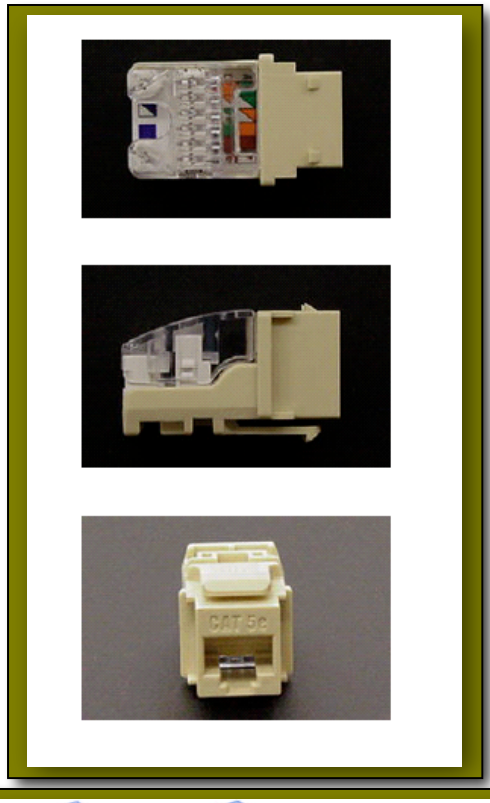


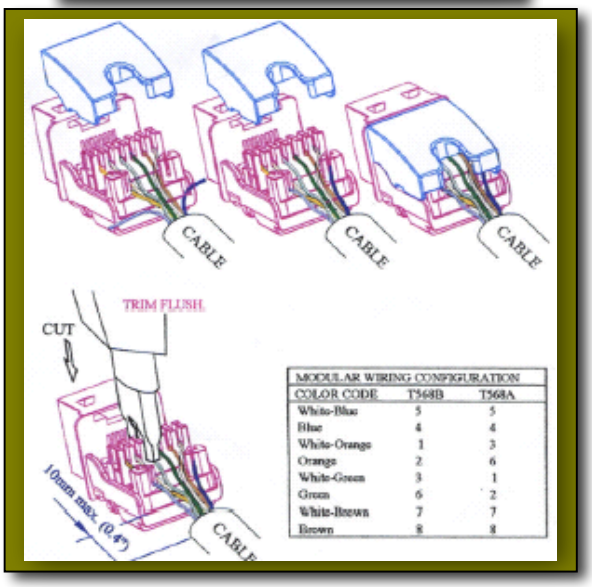
6H.5. RJ-45 Modular Jack used for Crimping Cat 5e/5t wiring

RJ45 Cat 5e Modular Plugs
(Bag of 25)

SBC-12STATE PID 301092185

SBC-SNET PID 3585930





6H.6. Modular Plug Hand Tool for RJ-45

This set of illustrations shows the new Modular Plug Hand Tool for crimping RJ-45 terminations. Refer to Tyco Electronics Instruction Sheet 408-9767, *Modular Plug Hand Tool (Premium Grade) Part # 231652*, revision H, issued June 2002.

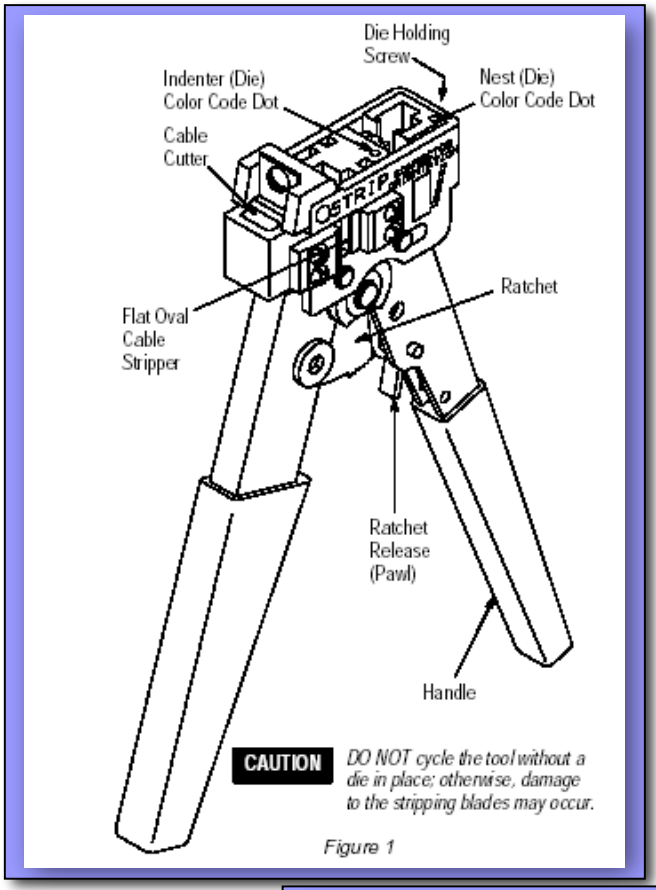


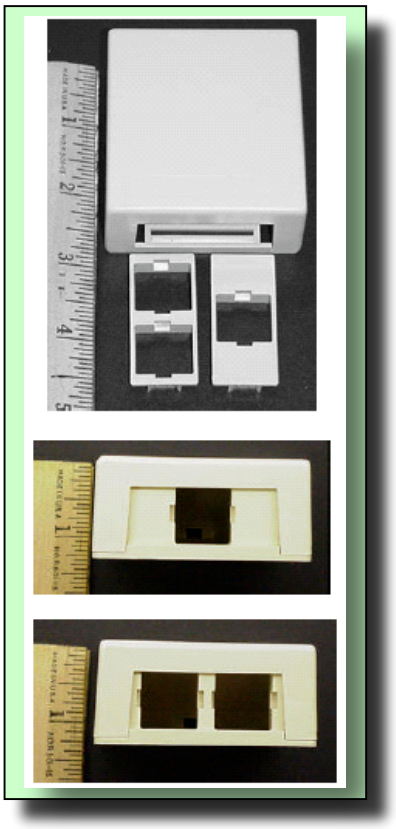
Figure 1

Crimper Tool

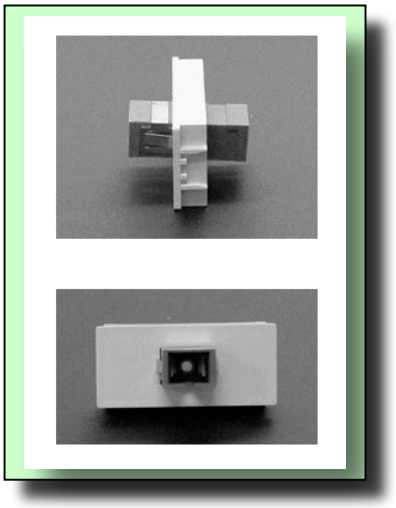
SBC-12STATE PID 301092177

SBC-SNET PID 3585929

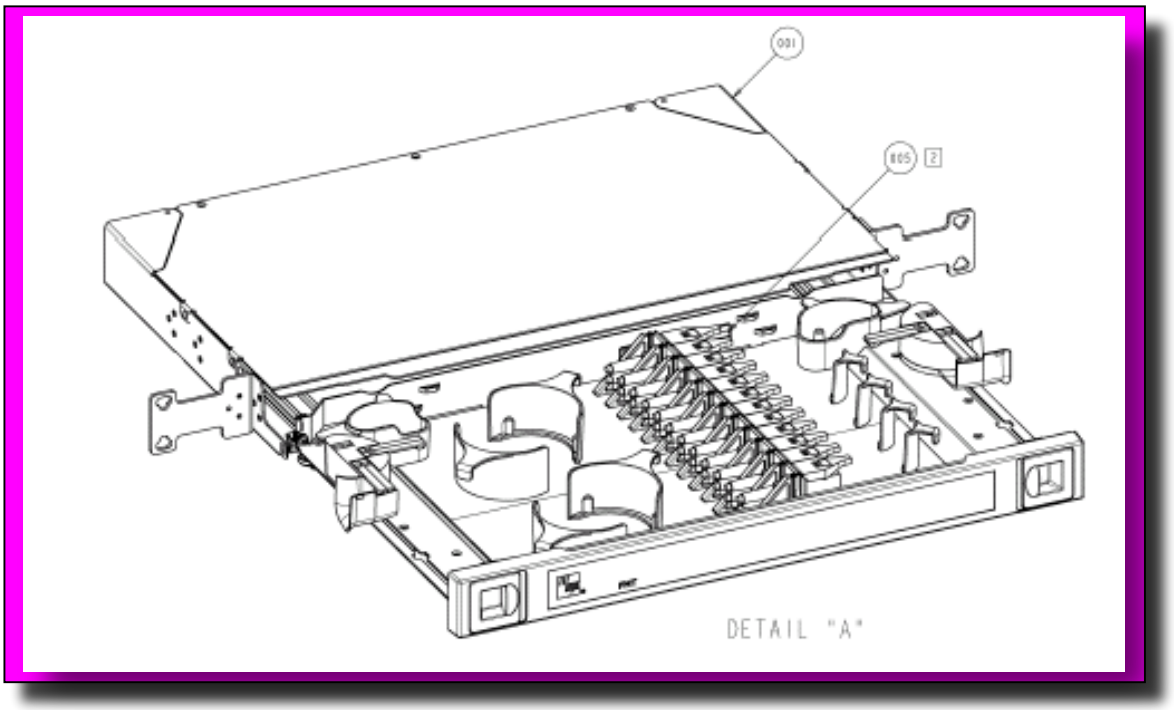
6H.7. Electrical Jack Housing for RJ-45



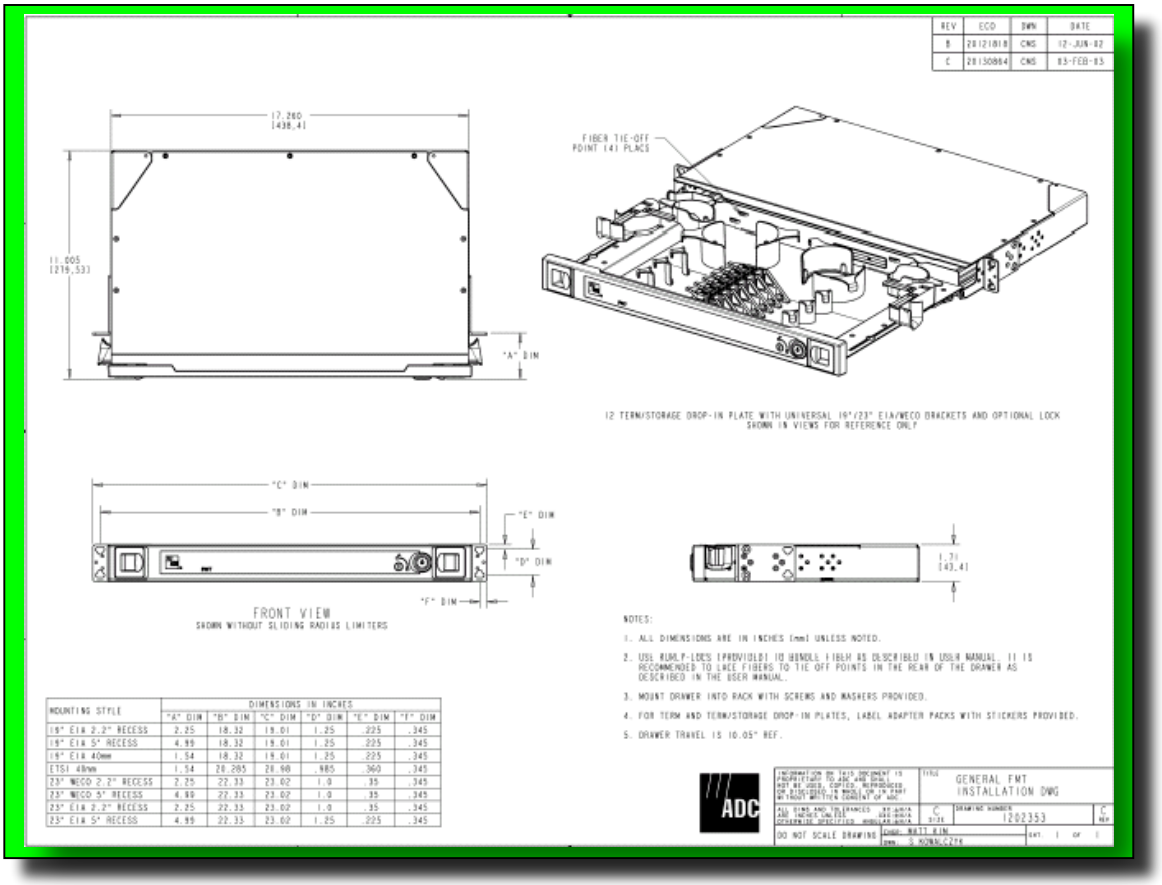
6H.8. Fiber Adapter



6H.9. Description of the Bay Mounted Optical Demarcation Point



6H.10. Description of the Optical Wall Mounted Demarcation Jack



MOUNTING STYLE	DIMENSIONS IN INCHES					
	"A" DIM	"B" DIM	"C" DIM	"D" DIM	"E" DIM	"F" DIM
19" EIA 2.2" RECESS	2.25	18.32	19.01	1.25	.225	.345
19" EIA 5" RECESS	4.99	18.32	19.01	1.25	.225	.345
19" EIA 40mm	1.54	18.32	19.01	1.25	.225	.345
ETSI 40mm	1.54	28.285	28.98	.985	.360	.345
23" WECO 2.2" RECESS	2.25	22.33	23.02	1.0	.35	.345
23" WECO 5" RECESS	4.99	22.33	23.02	1.0	.35	.345
23" EIA 2.2" RECESS	2.25	22.33	23.02	1.0	.35	.345
23" EIA 5" RECESS	4.99	22.33	23.02	1.25	.225	.345

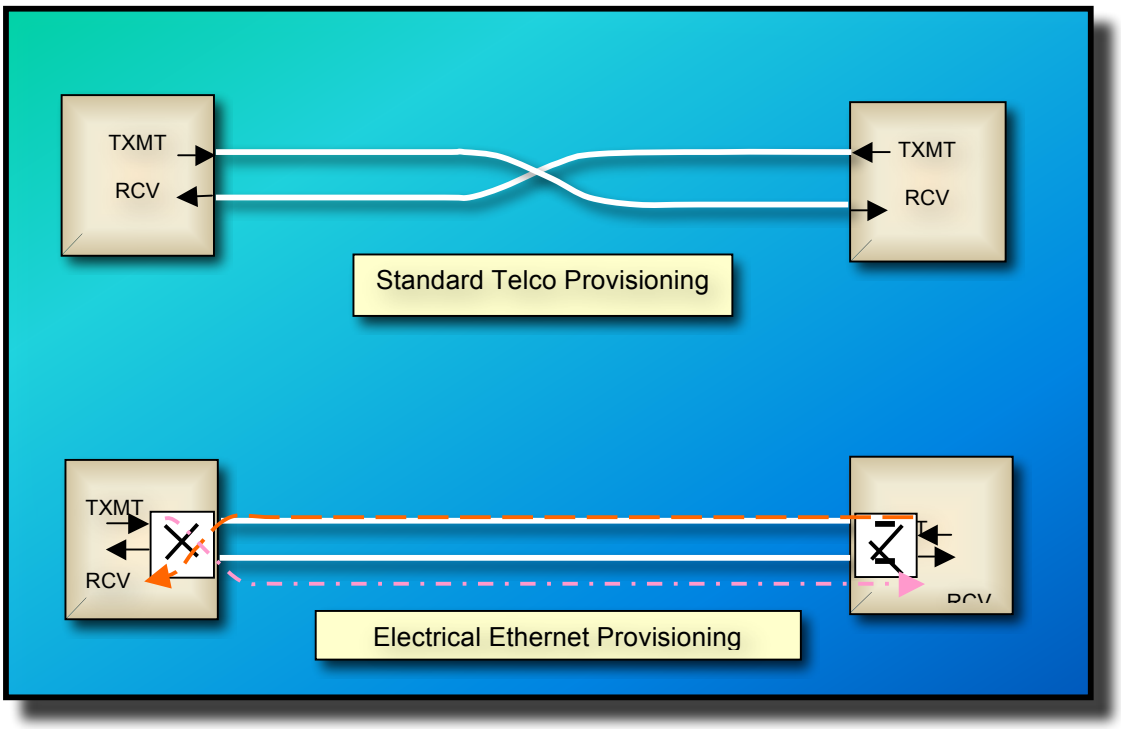
6I. Termination Methodology and Polarity

6I.1. Electrical Ethernet Differences with the Telco Cabling

Telco wiring dictates the need to provide a transmit/receive turnover external to the equipment in order to insure that the transmit leads from one Network Equipment Element to another. The Telco equipment expects to have the "Transmit" appearance of the circuit (TXMT) sent to the "Receive" (RCV) appearance of the corresponding equipment.

Electrical Ethernet cabling is installed differently than standard Telco cabling. The cabling is run "straight" without any TXMT/RCV turnovers. The Ethernet Network Equipment at each end point is designed to compensate for this transposition and will correct the routing indigenous to the equipment. The function operates in a Customer premises Equipment (CPE) manner where the terminated circuit is simply extended using the same cabling leads and the end equipment has a polarity reversal device.

Illustration of Electrical Ethernet verses Telco Provisioning



The standard layout will be Tip/Ring straight wiring, lead one to lead one, two to two and so on. Tip/Ring turnovers also known as "Reversals", Transposed Pairs terminated on different pair appearances, and Split pairs where the leads are separated onto different pair appearances are not acceptable for any Electrical Ethernet connections.

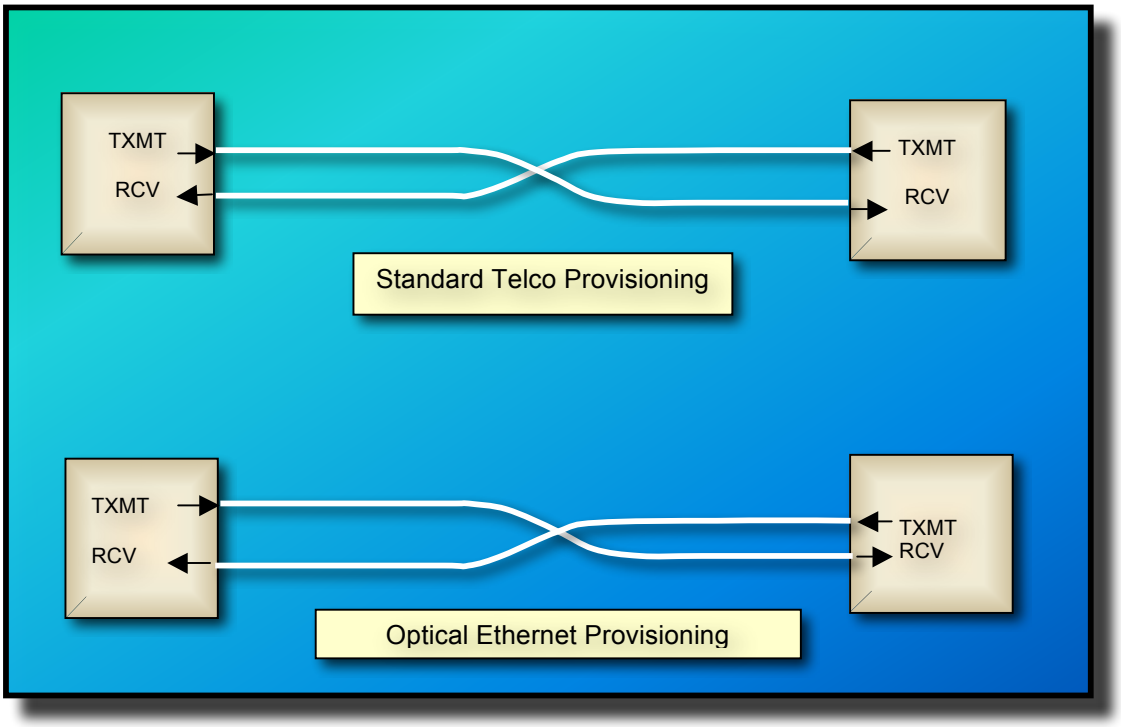
6I.2. Optical Ethernet Differences with the Telco Cabling

Optical Ethernet connections function in the same way that Telco Optical connections are arranged. The description is different for the customer premises environment, showing the connection of odd numbered fiber jumpers are in Position A at one end and Position B at the other end, while the even numbered fibers are Position B at one end and Position A at the other end. The faceplates of the two connected Network Elements have the appearances reversed from one another resulting in a pair reversal. It is further described that the reverse pair positioning can be achieved by installing fibers in consecutive fiber numbering (i.e.: 1,2,3,4..) on one end of the link and reverse pair numbering (i.e.: 2,1,4,3..) on the other side of the optical link.

This Ethernet description essentially states that there will be a TXMT/RCV turnover of each pair either at the Network Element equipment or in the optical jumper link between the two Network Elements. The Telco cabling uses the principle that the Network Element equipment will not have the connection appearances on the faceplates of the product; so as a result, all reversals will occur in the jumper tying the two Network Elements together.

Telco wiring dictates the need to provide a transmit/receive turnover external to the equipment in order to insure that the transmit leads from one Network Equipment Element to another. The Telco equipment expects to have the “Transmit” appearance of the circuit (TXMT) sent to the “Receive” (RCV) appearance of the corresponding equipment.

Illustration of Optical Ethernet verses Telco Provisioning



7. Records Assignments

7A. OSMINE Record Assignments

Each Manufacturer of Ethernet Network Elements needs to be OSMINE compliant in accordance with Telcordia document BR 751-100-790, Issue 6**,** November 1992, Table B, Format T. Each manufacturer shall file documents with Telcordia Technologies and meet COMMON LANGUAGE Distributing Frame Cross-Connect Point Codes. The Basic Level of OSMINE integration will dictate a minimal required level of Operational Support System (OSS) support in order to introduce a new network element into the network. Initial Telcordia OSMINE support such as HECI and FUNCTION codes along with basic monitoring capability with TL-1 or SNMP interfaces to the Network Monitoring and Analysis Systems will be paid by the manufacturer before deployment (TL-1 is required for Telco transport systems).

7B. TAB/db

The Tabular Database (TAB/db) is the inventory management tool for all FDF, panel and port assignments by type for SBC LOCAL EXCHANGE companies **Central Offices** only. The orientation is to provide support to the Equipment Engineer (NP&E) groups for provisioning of bays and panels. The TAB/db inventory system is being enhanced to cover the dedication of cable assignments on FDF panels. TAB/db will not provide Circuit Level assignment reference points or jumper cross-connect routes. TAB/db offers numerous training sessions on the use of the system, refer to the SBC LOCAL EXCHANGE companies Web Site: http://woodduck/tab_training.htm

The Equipment Engineer may begin in 2 ways after creating spec to work in:

- Locate panel which requires connector type changes (if list of panels is available)
- Query the system for Fiber assignments and check each panel returned by the query for updates.

1. Create a Record Only spec by using A7x if the internal to SBC or V7x if a vendor (where x = the next available number from 0-9).
2. Once the assignment chart is located select the 1st line to be changed.
3. Click in the connector type field to activate the drop-down menu and select the appropriate connector type (repeat for front and rear if both are required). **THIS IS A REQUIREMENT FOR BOTH FRONT AND REAR FOR MULTIMODE CONNECTORS.**
4. Once the changes are complete click save.
5. Once the changes are saved select copy special from the edit menu.
6. Select the next position that needs to be changed and select remove from the status menu.

7. Select the number of assignments to remove by using the shift key for contiguous positions and the control key for noncontiguous positions**. (Note: be sure they are all assigned to the same network element.)**

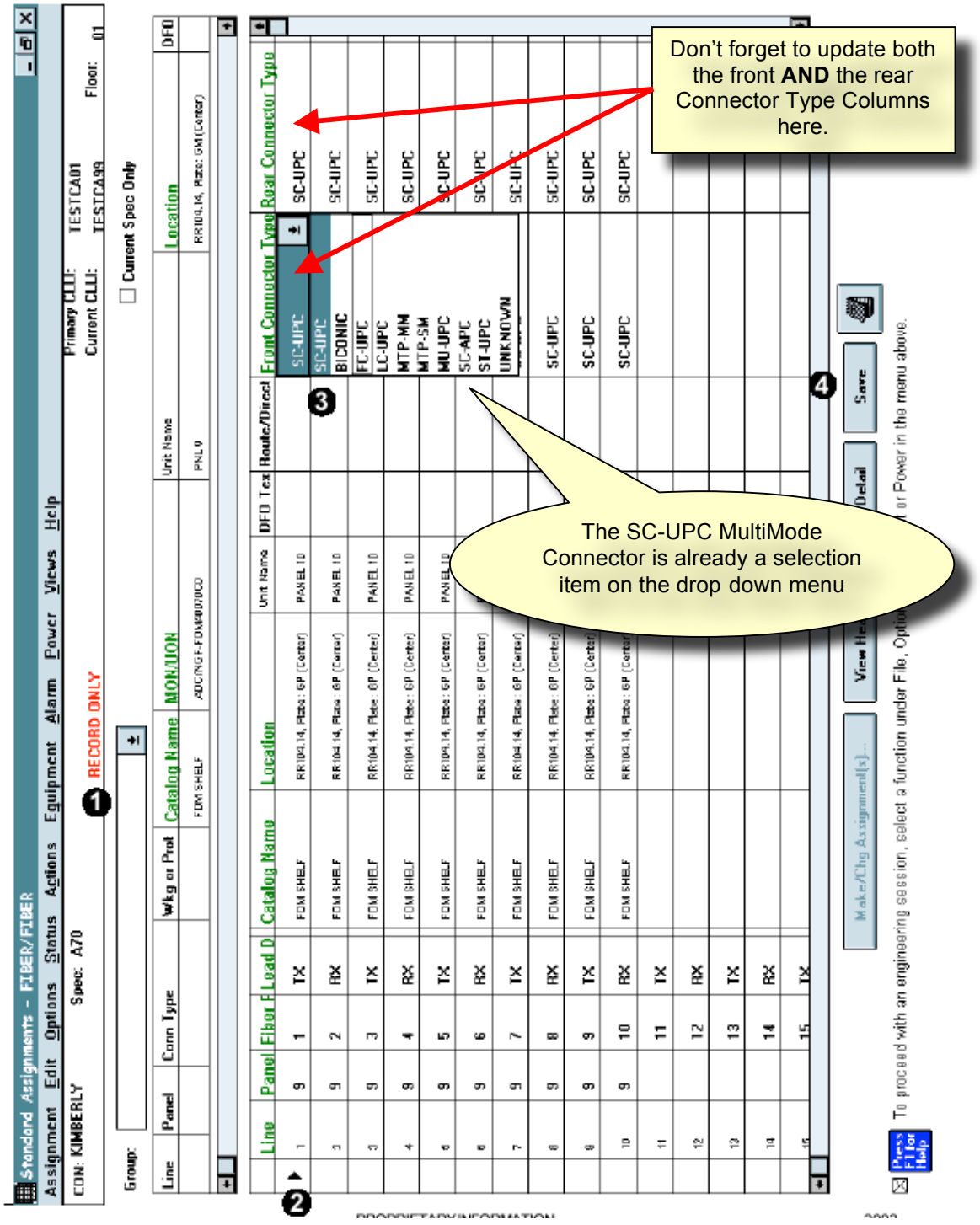
8. Then click OK to remove them.

9. Select paste multiple from the edit menu.

10. Select the number of assignments to paste by using the shift key for contiguous positions and the control key for noncontiguous positions. **(Note: be sure they are all assigned to the same network element.)**

11. Then click OK to paste them with the new connector type.

12. Remember that SC-UPC Connectors SingleMode will always use the Blue for the panel sleeve, separate connector and jumpers while SC-UPC MultiMode will use the Gray for the panel sleeve, separate connector and jumpers. The MultiMode service must use the gray arrangement and must be present physically before changes are made.



7C. Circuit Provisioning Administration

7C.1. TIRKS Overview
This section will be populated at a later issue.

7C.2. Mounting Configuration & Unit Numbering
This section will be populated at a later issue.

7C.3. Inventory/Assignment
This section will be populated at a later issue.

7C.4. Building the Inventory
This section will be populated at a later issue.

7C.5. TIRKS Documents
This section will be populated at a later issue.

8. Financial Requirements & Accounting

This product line including skeleton bays, panels and tails/stubs is classified as Major Materials and should be charged to the appropriate Field Report Code, FRC, in accordance with the Accounting Handbook Telephone Plant, Section V27.301. The cross-connect jumpers and optical jumpers will be classified as minor materials. Items may be a Field Reporting Code in one of the following groups: 257C, 357C, 377C or 477C for capital items.

9. Demarcation Standards

9A. Customer Premises

Per FCC rules and separate state Public Utility Commission (PUC/PSC) decisions, the termination point for regulated services from the telco is either a Single Point on the Premises or in the case of multi-unit premises; multiple such points as decided by the building/premise owner. This varies by state and in some cases, by customer premises or structure/campus. The FCC states the following:

"In multiunit premises in which wiring is installed, including major additions or rearrangements of wiring existing prior to that date, the provider of wireline telecommunications may place the demarcation point at the minimum point of entry (MPOE). If the provider of wireline telecommunications services does not elect to establish a practice of placing the demarcation point at the minimum point of entry, the multiunit premises owner shall determine the location of the demarcation point or points. The multiunit premises owner shall determine whether there shall be a single demarcation point location for all customers or separate such locations for each customer. Provided, however, that where there are multiple demarcation points within the multiunit premises, a demarcation point for a customer shall not be further inside the customer's premises than a point 30 cm (12 in) from where the wiring enters the customer's premises, or as close thereto as practicable. "

In multiple demarc properties, there is one demarcation point location per tenant and the Network Equipment (NE) must be placed with the other demarcation equipment for each tenant. If the application requires, the NE may be placed in a common location under SBC LOCAL EXCHANGE companies control such as the MPOE to the building or cross connect point, which can then be individually wired (copper or fiber) to each subscribing tenants demarcation point.

In a single demarc property, the NE must be located in the same location as the other existing Telco demarc (basement, equipment room, etc). See individual states as some have exceptions to this rule. Any wiring (copper or fiber) beyond this point is non-regulated.

Please keep in mind that this is a high level summary by states and these rules are subject to change. The current demarcation rules by state are shown below:

Missouri, Oklahoma, Kansas, Arkansas- Both single and multiple demarcation points allowed. Once a building/property has been converted to and built as a single demarc, it will remain so for the life of the property or until such time that the property is completely rebuilt.

Texas- Both single and multiple demarcation points allowed. Once a building/property has been converted to and built as a single demarc, it will remain so for the life of the property or until such time that the property is completely rebuilt. In Texas, the tariff allows for the creation of additional demarcs in a single demarc property if the customer pays the extra costs for special construction.

California- All properties constructed after 1993 were built as single demarc. Properties constructed before this time were a mix of single and multiple demarc. Additional demarcation points (secondary demarc) may be constructed as long as the customer pays for special construction and the additional demarc facility at the existing single demarc location.

Illinois- In the early 90's all properties were converted to single demarcation points with all inside wiring being transferred to the property owner. No multiple demarc properties exist. Tariff allows for the construction of additional points of presence (APOP) as long as the customer pays special construction and the APOP does not appear at the existing single demarc location and is located in a common area. The SAU/MAU must be located in the same location as the other Telco Demarcation Points (basement, equipment room, etc.).

Connecticut- All properties are single demarc. However, additional demarcs are allowed in a multi-unit building. The customer/property owner is subject to additional charges.

Nevada, Indiana, Ohio, Michigan, Wisconsin- Both single and multiple demarcation points allowed. Once a building/property has been converted to and built as a single demarc, it will remain so for the life of the property or until such time that the property is completely rebuilt.

9B. Central Office

The termination within the Central Office will follow the rules for termination of Competitive Local Exchange Carriers (CLECs) within the SBC LOCAL EXCHANGE companies.

The CLEC's SBC LOCAL EXCHANGE companies approved vendor will be required to use fire-retardant cabling in the SBC Central Offices and adhere to all applicable operations and Network Planning & Engineering (NP&E) documentation as follows:

- SBC-TP76200MP-000 – *Network Equipment – Building Systems (NEBS)*
- SBC-TP76300MP-000 – *Installation Guide within the Central Office*
- SBC-TP76400MP-000 – *Detail Engineer Requirements for the Central Office*
- SBC-TP76412-000 – *Electrical & Optical Ethernet Cat 5t & 6t Transmission Standards*
- SBC-TP76900MP-000 – *Installation Testing Requirements for the Central Office*
- SBC-TP76305-000*, Cable & Wire Installation and Removal Requirements for Cable Racks and Raceways*
- Interconnection Handbooks will reference these above listed documents for sources.

9C. Tagging/Marking the Demarcation Point

9C.1. Tag Information

SBC LOCAL EXCHANGE companies will provide a tag or marker at each Ethernet Demarcation Point that indicates the actual distance from the SBC provided Network Equipment and whether the additional loss has been compensated via a Media Converter or Extender. The method of Demarcation will also be provided.

Example One: 10 Base T, 150 feet.

10BaseT, RJ-45, 150 feet

Example Two: 100 Base T, 400 feet, extender used

100BaseT, RJ-45, 400 feet, compensated

Example Three: MultiMode Handoff, 400 feet.

1Gb/s, SC-UPC, MultiMode, 400 feet

9C.2. The Layout of the Tag

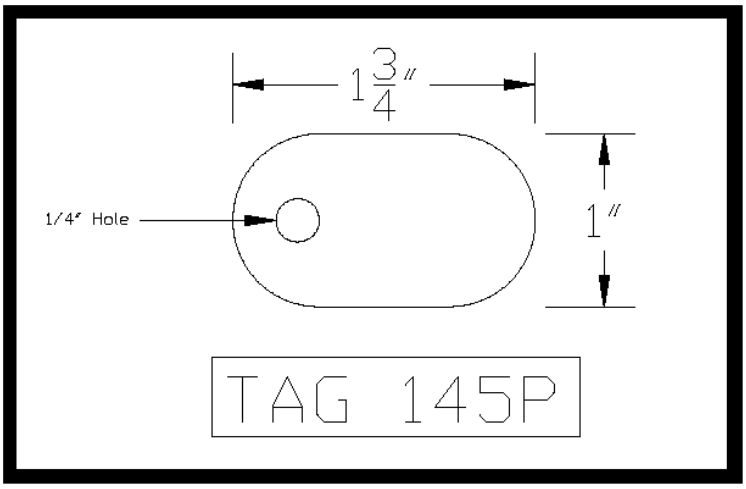
The Demarcation Point either in the Central Office or at the Customer's Premises needs to be identified with additional information that what has been provided for regulated services in the past. Due to the acute loss characteristics of the Ethernet signals, the SBC LOCAL EXCHANGE companies will need to follow the standards set forth in SBC-TP76300MP-000, *SBC Installation Guide for the Central Office, Section L. (Equipment Designations)* and SBC-002-301-005*, SSIM Special Services Marking and Protection*.

The standard specified tag within the Central Office is the 145P Tag, (or equivalent in the outside plant) for use in identifying equipment, connection points and circuits. This tag will be affixed to each circuit cable at the farthest reach for the Ethernet circuit toward the Demarcation Point. In the case of the Central Office, this represents the Network Equipment cable next to the plug attachment inserted into the EDF. This would be at the rear of the EDF Data Panel within 2-inches of the RJ-45/SC-UPC plug/connector. In the instance the customer (CLEC) has a Telco provided Point of Termination (POT) with his service request, the SBC LOCAL EXCHANGE companies Installation Supplier will also provide a tag at that point in the same manner as the EDF. In every case, distance markings will reflect the cable distance from that point back to the Telco Ethernet Network Equipment connection point.

In the outside plant and on the Customer's Premises, the use of the 145P Tag or equivalent is also required at end termination point. There is not a need to have a tag at the EDF at the Customers Premises if the Telco Ethernet Network Equipment is within 25-feet (cable distance) from the EDF on the Customer Premises. If the distance is greater, the EDF will need to be tagged as well. The following chart covers the standards for both the Central Office and the Customers Premises:

Ethernet Tag Standards

Topic	Central Office	Customers Premises
Type for Tag to be used	145P only	145P or equivalent
Label Type	Stenciled	Stenciled or Hand Written
Lettering Size (equivalent to Arial Font Size 10)	1/8” Minimum	1/8” Minimum
Properly Aligned and Spaced	Yes	Yes
Both Sides can be used	Yes	Yes
Tags outside of cover or heat shrinking tubing	Yes	Yes
PIDS used: SBC-12STATE 701271298 SBC-SNET 3585931	Yes	Yes
Circuit Designation on EDF Tag	No	No
Circuit Designation at the Demarcation Point Equipment provided by Telco	Yes	Yes
Service Type (i.e. 10 Base T vs Optical MultiMode) on all Tags	Yes	Yes
Distance from Ethernet Network Equipment on all Tags	Yes	Yes
Show Connector Type	Yes	Yes
Media Converter or Extender used-write “Compensated” on all Tags	Yes	Yes



10.Turn-Up Testing Procedures and Expected Results

This Section contains procedures for initial verification of equipment related for the installation of SBC LOCAL EXCHANGE companies Ethernet services. Use of these procedures will help ensure a successful service hand-off and reduce repeat troubles. This document also covers testing procedures that are features of a variety of test sets. Test and Turn-up procedures covered in this document are those utilizing two Acterna (Test Set) FST-2802 Test Pads. The test device must have the capability of operating as an Ethernet switch port on a circuit. Ethernet switches are capable of interpreting Ethernet frames (data); therefore, you can use the test set to ensure physical and data layer integrity by transmitting and analyzing Ethernet frames. The Acterna FST-2802 Test Pad is already being used by SBC LOCAL EXCHANGE companies personnel in connection with the Installation and Maintenance of Central Office Ethernet switches and the deployment of SBC's current Gig-E offering GigaMAN.

The following test will determine the physical characteristics of the Ethernet element. Testing the Ethernet Element from end to end will give a true test of all segments of the circuit. The same procedure can be of use; testing the different segments when needing to isolate a defect for repair purposes. The three tests performed are essential for the successful deployment of Ethernet services. These tests are to determine:

- Connectivity
- Throughput
- QoS

Ethernet Elements

The Ethernet elements that the 10/100BaseT signals passed through to complete the end-to-testing are the following:

- ADC FMT (Fiber Management Tray)
- ADC RJ-45 to RJ-45 (EIA/TIA T568-B specification)
- ADC Media Converter Module 10/100BaseT-100Base-LX, RJ-45, 1310nm,FP Laser, SC
- 10ft Cat 5e/5t patch cords
- 10ft Fiber Optic SC-UPC patch cords

10A. Ethernet Connectivity Test Procedure

1. Connectivity – Signal (Light)
2. Synchronization (Bit Stream from far end)
3. Link Establishment with far end test set (Both ends communicating)

Before you transmit and receive traffic (Ethernet frames) over a circuit, you must initialize an Ethernet link. At a minimum, initializing a link involves connecting compatible test sets that emulates Ethernet switch ports to a circuit, and allows the test sets to transmit idle traffic.

Connectivity Link Establishment

To specify link initialization parameters

1 Using the application buttons, select a TERM 10/100 (Unit A)
2 Select SETUP. A group of quick configuration buttons appears.
3 Select Link Init. The Link Init tab appears.
4 Set the parameters to Auto Neg On, Flow Control On.
5 Click OK to get back to the main user interface
6 Repeat the same process at the far end test (Unit B).
7 Connect each test set each end of circuit (See Figure 1 and 2)
8 Turn Signal ON for Unit A
9 Now look for Signal (from previous step), Sync LEDs on the test set of Unit B. If link is not established check the settings on both devices and try again.
10 Turn Signal ON for Unit B
11 Now look for Signal (from previous step), Sync LEDs on the test set of Unit A. If link is not established check the settings on both devices and try again.
12 You now have an Ethernet connection between the two ends of the circuit. This will be indicated by a Sync LED on both test sets at either end of the circuit.

10B. Frame Generation

1. Monitor the LED's for Signal, Sync, Link Active, and Frame Detect.
2. All are lit indicating the Test Pad detects a signal, obtains synchronization, link is active, and frames are detected.
3. On the left results pane, select the Result Category button.
4. Select Link Stats and record stats:
    Average Bandwidth Received- 100%
    Current Bandwidth- 100%
    Shows a continual growing number of frames received and frames transmitted.
5. On the right results pane, select the Result Category Button.
6. Select the Error Stats and record stats:
    Symbol Errors-0
    FCS Errored Frames- 0
    Runts-0
    Undersized Frames-0
    Oversized Frames-0
    Errored Frames- 0

10C. Signal Throughput

The test set supports three traffic load types. They are Constant Rate, Burst, or Ramp. For this application we will use a Constant Load type at 10/100. The First step is to prepare the test Ethernet frames for transmission.

10C.1. Constant Load Test

To choose a frame profile

1. Select Setup.
2. A menu appears listing the Quick Configuration buttons.
3. Select Tx Profiles. The Tx Profiles tab appears.
4. Under Selections/Tx Profile, select the Profile P1.
5. There is no need to change anything in the Settings fields.
6. Repeat for the far end test set (Unit B) .

To set-up for a Constant Load Test

1 Select Setup (if not already in set-up).
2 Select the Traffic Tab.
3 Select Const.
4 Select %BW and 100%.
5 Select OK and return to the main user interface.
6 Repeat steps 1 through 5 for the far end test set (Unit B).
7 Select restart to clear any errors, and press button to Start Traffic.
8 You are now transmitting traffic at 100 percent of the circuit capability. Note if errors occur. See the Test Results section for details on results categories and values. Perform the 100% transmission test for 8 minutes or more.
9 Repeat process for far end unit.

10C.2. Constant Load Test Expectations

On the left results pane, select the Result Category button.
Select Link Stats and record stats:
Average Bandwidth Received- 100%
Current Bandwidth- 100%
Shows a continual growing number of frames received and frames transmitted.
On the right results pane, select the Result Category Button.
Select the Error Stats and record stats:
Symbol Errors-0
FCS Errored Frames- 0
Runts-0
Undersized Frames-0
Oversized Frames-0
Errored Frames- 0

10C.3. Link Stats Expectations

The Link Stats category lists link statistics such as the average frame rate, peak frame rate, and the number of frames transmitted, etc. To view Link Stats results, set the result category to Link Stats. The following is a list and a general explanation of all the Link Stats results. Bold type indicates elaboration as to the relevance to this specific test procedure.

Link Statistics (Stats) Test Expectations

Benchmark Test Result Expectations	Description
Total Util %, Average	The average bandwidth received, expressed as a percentage of the entire 1 Gbps of available bandwidth. The average is calculated over the time period elapsed since the last test restart.
Total Util %, Cur	The current bandwidth received expressed as a percentage of the entire 1 Gbps of available bandwidth. **This result indicates what rate of traffic is making it across the link from the far end.**
Total Util %, Peak	The peak bandwidth utilized by the received traffic expressed as a percentage of the entire 1 Gbps of available bandwidth since the last test restart.
Frame Rate, Average	The average rate of received frames, expressed in frames per second. The average is calculated over the time period elapsed since the last test restart.
Frame Rate, Cur	The current rate of received frames, expressed in frames per second. This measurement is an average taken over the prior second of test time.
Frame Rate, Min	The minimum rate of received frames over a one second period, expressed in frames per second.
Frame Rate, Peak	The maximum rate of received frames over a one second period, expressed in frames per second.
Frame Size, Min	The size in bytes of the smallest frame seen since last test restart.
Frame Size, Max	The size in bytes of the largest frame seen since last test restart.
Received Frames	The number of frames received since the last test restart.
Transmitted Frames	The number of frames transmitted since the last test restart. **In a loop back test Received and Transmitted frames should be equal. If they are not, an error may have occurred. Check error counters.**
Rx Bits/Sec, Cur	The current bandwidth utilized by the received traffic expressed in bits per second. This measurement is an average taken over the prior second of test time. **In a loopback test, the Rx and TX Bits/Sec Cur values should track together. This is also true for an end to end test, if the same profile settings are used.**
Tx Bits/Sec, Cur	The current bandwidth utilized by the transmitted traffic expressed in bits per second. This measurement is an average taken over the prior second of test time. This will tell us how fast we are transmitting. **In the Ramp Test, once a pause frame is received, we want to check this result to see that it settles in near the rate in the customer contract.**
Delay, Max	The maximum Round Trip Delay measurement since the last test restart. You must transmit an Acterna payload to measure round trip delay. RTD measurements are only performed when using a Constant traffic type. **Check the service contract or SLA for a max RTD parameter. If there is none, a benchmark for the particular network is still recommended. In general, the Max RTD should not be vastly greater than the average. A significant differential**

	would indicate packet jitter is being imposed on the circuit by a switching or buffering device.
Delay, Min	The minimum round trip delay calculated in microseconds. You must transmit an Acterna payload to measure round trip delay. RTD measurements are only performed when using a Constant traffic type. **Check the service contract or SLA for an average. RTD parameter. If there is none, a benchmark for the particular network is still recommended. In general, this value should be under 100 ms. Average delays in excess of 100 ms might impair the performance of delay sensitive applications.**
Delay, Avg.	The average round trip delay calculated in microseconds. You must transmit an Acterna payload to measure round trip delay. RTD measurements are only performed when using a Constant traffic type
Svc Disruption	The service disruption time (maximum inter-frame gap) when service switches to a protect line calculated in milli-seconds.

10C.4. Link Counts Expectations

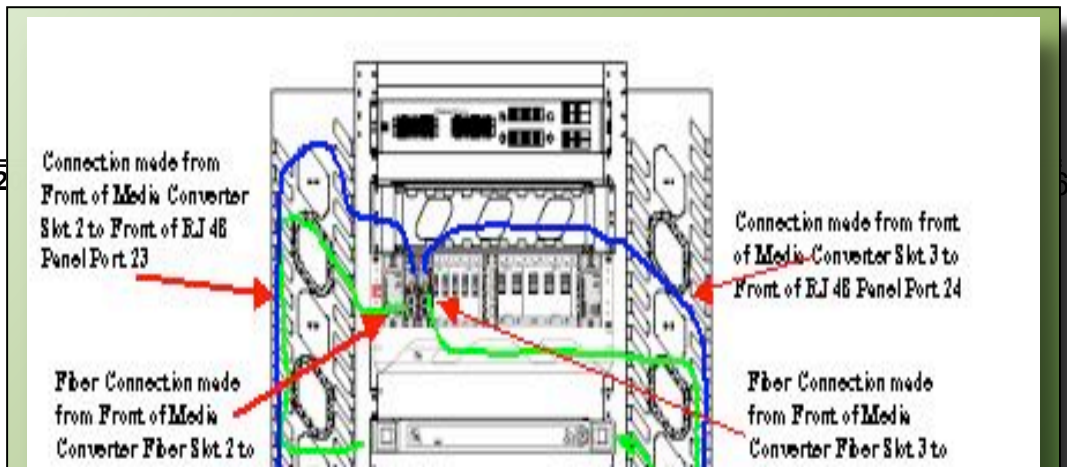
Test Result	Description
Received Frames	A count of frames received since the last test restart, including errored frames.
Transmitted Frames	A count of frames transmitted since the last test restart.
RX Acterna Frames	A count of received frames with Acterna test packets.
PAUSE Frames	A count of PAUSE frames received from a remote Ethernet device. **This should be 0 until using the Ramp Test. When the bandwidth approaches the provisioned limit, this counter should increment by at least 1.**
Out of Seq Frames	A count of out of sequence frames. Only valid while receiving frames with the Acterna payload. **If this result is non zero, it indicates that frames are being lost on the circuit under test.**
VLAN Frames	A count of VLAN frames as defined in IEEE 802.p/q. This result only appears for Test Pads with the VLAN Tagging option.
Unicast Frames	The number of unicast frames received since the last test restart.
Multicast Frames	The number of multicast frames received since the last test restart.
Broadcast Frames	The number of broadcast frames received since the last test restart.
64 Byte Frames	A count of frames with a length of 64 bytes.
65-127 Byte Frames	A count of frames with lengths between 65 and 127 bytes, inclusive.
128-255 Byte Frames	A count of frames with lengths between 128 and 255 bytes, inclusive.
256-511 Byte Frames	A count of frames with lengths between 256 and 511 bytes, inclusive. **Since we chose a frame size of 256, all the frames should be counted here. If you chose a different frame size, the counts will fall into the appropriate bins.**
512-1023 Byte Frames	A count of frames with lengths between 512 and 1023 bytes, inclusive.
1024-1518 Byte Frames	A count of frames with lengths between 1024 and 1518 bytes, inclusive.

10C.5. Error Stats Expectations

The Error Stats category lists error statistics such as the number of symbol errors, FCS errored frames, and runts. In this test procedure, any non-zero value for these Error Stats, constitutes a test failure.

Test Result	Description
Symbol Errors	A count of invalid 10-bit code words received on the physical layer. This result will not increment more than one time per frame.
FCS Errored Frames	A count of frames containing Frame Check Sequence (CRC) errors.
Runts	A count of frames under the required 64 byte frame length containing Frame Check Sequence (CRC) errors.
Undersized Frames	A count of frames under the minimum 64 byte frame length.
Oversized Frames	A count of frames over the maximum 1518 byte frame length.
Errored Frames	A summed count of FCS Errored Frames, Runts, Undersized Frames, and Oversized Frames.

10D. End-to-End Testing Illustration



10E. Note on Sending Deliberate Errors

In the transport test world it is common to send a bit error across a circuit once BERT pattern synchronization has been achieved. This assures the technician(s) that the proper end locations are the ones that are synchronized. The parallel for Ethernet testing is to send a FCS error. However, one of the inherent traits of Ethernet is that error frames are discarded by Ethernet aware interfaces. In the case of the 10/100 and Gigabit services over SONET, the Network Element interfaces are Ethernet aware. Frames with deliberate FCS errors sent by the test set will be dropped by the locally connected Ethernet port. Instead of seeing an FCS, what the far end test set will see is that a frame was lost. In contrast, the DWDM application would behave

differently. The ports on the DWDM device handle traffic with complete transparency. Error frames are passed through along with valid frames. The far end test set would count an FCS error. However, since the test set is behaving as an Ethernet element, if it were in loop back, it would discard an error frame just as a switch would. In this way, the technique so often used in the TDM world can still be used for most Ethernet Transport applications.

Caution. Testing of cables, jumpers and frame facilities need to be performed from end-to-end without the attachment of active Ethernet devices. Perform testing from test set to test set to validate Category 5e/5t facilities.

11.Space Planning Considerations

11A. The Central Office

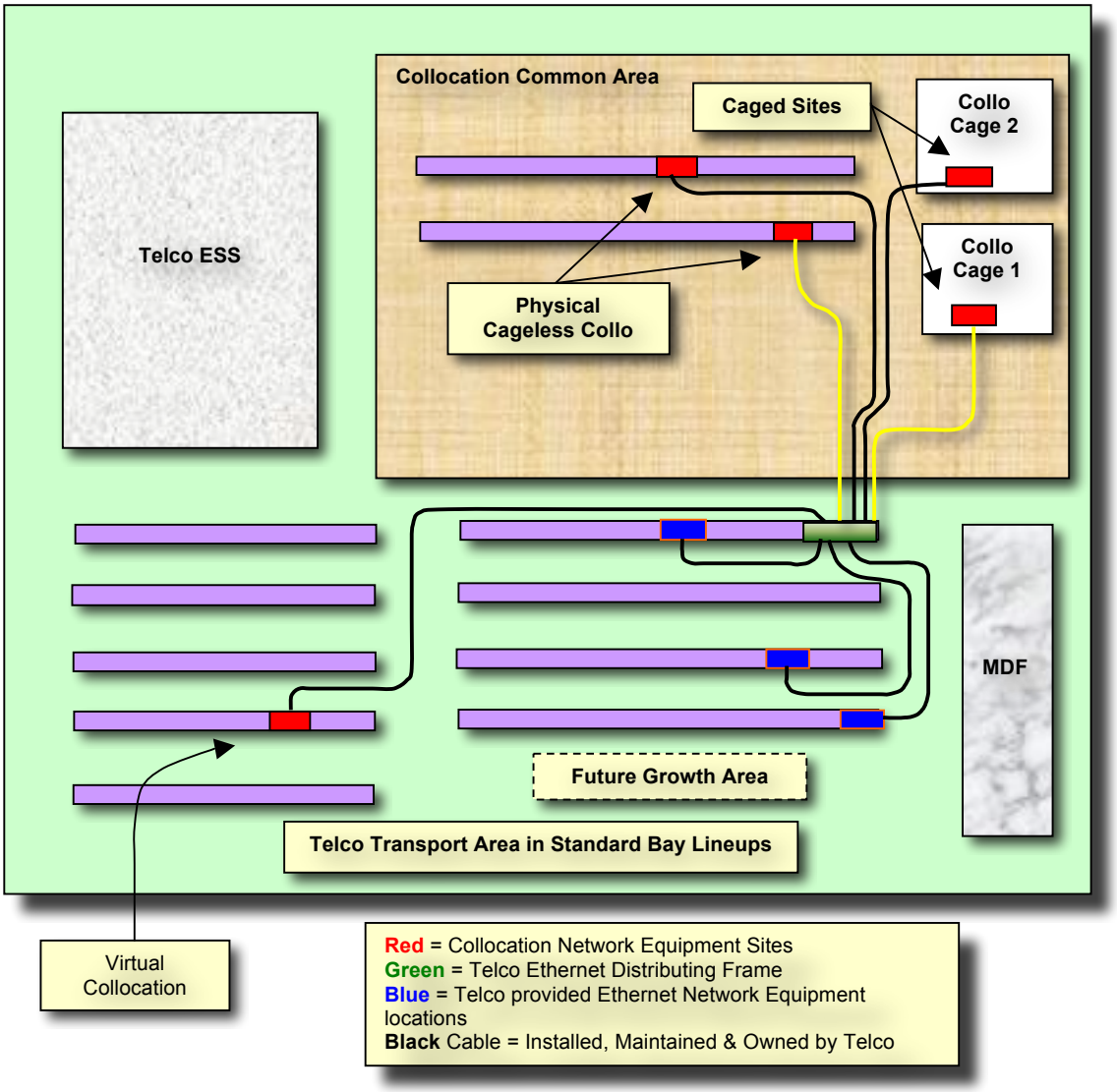
The Ethernet products have distinct electrical and optical distance limitations and subsequently dictate that the placement of the Network Element bays and frames along with the Ethernet Distributing Frame (EDF) be placed with this in mind. Using SBC-002-316-101*, Wire Center Planning M&P*, Issue 8, dated December 2001, space assignments within the Central Office involve the allocation of space in an efficient, cost effective and justifiable manner.

Maximizing space utilization refers to configuring the layout of network equipment environments so that network elements are located in their most appropriate physical relationship ***electrically*** as opposed to simply placing as much equipment in as little space as possible, or arbitrarily placing like equipment together. Ethernet services use protocols and equipment intended for short haul transmissions at the least possible cost outlay. The distance limitations between one Network Element and another within the Central Office become exceptionally restrictive, more so than DS3/STS-1 circuits.

The location of the Ethernet Network Elements and the Ethernet Distributing Frame need to be placed in close proximity to the customer base where their Network Element is located within the same facility. The customer base will represent primarily the Competitive Local Exchange Carriers (CLEC) and potentially other connection points through Unbundled Network Elements (UNEs). If the distance and the subtending electrical/optical limitations of the NE transceiver devices are exceeded, there will be a need to augment the circuits through the use of expensive repeaters and Media Converters. These repeater devices need to be avoided through the intelligent placement of these Ethernet NE and EDF products in close proximity to one another.

Space Planners will need to locate the Ethernet Distributing Frame (EDF) based upon the most limiting electrical or optical ethernet limitations. The EDF should be placed near the Collocation Common Area but specifically within the ILEC (SBC) Equipment Area. The distance from the EDF to the CLEC assigned spaces should not exceed 85 feet. If there are any inordinate distances within the Central Office, SBC Space Planners show the longest distance between the SBC owned Network Equipment and the EDF. In this manner, if Media Converters or Extenders are required, they will remain within SBC LOCAL EXCHANGE companies control being located at the SBC Network Equipment Bay and the EDF respectively.

Typical Layout of Ethernet Sites within the Central Office



CLEC customers may be provisioned within SBC Central Offices in a number of ways with the actual demarcation point varying by the method of interconnection requested by the CLEC. In addition, the ability for the CLEC to place their own cable is extremely inconsistent by state. Refer to this chart below:

Type of Collocation compared to the Method of Interconnection

Type of Interconnection Request	Virtual Collocation	Physical Caged Collocation	Physical Cageless Collocation
CLEC wants a Point of Termination (POT)	Not Available	Located within 10 feet of the Cage, SBC places cable to that POT	Located in SBC owned bay in close proximity to CLEC bay, SBC places cable to that POT
CLEC wants SBC to provide cable without POT	Standard Method	Located to the Cage with some slack, with Ethernet connectors (not available in SBC-Midwest)	Located to the Bay with some slack, with Ethernet connectors (not available in SBC-Midwest)
CLEC wants to place their own cable and connectors	Not Available	CLEC terminates cable on SBC EDF or FDF (cable side only)	CLEC terminates cable on SBC EDF or FDF (cable side only)
CLEC wants to place their own cable and connectors and use their own POT	Not Available	CLEC terminates cable on SBC EDF or FDF (cable side only) POT is only placed on CLEC side in their Cage only.	CLEC terminates cable on SBC EDF or FDF (cable side only) POT is only placed on the CLEC side within their Bay only.
CLEC wants to place their cable and POT near the EDF/FDF	Not Available	Not Available	Not Available

***** Caution *** CLECs obtain interconnection to the SBC LOCAL EXCHANGE companies network through their requests. To date, there are four methods: Twisted Pair (Cat 3), DS1 (Cat 3), DS3 (coax) and Fiber (SC-UPC, SingleMode). Ethernet uses three types, two of which are in conflict: Twisted Pair (Cat 5/5e/5t), Fiber (SC-UPC, SingleMode) and Fiber (SC-UPC, MultiMode) with the potential for other fiber connection methods. The CLEC manages the assignments and will be required to assign the proper facilities for interconnection. The wrong assignment will result in incompatible assignments. Before the Central Office portion of this service is made available, these new methods of interconnection will need to be introduced.**

11B. The Customer Premises

The average business structure, which is similar to a Central Office, is 120 feet by 120 feet. The premises may be laid out in a number of structures, or floors within one structure. In addition, the places that Demarcation Network Interfaces may be provided vary by state and by the building owner or customers in a number of potential arrangements (see Section 10 for more information). The key is to provide the service to a suitable handoff point recognizing that Ethernet Electrical and Optical arrangements have distinct distance limitations between the two Network Equipment placements.

This service is similar to DS3 handoffs in the sense that SBC will provide only one of two interconnected portions of a circuit needed to work. The Demarcation Point that terminates our service, is simply an administrative test point, but does not account for the overall loss of the service. We must tag/mark the handoff point in accordance with Section 10 and insure that our service meets our technical standards.

Whether the building structure uses a Single or Multiple Demarcation Point, the existing copper infrastructure cannot be used. New Category 5e/5t cabling will need to be placed from the Multiplexer and Network Equipment to the agreed Demarcation Point. When fiber optic facilities are used by SBC, SingleMode cable IFNR is deployed. Optical Ethernet services that use a SingleMode methodology can use this embedded cable. If MultiMode is used on the other hand, all new MultiMode cable or MultiMode Fiber jumpers must be placed independent of the existing facilities.

If fiber jumpers are used between the SBC Network Equipment and the Demarcation Point, the use of a Fiber Raceway or FiberGuide protected rack system or dedicated conduit will be required which is typically owned by the customer or building owner. SBC LOCAL EXCHANGE companies will not provide fiber jumpers as the method of interconnection when the use of standard mixed-use cable racks are the only option the placement of fiber jumpers and/or there is a requirement to pull these jumpers through floors or walls.

The Demarcation Device may either be a Wall Mount or Relay Rack/Bay mounted unit. Based upon the expected Marketing Strategy for the provisioning of this service, it is recommended to use the bay mounted method as the preferred choice. Fiber Panels will be deployed in pairs, one 12 port MultiMode and one 12 port SingleMode. Tails for these panels will be available suitable for horizontal and/or vertical cable placement. Multiple Electrical Ethernet terminations will also be provided using the RJ-45 connectors in a bay mounted panel. This provides the ability to advance pre-provisioning of the services without subsequent dispatches. Media Converters and/or extenders will only be available in bay mounted arrangements. SBC LOCAL EXCHANGE companies will not place Media Converters or Extenders beyond the Demarcation Point. Please insure that electrical and/or optical drops are not connected to Customer Premises Equipment (CPE) or Ethernet Network Equipment in the same circuit segment where Media Converters or Extenders are used. In addition, insure that all cable is free of all junction points, splices (equivalent of Bridge-tap) and non-standard terminations such as quick-connect reterminations (i.e.: Scotch-Locks, Wire-Wraps, and 110 connectors).

Optical cable needs to be matched. MultiMode cable and jumpers must only be connected with each other and show all connectors/sleeves as tan/gray. SingleMode cable and jumpers must be only blue.

11C. Proper Planning for Optimum Ethernet Performance

Within the Central Office, provide only manufacturer connectorized cables and jumpers in order to mitigate activity related issues in cable racks by multiple service providers. All slack cable and jumpers need to be placed at the Ethernet Distributing Frame (EDF) without any excess slack in the cable rack, fiber raceways or the Network Element Equipment location. Cabling on customer premises may be either comprised of manufacturer connectorized cables or field provisioned using the correct tools and subsequently validating the service provisions.

Cabling between one Ethernet Network Equipment device and another follow a point-to-point arrangement on the handoff legs of the circuit. Cabling for end services should follow the "Star Topology" from the terminal Ethernet Network Equipment (commonly called a server) to each Customer Premises Equipment (CPE) device. Drops from the end server should not exceed 85 feet in any direction on a floor or geographic area. If that area exceeds that distance, a second server should be deployed on the opposite side of the serving area to provide end user service within the recommended 85 feet maximum.

Electrical Ethernet services provided by SBC need to be provided as a new facility in order to meet the new Category 5t standards as defined in SBC-TP-76412-000, *Electrical and Optical Cat 5t & Cat 6t Ethernet Standards*. The use of embedded customer or telco cable (Cat 3 or Cat 5 shall specifically not be used). Category 5e cabling may be used only upon specific One-Time Approval (OTA) acceptance by SBC Services NP&E Technical Staff. Please insure that electrical and/or optical drops are not connected to Customer Premises Equipment (CPE) or Ethernet Network Equipment in the same circuit segment where Media Converters or Extenders are used. In addition, insure that all cable is free of all junction points, splices (equivalent of Bridge-tap) and non-standard terminations such as quick-connect reterminations (i.e.: Scotch-Locks, Wire-Wraps, and 110 connectors).

Optical cable needs to be matched with the same type only. MultiMode cable and jumpers must only be connected with each other and show all connectors/sleeves as tan/gray. SingleMode cable and jumpers must be only blue. The optical facility layer uses 50/125 u (micron) MultiMode and a 9 u (micron) SingleMode cable type.

Ethernet provisioning is very susceptible to circuit degradation based upon increased resistance, electrical fields and incompatibility in cable types. All Ethernet cables need to be routed away from Ultraviolet (UV) light sources, no closer than 6-inches. Also insure Electrical Ethernet services are kept a minimum of 36-inches from any moving machinery or any product that is capable of generating an electric field.

If a Media Converter or Extender is needed in the Central Office, they will be provided in pairs, one located at the Ethernet Distributing Frame (EDF) and the other within or next to the Telco Provided Network Equipment. The only exception to this C.O. arrangement will be with a Virtual Collocation Site that is connecting to SBC Network Equipment on the other end. In this case, provide one device at the Virtual Collocation Site and another at the SBC Ethernet Network Equipment bay. SBC LOCAL EXCHANGE companies will not place Media Converters or Extenders beyond the Demarcation Point.

If the devices are needed at the Customer Premises, one will be deployed in or next to the Ethernet Network Equipment and the other at the Demarcation Point within a Relay Rack/Bay.

The following chart provides the maximum distances permissible without repeaters/extenders using the best types of facility products:

Assumptions:

1. The average EDF cross-connect for electrical ethernet service is 10 feet.
2. The average FDF cross-connect for optical ethernet service is 10 feet.
3. Circuits are wired straight without Tip/Ring or Transmit/Receive Turnovers as with normal Telco services. (The Network Equipment compensates for this physical arrangement).
4. The average maximum distance from the Electrical Ethernet Network Element to the EDF in the Central Office or the Network Element to the Demarcation Point would not exceed 220 feet.
5. The SBC objective will be to have an operable distance from the EDF (Central Office to the CLEC's Network Element) not exceeding 85 feet. Commensurately, on the Customer Premises, it is anticipated that the SBC LOCAL EXCHANGE companies Electrical Ethernet circuit should be operational up to 85 feet on the customer side of the Demarcation Point.

Maximum Distances before Media Converters need to be applied, Based upon 10/100BaseT

Highlighted circuit arrangements will need a Media Converter/Extender

Location	Overall Distance NE to NE	Maximum Distance from Telco NE - EDF	Expected Distance for the EDF Cross-Connect	Expected Distance to the CLEC Handoff Point	Expected Distance to the Demarcation Point	Customer Distance
Cust. Premises	< 325 feet	220 feet	10 feet	N/A	10 feet	85 feet
Cust. Premises	< 325 feet	150 feet	10 feet	N/A	10 feet	150 feet
Cust. Premises	< 325 feet	85 feet	10 feet	N/A	10 feet	220 feet
Cust. Premises	**>325 feet**	**250 feet**	**10 feet**	**N/A**	**0 feet**	**100 feet**
Cust. Premises	**> 325 feet**	**180 feet**	**10 feet**	**N/A**	**0 feet**	**180 feet**
Central Office	< 325 feet	220 feet	10 feet	85 feet	N/A	N/A
Central Office	< 325 feet	150 feet	10 feet	150 feet	N/A	N/A
Central Office	< 325 feet	85 feet	10 feet	220 feet	N/A	N/A
Central Office	**> 325 feet**	**250 feet**	**10 feet**	**100 feet**	**N/A**	**N/A**
Central Office	**> 325 feet**	**180 feet**	**10 feet**	**180 feet**	**N/A**	**N/A**

Always test and validate the various components all meet the minimum standards of Cat 5e/5t in order to maximize the facility reach of Ethernet Network Components.

12.References

For further information or electronic copies of this document and related information, visit the internal SBC LOCAL EXCHANGE companies web site: **http://ebiz.sbc.com/commonsystems** or **http://apex.sbc.com**. Drawings may be viewed on the SBC LOCAL EXCHANGE companies Internal web site: **http://woodduck/standarddrawings/sbc/cbc-index.htm**

Document	Description	Issue & Date
SBC-002-200-992	SBC-OTA of Non-Approved Products	Issue 2, Jan 2003
SBC-002-216-074	SBC-Demarcation Policy for Access Services	Issue 2, June 2001
SBC-002-216-266	SBC-Turn-up and Test for FTTH	Issue 2, Nov 2002
SBC-002-301-005	SBC-SSIM Special Services Marking & Protection	Issue 2, Apr 2001
SBC-002-316-043	SBC-FDF Frame Deployment M&P Replaces AM-915-890-953 effective Dec 2001 Replaces AM IL 95-07-017 effective Dec 2001	Issue 4, Jan 2003
SBC-002-316-053	SBC-Fiber Raceway Deployment M&P	Issue 3, Jan 2002
SBC-002-316-066	SBC-Breakout Bay Deployment in Support of the NORTEL OPTera Connect DX System	Issue 2. May 2002
SBC-002-316-069	SBC-Fiber Optic Protection M&P	Issue 1, Apr 2003
SBC-002-316-074	SBC-Fiber Optic Bridging for the FDF	Issue 1, Mar 2003
SBC-002-316-076	SBC-Electrical Ethernet Architecture M&P	Issue 1, Mar 2003
SBC-002-316-078	SBC-Fiber Connector/Mode Policy	Issue 1, Jan 2003
SBC-002-316-079	SBC-Fiber Connector/Mode Policy Addendum by Applied Services Approved for Use	Issue 1, Jan 2003
SBC-002-316-101	SBC-Wire Center Planning M&P	Issue 8, Dec 2001 Issue 9, Pending
SBC-002-203-001 Section 13	SBC-Infrastructure Deployment Guidelines, Transport, Wavelength Division Multiplexing (WDM)	June 2002
SBC-002-203-001 Section 12	SBC-Infrastructure Deployment Guidelines, Transport, Fiber Optic Splitters	June 2002
SBC-002-203-001 Section 14	SBC-Infrastructure Deployment Guidelines, Transport, Electrical and Optical Ethernet Provisioning	Apr 2003
SBC-002-203-001 Section 4	SBC-Infrastructure Deployment Guidelines, Transport, Fiber Distribution Frames (FDF)	Jan 2003
SBC-ITO Document	SBC-ITO Structured Cabling System Standards	Issue 3.3.1, Sep 2002
SBC-E-01885-E	SBC-Ethernet Dist. Frame-Equipment	Feb 2003
SBC-E-01885-W	SBC-Ethernet Dist. Frame-Wiring	Feb 2003
SBC-E-01886-E	SBC-Ethernet Media Converter-Equipment	Feb 2003
SBC-E-01886-W	SBC-Ethernet Media Converter-Wiring	Feb 2003
SBC-E-00136-E	SBC-Fiber Patch cords, Cable and Attenuators	Current Issue
SBC-E-01140-E-01	SBC-Fiber Distribution Frame Drawings	Current Issue
SBC-C-50001-E-00	SBC-Fiber Raceway Drawings	Current Issue
SBC-E-01110-W	SBC-Interconnection Drawing for the Nortel OPTera Connect DX	Current Issue
SBC-E-00136-E	SBC-Fiber Cable Standards	Current Issue
SBC-TP76200MP-000	SBC-Network Equipment – Building Systems (NEBS)	Current Issue
SBC-TP76300MP-000	SBC-Installation Guide within the Central Office	Current Issue
SBC-TP76400MP-000	SBC-Detail Engineer Requirements for the C.O.	Current Issue
SBC-TP76412MP-000	SBC-Electrical & Optical Ethernet Telco Cat 5t & Cat 6t Transmission Standards	Mar 2003
SBC-TP76413MP-000	SBC-Connecting Block Standards	Mar 2003
SBC-TP76450MP-000	SBC-Common Systems Standards for the SBC Communications Network	Pending
SBC-PAN-2003-3181	SBC-Outside Plant Fiber Optic MultiMode Jumper Assemblies	Mar 2003
SBC-PAN-2003-3167	SBC-Outside Plant Fiber Optic SingleMode Jumper	Feb 2003

	Assemblies	
SBC-PAN-2003-3161	SBC-Electrical & Optical Ethernet Component Approval	Mar 2003
SBC-PAN-2003-3148	SBC-Special Fiber Bay for Network Equipment	Jan 2003
SBC-PAN-2003-3146	SBC-Fiber Optic Bridge between FDF Lineups	Jan 2003
SBC-PAN-2003-3139	SBC-Destandardization of NGF FDF & Removal of PAN 20011120	Jan 2003
SBC-PAN-2003-3138	SBC-Generation III FDF Approval for Use	Jan 2003
SBC-PAN-2003-3137	SBC-Angled SC-APC Connectors and Panels	Jan 2003
SBC-PAN-2002-3021	SBC-Category 5e/5t Inside Station Wire (IW)	July 2002
SBC-PAN-2002-3001	SBC-Standard for Fiber Jumpers & Attenuators	June 2002
PAN 20021030	SBC-Fiber Breakout Bay Product Approval Notice for the Nortel OPTera Connect DX Platform	Apr 2002
PAN 20011120	SBC-AIT Restricted Approval for AIT only with Sunset Clause for FMDF	Dec 2001
PAN 20021012	SBC-Fiber Management Tray (FMT) for Outside Plant	June 2002
PAN 19995259.0002	SBC-FDF OSP Panels with Tails/Stubs Standards	June 2002
PAN 19995259.0001	SBC-FMT Panels for Central Office Use	June 2002
PAN 19995259	SBC-Frames (FDF) and Fiber Optic Apparatus	June 1999
PAN 19985043	SBC-Fiber Protection Systems (Raceways & Fiber Duct Work)	Aug 1998
SBC-NOT-000-000-473	SBC-Optical In-Line Attenuators for the FDF	Issue 1, June 2002
FLASH OSP-4/23/2002	SBC-Cleaner, Fiber Optic Connector Universal	Apr 2002
GR-449-CORE	Telcordia-Fiber Distribution Frames (FDF)	Issue 2, Mar 2003
408-9767	Tyco-Modular Plug Hand Tool (Premium Grade)	Rev H, Jun 2002
ADC Drawing #1228576	ADC-Cable Manager, Vertical Cable Drawings	Rev A, Jul 2002
ADCP-92-044	ADC-16-port 1300 nm SC Chassis Media Converter Sys.	Rev A, Aug 2002
ADCP-92-009	ADC-Glide Installation Manual	Rev A, Sep 2000
ADCP-92-016	ADC-Glide User Manual	Rev A, Jul 2002
ADCP-90-198	ADC-7-Inch FDF Application Guide & User Manual	Issue 6, Jan 2001
ADCP-90-325	ADC-Fiber Distribution Panel User Manual	Issue 1, Jul 2001
ADCP-90-329	ADC-Fiber Breakout Bay Cable Routing Guide	Issue 3, Apr 2002
ADCP-95-007	ADC-FDF Interbay Cross-Connect Wiring Procedures	Jun 1999

13.Contacts

13A. SBC Contacts

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