Deployment of Secure VoIP Networks Over Zone Cabling Applications

Overview

The growing popularity of Voice over Internet Protocol (VoIP) solutions within a secure communications network is driving the development of seamless, cost-effective infrastructure solutions. A VoIP network can be implemented as a retrofit in “Brownfield” applications or as a new deployment in “Greenfield” applications.

In applications requiring high levels of security, fiber optic cables enhance the security of the voice network due to the inherent resistance of fiber media to signal tapping. One common network application is to run fiber cables from a Main Distribution Frame (MDF) switch to zone enclosures at remote workgroup stations (from office buildings to guard stations) in order to provide a secure line across long distances.

This application note describes the equipment and construction steps necessary for deploying a secure VoIP network over short-reach and long-reach zone applications. The instructions, concepts, and bill of materials included in this document may be scaled for use in any field-scale VoIP network deployment.

About this Note

The successful bench-scale test configuration described in this document can be scaled up and utilized to deploy full-scale secure VoIP systems. For example, in the field, a call manager and access router would typically be located in the MDF rather than in the stand-alone telecommunications rack. Also, the test configuration uses two of eight available slots in the Transition Networks® Point System™ Media Convertor Chassis; actual field configurations may achieve a density of eight fiber channels per chassis.

VoIP telephones can be deployed at single workstations or in entire workgroups as they are needed. For this test configuration, the short-reach workstation group was designated as multi-user and the long-reach workstation group was designated as single-user. However, workgroup designations can be switched and/or modified in layouts that are best suited for the specific VoIP network application.

The following products were used in this application to successfully deploy a secure VoIP network:

- General Dynamics Sectéra® vIPer™ Phones
- Transition Networks® Point System™ Media Converter Chassis and Modules
- Transition Networks® Stand-Alone PoE Media Converter
- Cisco 3745 Multiservice Access Router* with Cisco Call Manager and V150 emulation
- Cisco Catalyst 3750 Series 48-Port Switch
- *PANDUIT* Copper and Fiber Connectivity (Cables, Patch Cords, Modular Patch Panels, Outlets)
- *PANDUIT* Cable Routing Systems (Racks, Raceway)
- *PANDUIT*® *DPoE*™ Compact 8 Midspan and Power Supply
- *PANDUIT*® *PANZONE*™ Enclosures

Color Legend

Fiber Cabling Connections

Yellow identifies long-reach singlemode (9/125µm) fiber

Orange identifies short-reach multimode (50/125µm) fiber

Copper Cabling Connections

Blue identifies LAN path between the workgroup switch, media converters, and zone devices (midspan PoE-enabled)

Power Cords

Black identifies all power cords (AC and DC)

Jacks

All *PANDUIT*® *MINI-COM*® Modular Copper RJ45 Jacks and Patch Cords can be color coded to indicate purpose and identify dedicated cabling paths. *PANDUIT* Fiber Patch Cords are color coded according to convention (yellow for singlemode and orange for multimode).

*The Cisco 3785 Multiservice Access Router has superseded the Cisco 3745 model, and is referenced throughout this application note (including the bill of materials).

Installation Overview

This application note describes the construction steps taken, and the equipment utilized, to deploy and test a secure VoIP network over short-reach and long-reach zone applications.

Zone cabling solutions enable complete installation of all workgroups in a single event, or phased installation of individual workgroups over time. The installation process should begin at the Main Distribution Frame (MDF) or Telecommunications Room (TR), move outward toward the workgroup zone enclosures, and end at workgroup workstations.

The installation instructions in this document are organized as follows to reflect this process:

I. Telecommunications Room

II. Short Reach Zone Enclosure

III. Long Reach Zone Enclosure

IV. Workgroup Station

Installation Notes

(1) Secure networks require a level of physical layer security that conventional connector solutions cannot provide. *PANDUIT* offers an enhanced security solution in the form of fiber connectors with color-specific key options with positive and negative keying features. *PANDUIT*® Keyed LC *OPTICAM*® Fiber Optic Connectors are designed for secure fiber deployments, allowing design flexibility and accommodating more discrete networks. These connectors enable installers to mechanically and visually distinguish between discrete networks and adjacent ports, and maintain enhanced network security by preventing unauthorized physical-layer connections from occurring.

(2) Ensure fiber connector cleanliness any time fiber termination or installation is performed in the field by following *PANDUIT* Best Practices document PN446, “Visual Inspection and Cleaning of Fiber Optic Components”.

(3) Modular jacks (copper and fiber connections) should be used to fully cable each interconnected device as required. If an odd number of devices are installed, installers should use black *MINI-COM*® Blank Modules (CMBBL-X) to fill the empty module positions.

(4) Network reliability depends in large part on the proper handling and installation of cables, active equipment, interconnections, and secure enclosures. Disregard for cable management standards, such as bend radius and tension parameters, can significantly degrade and potentially interrupt transmission performance.

(5) All the installation elements described in this application note should be grounded and bonded using all applicable elements of the *PANDUIT*® *STRUCTUREDGROUND*™ System to provide a high quality, visually verifiable and dedicated grounding path. These systems help network stakeholders improve network reliability, maintain system performance, and protect equipment and personnel by meeting all applicable grounding and bonding industry standards: ANSI/TIA-942; J-STD-607-A-2002; and IEEE Std 1100™-2005 (the Emerald Book).

(6) The *PANDUIT*® *FIBERRUNNER*® Cable Routing System, while not specified in this application note, may be used to route and protect fiber cables in overhead channels, and is listed in the bill of materials as optional.

Installation Steps

The information in this Application Note is based on the configuration shown in Figure 1. A consistent color-code scheme is used throughout to identify different links that connect various channel elements. Product numbers are noted in text and figures to assist in identifying components during the installation.

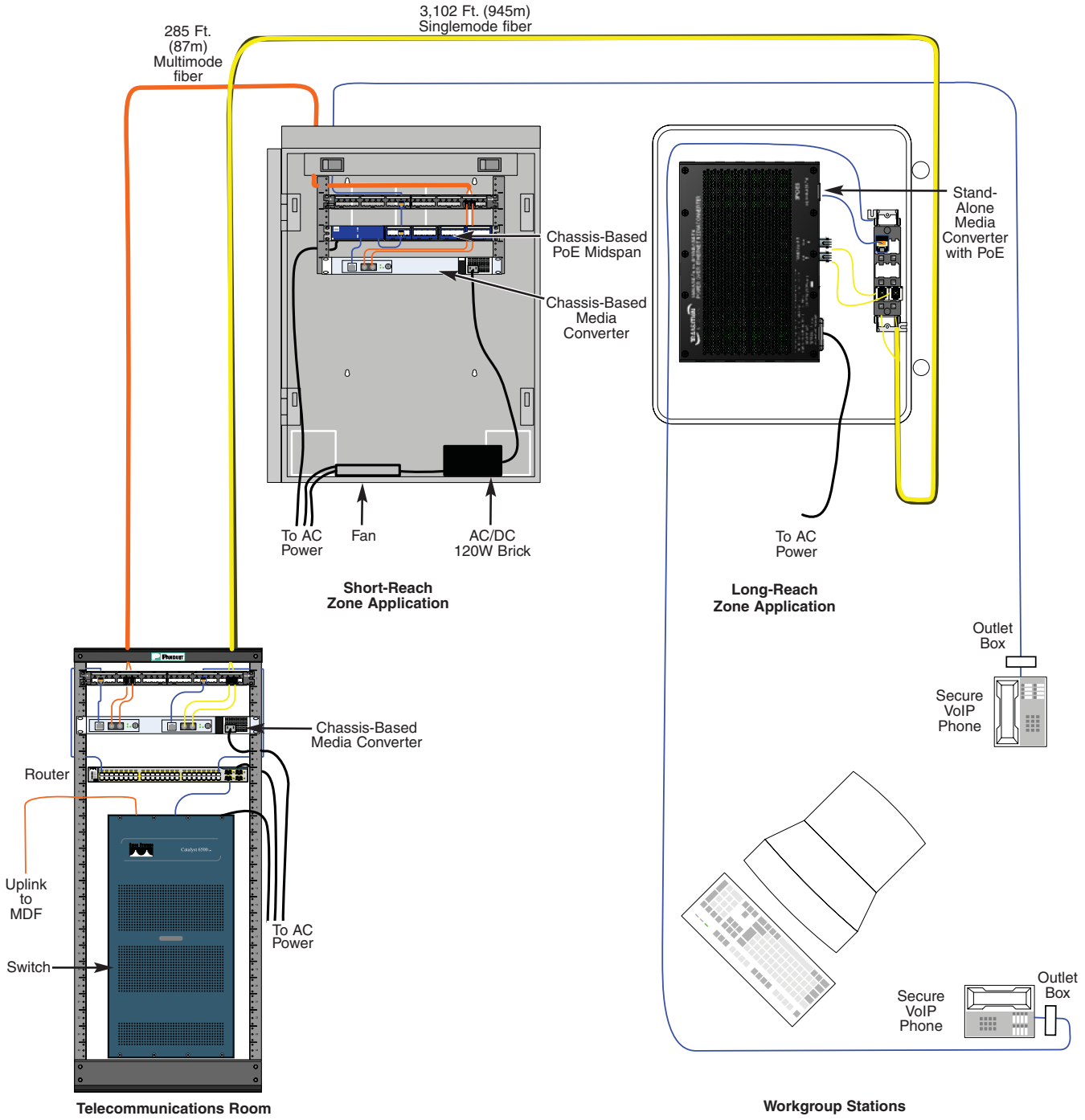


Figure 1. Diagram of secure VoIP network installation showing active equipment and zone cabling elements

I. Telecommunications Room (TR)

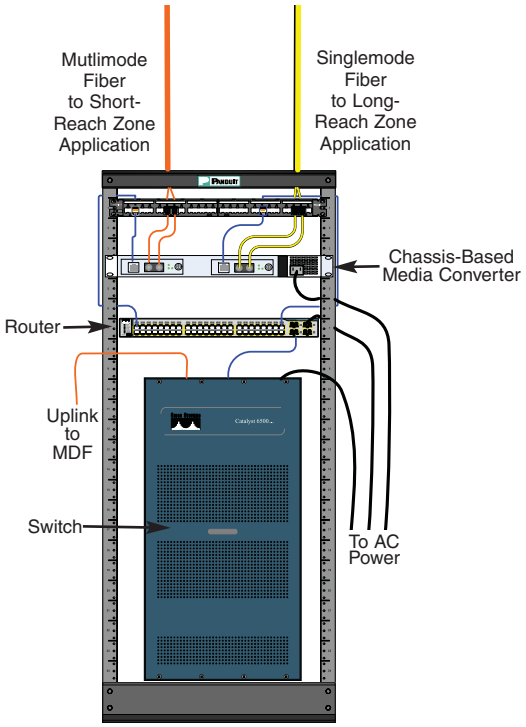
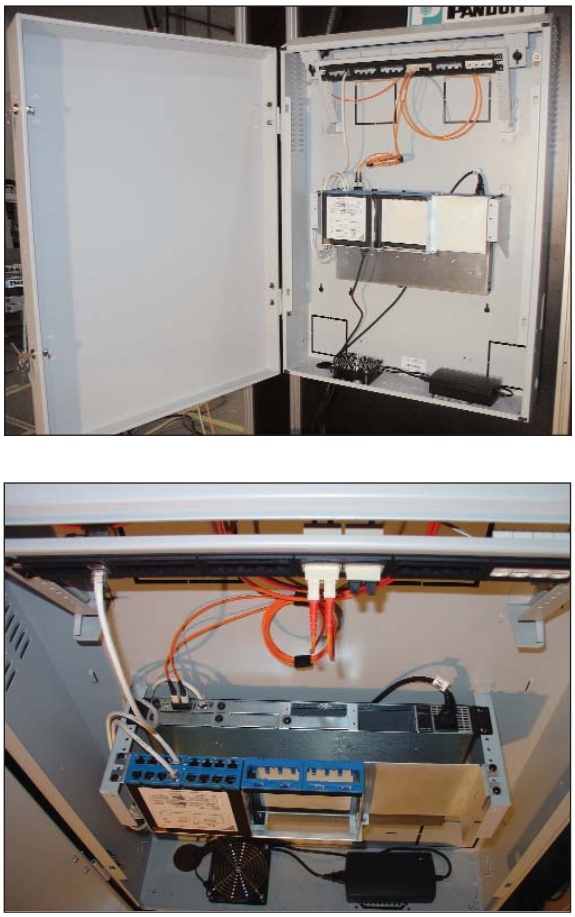


Figure 2. Chassis-Based Media Converter and Patch Panel Connected in TR Rack

1. Install Cisco Catalyst 3750-48TS Switch and Cisco 3845 Multiservice Access Router into a standard two-post equipment rack (CMR19X47).
2. Terminate singlemode fiber cable (FSDR906Y) and multimode fiber cable (FSDP606Y) with SC *OPTICAM*® Connectors (FSCSCBU [Singlemode], FSCMC6BL [Multimode]), in accordance with installation instructions for *PANDUIT*® SC *OPTICAM*® Fiber Optic Connectors.
3. Install modular patch panel (UICMPP24BLY) onto the equipment rack.
4. Install one singlemode fiber adapter (CMDBUSCZBU), one multimode fiber adapter (CMDEISCEI), and two copper jack modules (CJ5E88TGIW) into the patch panel.
5. Insert newly terminated fiber cables (one singlemode and one multimode) into rear of fiber adapters.
6. Install Transition Networks® Point System 8-slot Media Convertor Chassis, singlemode Media Converter Module (1310nm Singlemode port), and multimode Media Converter Module (1300nm Multimode port).
7. Install two simplex singlemode fiber optic patch cords (F9S3-3M1Y) with SC connectors from the fiber optic adapter to the singlemode media converter.
8. Install two simplex multimode fiber optic patch cords (F6S3-3M1Y) with SC connectors from the fiber optic adapter to the multimode media converter.
9. Install one copper patch cord (UTPCH5Y) from each Transition Networks® Media Converter Module to front of patch panel modules.
10. Install two copper patch cords (UTPCH5Y) from rear of patch panel modules to Cisco Multiservice Access Router.
11. Install one copper patch cord (UTPCH5Y) from the Cisco Multiservice Access Router to the Cisco Catalyst Switch.
12. Install and route AC power cords for the media convertor chassis, switch, and router.

II. Short-Reach Zone Enclosure



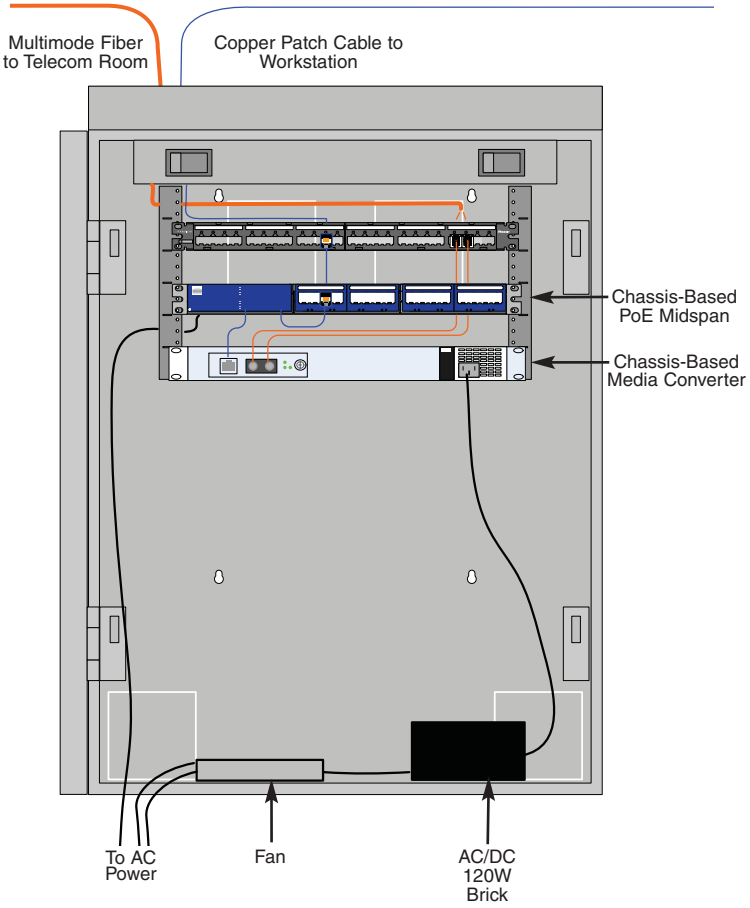


Figure 3. Top view and front view of chassis-based media converter and PoE midspan connected inside active wall mount zone enclosure

1. Prepare the *PANDUIT® PANZONE™* Active Wall Mount Enclosure (PZAEWM3):
   a. Knock out all appropriate openings in enclosure to accommodate incoming/outgoing cables.
   b. Install enclosure door, fan (PZAEFAN), and locks (PZAELOCK).
   c. Mount enclosure on wall.
2. Install modular patch panel (UICMPP24BLY) onto top rack of zone enclosure. The top rack is hinged and locked with thumbscrews.
3. Install one multimode fiber adapter (CMDEISCEI) and one copper jack module (CJ5E88TGIW) into the patch panel.
4. Establish fiber, copper, and power cable (AC and DC) pathways.
5. Terminate incoming multimode fiber cable with SC *OPTICAM®* Connectors (FSCMC6BL), in accordance with installation instructions for *PANDUIT®* SC *OPTICAM®* Fiber Optic Connectors.
6. Insert terminated multimode fiber cable into rear of fiber adapter.
7. Create link between short-reach zone enclosure and desktop by running Category 6 copper cable (UJPBU20BLY) from rear of patch panel module to workstation outlet.

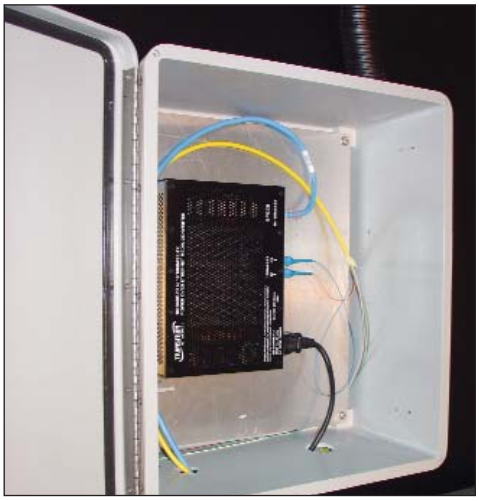
8. Install 120W *DPoE*™ Stand-Alone DC Power Supply (DPOEPWRB120Y) at the bottom of the zone enclosure.
9. Install Transition Networks® Point System 8-slot Media Convertor Chassis and multimode Media Converter Module (1300nm Multimode port) into bottom rack of the zone enclosure. The bottom rack is fixed.
10. Install and ground the POE system:*
    a. Place the *DPoE*™ Midspan (DPOE8S2XG) into the *DPoE*™ Shelf (DPOESHELF).
    b. Place the *DPoE*™ Passive Module (DPOEPL8BU) into the *DPoE*™ Shelf.
    c. Attach the equipped *DPoE*™ Shelf to bottom rack of the zone enclosure, and plug DC power cable from 120W supply into the midspan.
11. Install two simplex multimode fiber optic patch cords (F6S3-3M1Y) with SC connectors from the fiber optic adapter to the media converter.**
12. Install one copper patch cord (UTPCH5Y) from media converter module to midspan.
13. Install one copper patch cord (UTPCH5Y) from midspan to front of patch panel module.
14. Install and route AC power cords for media convertor chassis, DC power supply, and zone enclosure fan.

Notes:

*If PoE powering requirements exceed 120W, a *DPoE*™ Power Chassis/Rectifier System should be used. The chassis/rectifier system should be mounted to the zone enclosure bottom rack, and the *DPoE*™ Power Chassis's DC power supply cable should be plugged into the *DPoE*™ Midspan. Part numbers for the *PANDUIT*® *DPoE*™ Power Chassis/Rectifier System are listed as optional in the bill of materials.

**An alternative deployment method for zone applications with high interconnect densities is the use of *PANDUIT*® *QuickNet*™ Pre-Terminated Fiber Solutions, which employ high-performance Small Form Factor (SFF) array-based connectors on the rear of the units that route to 12 or 24 SFF LC or 12 SC adapters on the patch field side. Modular cassettes support network data rates up to 10Gb/s for link lengths up to 300 meters using laser-optimized OM3 fiber, and comply with IEEE 802.3ae 10GbE and ANSI T11.2 Fibre Channel requirements. High-density ribbon interconnect cables terminated with array-based fiber connectors are used to link cassettes, and enclosures hold up to 4 cassettes allowing up to 48 fiber connections (or 96 fibers) to be deployed in one rack unit (1 RU). *PANDUIT* part numbers for *QuickNet*™ Components are listed as optional in the bill of materials.

III. Long-Reach Zone Enclosure



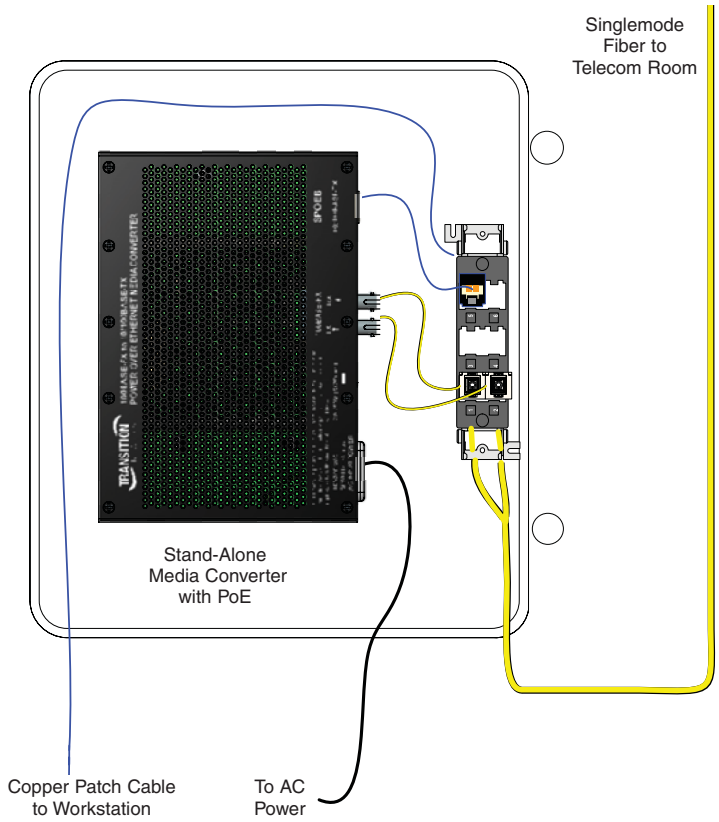


Figure 4. Transition networks PoE media converter (left top), connected in WAP Enclosure (left bottom), interconnection diagram (right)

1. Prepare the *PANDUIT® PANZONE™* Wireless Access Point (WAP) Enclosure (PZNWE14) for mounting and equipment installation.
   a. Drill openings for cable feed-through in enclosure to accommodate incoming/outgoing cables.*
   b. Mount enclosure on wall.
2. Fasten patch panel wall mount bracket (WB89D) to enclosure, allowing sufficient clearance to observe proper bend radii for copper/fiber cabling.
3. Establish fiber, copper, and power cable (AC and DC) pathways.
4. Install one singlemode fiber adapter (CMDBUSCZBU) and one copper jack module (CJ5E88TGIW) into the 12-port patch panel (CPP12WBL), but do not snap panel into bracket yet.**
5. Terminate incoming singlemode fiber cable with SC *OPTICAM®* Connectors (FSCSCBU), in accordance with installation instructions for *PANDUIT®* SC *OPTICAM®* Fiber Connectors.
6. Insert terminated singlemode fiber cable into rear of fiber adapter mounted in the patch panel.

Notes:

*Optional step: Install the *PANDUIT® PANZONE™* Enclosure NEMA Drain and Vent Kit (PZNDVK) and NEMA-rated fittings (PZNF1, PZNF2, PZNF3).

**A patch field within the zone enclosure was not created for this test configuration. However, the steps to deploy a permanent link patch field termination are included in these installation steps. Patch field components are listed as required on the bill of materials.

7. Create the link between the long-reach zone enclosure and workstation outlet:
   a. Terminate both ends of a Category 6 UTP copper cable (PUP6004BU-UY) with *MINI-COM*® Jack Modules (CJ688TGIW); horizontal cable length is determined by distance from the zone enclosure to the workgroup station.
   b. Route the terminated cable through the secure *PAN-POLE*™ Power and Communications Pole (PCPA13R20IW) between the zone enclosure and the desktop outlet at the workgroup station.
   c. Snap cable end into the zone enclosure patch panel.
8. Install the Transition Networks® stand-alone PoE media converter (with 1310nm singlemode port) into the enclosure.
9. Install two simplex singlemode fiber optic patch cords (F9S3-3M1Y) with SC connectors from the fiber optic adapter to the POE media converter.
10. Install one copper patch cord (UTPSP3Y) from copper jack module in patch panel to PoE media converter.
11. Snap equipped patch panel into the wall mount bracket.
12. Install and route AC power cord for POE media convertor.

IV. Workgroup Station

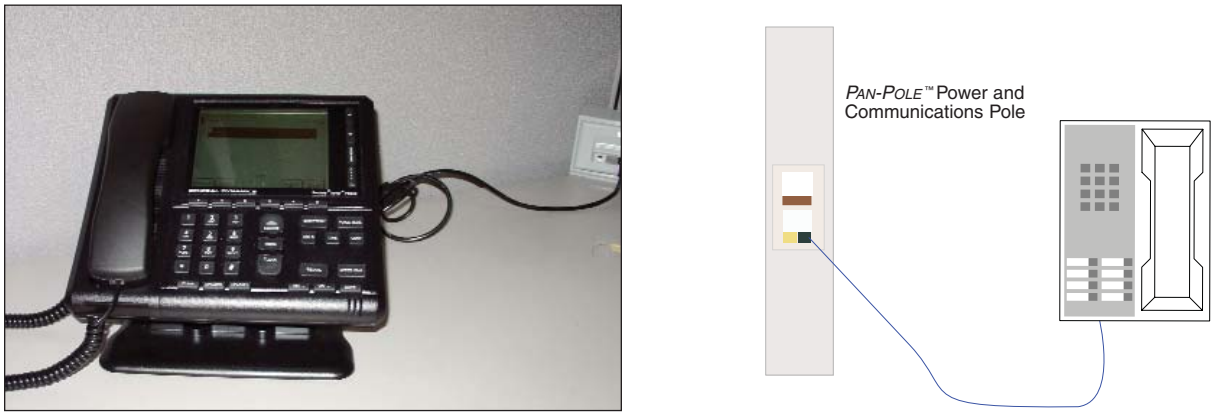


Figure 5. General Dynamics Sectéra® vIPer™ Telephone (left) Connected at workgroup station (right)

At each workgroup station:

1. Install secure *PAN-POLE*™ Power and Communications Pole (PCPA13R20IW).
2. Install the *MINI-COM*® Water-Resistant Faceplate (CFPWR4CIG) with tamper-resistant screws onto the power and communication pole. A standard *MINI-COM*® Surface Mount Box (CBX4IW-AY) can be used if tamper-resistance or water-resistance is not required for the application.
3. Add faceplate labels (C125X030FJC) to identify workstation ports.
4. Snap incoming copper cable from short-reach or long-reach zone enclosure into the faceplate.
5. Install the jack module blockout devices as required in red (PSL-DCJB) or black (PSL-DCJB-BL) to protect against unauthorized access to unused faceplate ports.
6. Install one copper patch cord (UTPSP3Y) from the faceplate to each General Dynamics Sectéra® vIPer™ Telephone.

Bill of Materials

To assist you in selection and ordering of *PANDUIT* products for deploying a secure VoIP network, this example includes all products and accessories required to install cabling and equipment for two workgroup stations, one short-reach and one long-reach zone.

Bill of Materials

This Bill of Materials reflects the parts utilized in this configuration.
Be sure to visit www.panduit.com to locate any other *PANDUIT* accessories necessary to complete your layout.
Additional products will need to be manually added to the BOM.

Part Number	Description	Color	Qty.	Units
I. Telecommunications Room				
Active Equipment				
—	Transition Networks ® Point System ™ 8-Slot Media Converter Chassis.	Black	1	pc
—	Transition Networks ® Media Converter Module (1300nm MM port).	Black	1	pc
—	Transition Networks ® Media Converter Module (1310nm SM port).	Black	1	pc
—	Cisco 3845 Multiservice Access Router with Cisco Call Manager and V150 emulation software installed.	Black	1	pc
—	Cisco Catalyst 3750-48TS Switch (48 10/100 Ethernet ports, 4 SFP ports).	Black	1	pc
Cable Management				
CMR19X47	Two-post standard 19" equipment rack.	Black	1	pc
UICMPP24BLY	*Mini-Com* ® *Ultimate ID* ® Modular 24-Port Patch Panel with six *Mini-Com* ® *Ultimate ID* ® Faceplates.	Black	1	pc
MISC.	*FiberRunner* ® Routing System Optional: not used in test configuration.	Yellow	—	pc
Connectivity				
FSDR906Y	*Opti-Core* ® Singlemode 9/125µm (OS1) Fiber Optic Distribution Cable, 6-fiber riser, non-ribbon, plenum-rated * Length determined by distance from telecom room to zone enclosure (1,000 ft / box).	Yellow	1*	pc
FSDP606Y	*Opti-Core* ® Multimode 62.5/125µm (OM1) Fiber Optic Distribution Cable, 6-fiber riser, non-ribbon, plenum-rated * Length determined by distance from telecom room to zone enclosure (1,000 ft / box).	Orange	1*	pc
FSCSCBU	*SC OptiCam* ® Singlemode Simplex Fiber Optic Connector for 900µm tight-buffered fiber installation.	Blue	2	pc
FSCMC6BL	*SC OptiCam* ® Multimode Simplex Fiber Optic Connector for 900µm tight-buffered fiber installation.	White	2	pc
CMDBUSCZBU	*SC Mini-Com* ® Singlemode Duplex Fiber Optic Adapter Module with zirconia ceramic split sleeves.	Blue	1	pc
CMDEISCEI	*SC Mini-Com* ® Multimode Duplex Fiber Optic Adapter Module with phosphor bronze split sleeves.	White	1	pc
F9S3-3M1Y	*Opti-Core* ® SC to SC Singlemode 9/125µm (OS1) Simplex Patch Cord (1m).	Yellow	2	pc
F6S3-3M1Y	*Opti-Core* ® SC to SC Multimode 62.5/125µm (OM1) Simplex Patch Cord (1m).	Orange	2	pc
CJ5E88TGIW	*Mini-Com* ® *TX5e* ™ Category 5e UTP Jack Module; RJ45, 8-position, 8-wire universal.	White	2	pc
UTPCH5Y	*TX5e* ™ Category 5e UTP Patch Cord with *Pan-Plug* ™ Modular Plugs on each end.	White	5	pc
CORD-S15	AC power cord.	Black	3	pc

Bill of Materials (continued)

Part Number	Description	Color	Qty.	Units
II. Short-Reach Zone Enclosure				
Active Equipment				
—	Transition Networks ® Point System ™ 8-Slot Media Converter Chassis.	Black	1	pc
—	Transition Networks ® Media Converter Module (1300nm MM port).	Black	1	pc
DPOEPWRB120Y	*DPoE* ™ 120W Power Supply.	Black	1	pc
DPOE8S2XG	*DPoE* ™ 8-port Power Midspan (STP 10/100/1000).	Black	1	pc
DPOEPL8BU	*DPoE* ™ 8-Port Passive Patch Panel Module.	Blue	1	pc
DPOESHELF	*DPoE* ™ Power Midspan 1 RU Shelf.	Steel	1	pc
DPOEPWRR1250	*DPoE* ™ 1250W Power Rectifier. Optional: not used in test configuration.	Steel	1	pc
DPOEPWRCU	*DPoE* ™ Power System Chassis (unmanaged). Optional: not used in test configuration.	Steel	1	pc
Cable Management				
PZAEWM3	*PanZone* ™ Active Wall Mount Enclosure.	Off-White	1	pc
PZAEFAN	*PanZone* ™ Active Wall Mount Enclosure Accessory Air Exchange Fan.	Black	1	pc
PZAELOCK	*PanZone* ™ Active Wall Mount Enclosure Accessory Lock.	—	1	pc
UICMPP24BLY	*Mini-Com* ® *Ultimate ID* ® Modular 24-Port Patch Panel with six *Mini-Com* ® *Ultimate ID* ® Faceplates.	Black	1	pc
MISC.	*FiberRunner* ® Routing System. Optional: not used in test configuration.	Yellow	—	pc
Connectivity				
FSCMC6BL	*SC OptiCam* ® Multimode Simplex Fiber Optic Connector for 900µm tight-buffered fiber installation.	White	2	pc
CMDEISCEI	*SC OptiCam* ® Multimode Duplex Fiber Optic Adapter Module with phosphor bronze split sleeves.	White	1	pc
F6S3-3M1Y	*Opti-Core* ® SC to SC Multimode 62.5/125µm (OM1) Simplex Patch Cord (1m).	Orange	2	pc
CJ5E88TGIW	*Mini-Com* ® *TX5e* ™ Category 5e UTP Jack Module; RJ45, 8-position, 8-wire universal.	White	1	pc
UTPCH5Y	*TX5e* ™ Category 5e UTP Patch Cord with *Pan-Plug* ™ Modular Plugs on each end.	White	2	pc
UJPBU20BLY	*PanZone* ™ Category 6 UTP Cable Assembly (20 ft), plenum rated with a *TX6* ™ *PLUS* Modular Plug on one end and a *Mini-Com* ® *TX6* ™ *PLUS* Jack Module on the other.	Blue	1	pc
CORD-S15	AC power cord.	Black	3	pc
OPTIONAL: *QuickNet* ™ Deployment				
FC6-12-3SY	*QuickNet* ™ Pre-Terminated MTP* Cassettes. Singlemode 62.5/125µm (OM1), 12 SC simplex adapters to one male MTP* (12 fiber).	Black	—	pc
FC6-12-3Y	*QuickNet* ™ Pre-Terminated MTP* Cassettes. Singlemode 62.5/125µm (OM1), 6 SC duplex adapters to one male MTP* (12 fiber).	Black	—	pc
FCE1	*QuickNet* ™ 1 RU Rack Mount Fiber Cassette Enclosure.	Black	—	pc
F6S3-3M1Y	*Opti-Core* ® SC to SC Multimode 62.5/125µm (OM1) Simplex Patch Cord (1m).	Orange	—	pc
HDCRT	*OptiCom* ® High-Density Connector Removal Tool (LC end effector kit).	Black	1	pc
KHDCRT-SCE	*OptiCom* ® High-Density Connector Removal Tool (SC end effector kit).	Black	1	pc

*MTP is a registered trademark of US Conec Ltd.

Bill of Materials (continued)

Part Number	Description	Color	Qty.	Units
III. Long-Reach Zone Enclosure				
Active Equipment				
—	Transition Networks ® Stand-Alone PoE Media Converter.	Black	1	pc
Cable Management				
PZNWE14	*PanZone* ™ NEMA 4X/IP66 Rated Wireless Access Point Enclosure.	Off-White	1	pc
WB89D	Wall mount bracket for 12-port snap-in faceplate patch panel.	White	1	pc
PCPA13R20IW	*PanPole* ™ Power and Communication Pole.	Off-White	1	pc
PZNDVK	*PanZone* ™ Enclosure NEMA Rated Drain and Vent Kit. Optional: not used in test configuration.	Gray	1	pc
PZNF1, PZNF2, PZNF3	*PanZone* ™ Enclosure NEMA Rated Compression Fittings. Optional: not used in test configuration.	Gray	3	pc
MISC.	*FiberRunner* ® Routing System. Optional: not used in test configuration.	Yellow	—	pc
Connectivity				
CPP12WBL	*Mini-Com* ® 12-Port Modular Faceplate Patch Panel Supplied with three factory-installed snap-in faceplates (CFFP4); mounts to standard WB89D bracket.	Black	1	pc
FSCSCBU	*SC OptiCam* ® Singlemode Simplex Fiber Optic Connector for 900µm tight-buffered fiber installation.	Blue	2	pc
F9S3-3M1Y	*Opti-Core* ® SC to SC Singlemode 9/125 (OS1) Simplex Patch Cord (1m).	Yellow	2	pc
CMDBUSCZBU	*Mini-Com* ™ SC Singlemode Duplex Fiber Optic Adapter Module with zirconia ceramic split sleeves.	Blue	1	pc
CJ688TGIW	*Mini-Com* ® *TX6* ™ PLUS Category 6 UTP Jack Module; RJ45, 8-position, 8-wire universal.	White	2	pc
CJ5E88TGIW	*Mini-Com* ® *TX5e* ™ Category 5e UTP Jack Module; RJ45, 8-position, 8-wire universal.	White	1	pc
PUP6004BU-UY	TX6000 ™ Category 6 UTP 4-Pair Copper Cable, plenum-rated *Length determined by distance from zone enclosure to workstation (1,000 ft / box)	Blue	1*	pc
UTPSP3Y	*TX6* ™ *PLUS* Category 6 UTP Patch Cord, plenum-rated.	White	1	pc
CORD-S15	AC power cord.	Black	1	pc

Bill of Materials (continued)

Part Number	Description	Color	Qty.	Units
IV. Workgroup Station				
Active Equipment				
—	General Dynamics Sectéra ® vIPer ™ phone.	Black	1	pc
Cable Management				
PCPA13R20IW	*PAN-POLE* ™ Power and Communication Pole.	Off-White	1	pc
CFPWR4CIG	*MINI-COM* ® Water-Resistant Faceplate with tamper resistant screws. Accepts four *MINI-COM* ® modules.	Grey	1	pc
C125X030FJC	*P1* ™ Network Component Label Cassettes for *PANTHER* ™ *LS8E* Hand-Held Thermal Transfer Printer (200/cassette).	White	1	pc
CBX4IW-AY	*MINI-COM* ® Surface Mount Box with label holder/screw cover. Accepts four *MINI-COM* ® Modules. Optional: not used in test configuration.	Off-White	1	pc
Connectivity				
UTPSP3Y	*TX6* ™ *PLUS* Category 6 UTP Patch Cord, plenum-rated.	White	1	pc
PSL-DCJB	Jack Module Blockout Device – red (pack of 10 plus removal tool).	Red	1	pc
PSL-DCJB-BL	Jack Module Blockout Device – black (pack of 10 plus removal tool).	Black	1	pc
PSL-DCPL	RJ45 Plug Lock-In device – red (pack of 10 plus installation/removal tool) Optional: not used in test configuration.	Red	1	pc
PSL-DCPLR-BL	RJ45 Plug Lock-In device – black (pack of 10 plus installation/removal tool) Optional: not used in test configuration.	Black	1	pc

PANDUIT assumes no obligation or liability for the accuracy of this bill of materials. It has been prepared to the best of our ability with the drawings and specifications provided to us. All material and quantities should be verified by the installer. Applicable components are shown to the nearest purchasable quantity. To order the components listed on this bill of material, call your authorized *PANDUIT* distributor or *PANDUIT* at (800) 777-3300.

About *PANDUIT*

PANDUIT is a leading, world-class developer and provider of innovative networking and electrical solutions. For more than 50 years, *PANDUIT* has engineered and manufactured end-to-end solutions that assist our customers in the deployment of the latest technologies. Our global expertise and strong industry relationships make *PANDUIT* a valuable and trusted partner dedicated to delivering technology-driven solutions and unmatched service. Through our commitment to innovation, quality and service, *PANDUIT* creates competitive advantages to earn customer preference.

For more information contact *PANDUIT*:
Web: www.panduit.com email: cs@panduit.com
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LifeElectronics
Живое партнерство

ООО «ЛайфЭлектроникс» **“LifeElectronics” LLC**

ИНН 7805602321 КПП 780501001 Р/С 40702810122510004610 ФАКБ "АБСОЛЮТ БАНК" (ЗАО) в г.Санкт-Петербурге К/С 30101810900000000703 БИК 044030703

Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

Мы предлагаем:

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- *Формирование склада под заказчика.*

- *Сертификаты соответствия на поставляемую продукцию (по желанию клиента).*
- *Тестирование поставляемой продукции.*
- *Поставку компонентов, требующих военную и космическую приемку.*
- *Входной контроль качества.*
- *Наличие сертификата ISO.*

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

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Тел: +7 (812) 336 43 04 (многоканальный)
Email: org@lifeelectronics.ru

www.lifeelectronics.ru