3com

Guide to Interconnecting 3Com Switches Using 10-Gigabit Ethernet

TECHNICAL GUIDE

CONTENTS

INTRODUCTION

As the cost of 10-Gigabit continues to decrease, it has become increasingly popular for interconnecting switches. As an alternative to multiple trunked Gigabit connections, 10-Gigabit has the obvious advantage of using one connection and getting 10x the bandwidth. 10-Gigabit also has matured sufficiently so that today there are enough connection choices to meet nearly all network requirements. Yet sorting through these options can be a challenge.

Various 3Com switches now support 10-Gigabit. This guide outlines the choices for using 10-Gigabit Ethernet for interconnecting 3Com switches and for connecting to other devices over 10-Gigabit.

1.0 UNDERSTANDING 10-GIGABIT TECHNOLOGY

1.1 WHAT IS 10-GIGABIT ETHERNET?

10-Gigabit Ethernet (10GBASE-X) is a telecommunication technology that offers data speeds up to 10 billion bits per second. It is the fastest standards-based Ethernet-based technology presently commercially available. The standard IEEE 802.3-2005 defines both 10-Gigabit over fiber and InfiniBand copper cabling (InfiniBand 4X CX4); 10-Gigabit over twisted pair or 10GBASE-T (IEEE 802.3an) is expected on the market late 2007.

1.2 BEHIND 10-GIGABIT ETHERNET'S GROWTH

10-Gigabit Ethernet is on the rise. The industry analyst Dell'Oro Group is projecting 10-Gigabit annual port shipments to grow from slightly over 300,000 per year in 2006 to over 12,000,000 per year in 2011 (Dell'Oro Group 1/2007). Driving this rapid growth are:

› Increased need for higher network bandwidth, particularly in the core, as Gigabit-to-the-desktop takes hold at the edge and applications – including delay-sensitive voice and video—push for greater bandwidth across the network.

› Rapidly falling prices for 10-Gigabit that make this high-bandwidth technology more affordable for non-specialized network environments.

› Availability of metro area transmission options using 10-Gigabit.

› More 10-Gigabit connection options for both fiber and copper.

1.3 10-GIGABIT CABLING OPTIONS

The distance required for transport will determine which media can be used. Costs generally increase to support longer distances over 10-Gigabit. Here are the most common options:

10GBASE-CX4: Low cost copper-based technology for connecting over short distances, ideal for wiring closet and data center connections.

10GBASE-SR: Lowest-cost fiber 10-Gigabit technology, supporting typical connection distances of up to 30 meters over standard multimode fiber, or up to 300 meters using new laser-optimized multimode fiber.

10GBASE-LR: Using higher cost 1300 nm optics, this technology supports single-mode fiber up to 10 km.

10GBASE-LX4: This technology supports both multimode fiber up to 300 meters, and single-mode fiber up to 10 km. LX4 is more expensive than SR or LR because it requires more optical and electrical components per connection, all to drive four parallel optical wavelengths.

10GBASE-LRM: This technology, recently standardized within the IEEE 802.3ae standards body, targets backhauling Ethernet traffic out of wiring closets over FDDI-grade multimode fiber with a single wavelength. This is anticipated to be a major boon for 10-Gigabit due to its lower cost for multimode connections.

10GBASE-T: Also recently standardized, this will allow 10-Gigabit over copper Category 6 and Category 7 cabling. Analysts anticipate this ultimately to take 10-Gigabit connections to a new higher level but not until 2008.

Distance Required	Recommended Technology	Recommended Cabling
Copper		
Up to 15 meters	10GBASE-CX4	Infiniband 4X
Up to 55 meters	10GBASE-T	CAT-6 unscreened
Up to 100 meters	10GBASE-T	CAT-6 screened
Multimode fiber		
Up to 30 meters	10GBASE-SR	62.5μ, 200 MHz/km or better modal bandwidth
Up to 300 meters	10GBASE-SR	50μ, 2000 MHz/km or better modal bandwidth
Up to 220 meters	10GBASE-LRM	62.5μ, 700 MHz/km or better modal bandwidth
Up to 300 meters	10GBASE-LX4	62.5μ or 50μ, 500 MHz/km or better modal bandwidth
Single-mode fiber		
Up to 10 km	10GBASE-LX4	9μ
Up to 10 km	10GBASE-LR	9μ
Up to 40 km	10GBASE-ER	9μ

1.4 UNDERSTANDING 10-GIGABIT TRANSCEIVERS

Transceivers are commonly used in 10-Gigabit connections to give flexibility to the connection type. Transceivers provide the interface between the switches that send and receive the data and the actual cabling transporting the data. Transceivers are pluggable for high flexibility, allowing a customer to buy one switch or switch module and later choose the connection media—most typically single-mode fiber, multimode fiber or CX4 copper.

There are four notable types of transceivers used for 10-Gigabit connections. Of these, 3Com today offers the XENPAK and XFP versions.

Transceiver Type	Description		Notes
XENPAK	Slide-in module approximately 1 inch wide, .5 inch tall, 4 inch deep		First-generation technology. Offered by 3Com. There are more XENPAK types offered compared with competing technologies but costs can be higher.
X2	Slide-in module approximately 1 inch wide, .5 inch tall, 3 inch deep		Alternative XENPAK technology offered by Cisco and HP.
XFP	Slide-in module approximately .75 inch wide, .25 inch tall, 4 inch deep		Second-generation technology. Offered by 3Com. Most compact design for highest port densities. Due to its small size, not all technologies are available (e.g., there is no LX4 XFP).
SFP+	Slide-in module 30% smaller than XFP, or the same size as today's Gigabit mini-GBIC SFP transceivers, .5 inch wide, .25 inch tall, 2 inch deep.		Expected to become commercially common in 2008-2009, this next-generation technology promises to require less power, use fewer components, and be less expensive than today's XFPs.

Today we're beginning to see a shift away from XENPAK and towards XFP. Because the XFP transceivers and the corresponding slot on the switch are smaller than the corresponding XENPAK variation, higher densities of 10-Gigabit ports can be achieved using XFPs; this is why 2-port or 4-port 10-Gigabit modules are typically XFP. Also, the XFP form uses less energy and generates less heat.

The 3rd generation technology SFP+, which promises an even smaller footprint and less energy use, is on schedule for standardization, with the first implementations expected in 2008.

1.5 COMPONENTS NEEDED FOR 10-GIGABIT CONNECTIONS

These are the elements needed for 10-Gigabit connections:

› A 10-Gigabit enabled device is required at either end of your 10-Gigabit connection. Often you will need an optional module in the device to add the 10-Gigabit port.

› Some devices come with fully functional 10-Gigabit ports but more often a 10-Gigabit transceiver is needed to provide the media connection type in the 10-Gigabit port. This approach has the advantage of giving flexibility to the connections, much like a Gigabit small-form factor mini-GBIC SFP transceiver used in Gigabit ports. In 10-Gigabit, the transceiver gives the connection type, which must be matched at both ends of the connection—but the transceiver type can be mixed.

Example:
LR XENPAK to LR XENPAK   *valid configuration*
LR XENPAK to LR XFP   *valid configuration*
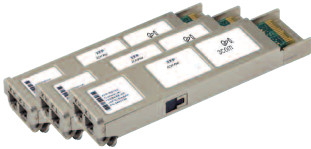LR XENPAK to SR XENPAK   *invalid configuration*

› Appropriate cabling. Today's cable types are InfiniBand 4X CX4, single-mode fiber, or multimode fiber. Fiber optic cables are further defined by their light passing characteristics.

2.0 3COM TRANSCEIVERS

These are the transceivers offered by 3Com for our devices:

XENPAK Transceiver Family

Transceiver	Technology	SKU
XENPAK	LX4**	3CXENPAK91
XENPAK	LR	3CXENPAK92
XENPAK	SR	3CXENPAK94
XENPAK	CX4	3CXENPAK95
XENPAK	ER	3CXENPAK96
XFP	LRM*	3CXFP90
XFP	LR	3CXFP92
XFP	SR	3CXFP94
XFP	CX4*	3CXFP95
XFP	ER	3CXFP96

XFP Transceiver Family

3.0 10-GIGABIT BY 3COM PRODUCT

3.1 3COM SWITCH 3870

The Switch 3870 at the rear of the unit has built-in 10-Gigabit stacking ports and a separate expansion slot for a single 10-Gigabit uplink.

The expansion slot can take a 1-port 10-Gigabit XENPAK-based module.

3C17461 Switch 3870 XENPAK Module

Type of Connection	Module	SKU
XENPAK-based	Switch 3870 1-Port 10-Gigabit XENPAK Module	3C17461
XFP-based	Not Available	N/A

These XENPAKS are supported by the Switch 3870 1-Port 10-Gigabit XENPAK Module.

Transceiver	Technology	SKU
XENPAK	LX4	3CXENPAK91
XENPAK	LR	3CXENPAK92
XENPAK	SR	3CXENPAK94
XENPAK	CX4	3CXENPAK95
XENPAK	ER	3CXENPAK96

While stacking bandwidth is 10-Gigabits per second per connection (or 20 Gbps full duplex and 40 Gbps with resilient stacking), the 3870 stacking connections are specific to the Switch 3870 and do not use standard 10-Gigabit links. The devices daisy chain unit-to-unit together to form the stack, with a top to bottom connection completing a loop where resilient stacking is required. Stacking can go to eight units high. These are the available cables for Switch 3870 stacking:

3C17463 Switch 3870 Stacking Cable

Cable	SKU
Switch 3870 Stacking Cable 30 cm (11.8 in)	3C17462
Switch 3870 Stacking Cable 130 cm (51.2 in)	3C17463

* Available 2nd half calendar year 2007. Check www.3com.com/transceivers for availability.

**There is no LX-4 in XFP form-factor available, or planned, due to thermal and mechanical restrictions.

3.2 3COM SWITCH 4200G

A single Switch 4200G has two expansion slots in the rear of the unit. The expansion slots are a unique and innovative 3Com design. Each can directly take a XENPAK with no additional module required. Alternatively, a 1-port 10-Gigabit module (XFP) can be inserted, and that along with a suitable XFP transceiver gives the 10-Gigabit connection. The XFP module only works in the 4200G.

Type of Connection	Module	SKU
XENPAK	None required	N/A
XFP	Switch 4200G 1-Port 10-Gigabit XFP Module	3C17666

These XENPAKS are supported for direction connection into the Switch 4200G:

Transceiver	Technology	SKU
XENPAK	LX4	3CXENPAK91
XENPAK	LR	3CXENPAK92
XENPAK	SR	3CXENPAK94
XENPAK	CX4	3CXENPAK95
XENPAK	ER	3CXENPAK96

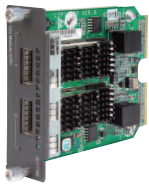These XFPs are supported for use with the Switch 4200G 1-Port 10-Gigabit XFP module:

Transceiver	Technology	SKU
XFP	LRM*	3CXFP90
XFP	LR	3CXFP92
XFP	SR	3CXFP94
XFP	CX4*	3CXFP95
XFP	ER	3CXFP96

There is no dedicated stacking on the 4200G so you will need to consider local switch-to-switch connections in addition to separate connections back to other switches. Most cost effective for short distance connections will be XENPAK-based CX4.

Owners of the Switch 4200G can choose XENPAK or XFP-based connections. Because the XENPAK-based connections do not require an additional module, this approach will generally be more cost-effective. However, using XFPs is perceived by some as being more future-proof as it is a more recent standard, and XFPs together with the additional module require less energy to run.


3C17666 Switch 4200G XFP Module

3.3 3COM SWITCH 4500G

A single Switch 4500G has two expansion slots in the rear of the unit which can take a 2-port CX4 Local Connection module or a 2-port XFP module. A 1-port XFP module will be released later in 2007. There is no dedicated stacking on the 4500G but the low-cost CX4 Local Connection Module can provide 10-Gigabit over short distances for local switch-to-switch connections. The XFP module is used for longer distance 10-Gigabit connections. These modules work today only in the 4500G but may in the future be used in other products.

Model	SKU
Switch 4500G 2-Port 10-Gigabit XFP Module	3C17766
Switch 4500G 2-Port Local Connection Module	3C17767
Switch 4500G 1-Port 10-Gigabit XFP Module	3C17768*

3C17766 Switch 4500G XFP Module
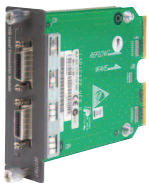
3C17767 Switch 4500G Local Connection Module

* Available 2nd half calendar year 2007. Check www.3com.com/transceivers for availability.

These XFPs are supported in the Switch 4500G 10-Gigabit XFP Modules:

Transceiver	Technology	SKU
XFP	LRM*	3CXFP90
XFP	LR	3CXFP92
XFP	SR	3CXFP94
XFP	CX4*	3CXFP95
XFP	ER	3CXFP96

3C17777 Local Connection CX4 Cable

In the Switch 4500G 2-Port Local Connection Module, no transceiver is required. A cable can directly attach to the port. A standard InfiniBand X4 CX4 cable (with a clip bayonet connector) up to 200cm length can be supported. Use the "Local Connection CX4 Cables" for this connection.

Cable	SKU
Local Connection CX4 Cable 50 cm (1.64 ft)	3C17775
Local Connection CX4 Cable 100 cm (3.28 ft)	3C17776
Local Connection CX4 Cable 200 cm (6.56 ft)	3C17777
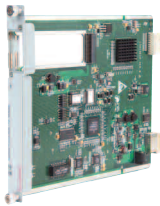
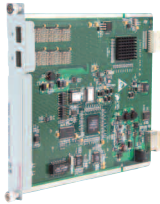3C17261 1-Port 10-Gigabit XENPAK Module

3.4 3COM SWITCH 5500G

A single Switch 5500G has built-in XRN® technology stacking ports and a separate expansion slot in the rear of the unit. The expansion slot can take either a 1-port XENPAK module or a 2-port XFP module. (The expansion slot can also take an 8-port Gigabit card for extra Gigabit ports). These modules only work in the 5500G.

Module	SKU
Switch 5500G 1-Port 10-Gigabit XENPAK Module	3C17261
Switch 5500G 2-Port 10-Gigabit XFP Module	3C17268

In the Switch 5500G 1-Port 10-Gigabit XENPAK Module, these XENPAKS are supported:

Transceiver	Technology	SKU
XENPAK	LX4	3CXENPAK91
XENPAK	LR	3CXENPAK92
XENPAK	SR	3CXENPAK94
XENPAK	CX4	3CXENPAK95
XENPAK	ER	3CXENPAK96

3C17268 2-Port 10-Gigabit XFP Module

For the XENPAK module with a CX4 transceiver, a standard InfiniBand X4 CX4 cable can be supported. The connection is made using a clip or bayonet connection. The "Local Connection CX4 Cables" sold for the Switch 4500G can be used for this connection.

Cable	SKU
Local Connection CX4 Cable 50 cm (1.64 ft)	3C17775
Local Connection CX4 Cable 100cm (3.28 ft)	3C17776
Local Connection CX4 Cable 200 cm (6.56 ft)	3C17777

3C17777 Local Connection CX4 Cable

* Available 2nd half calendar year 2007. Check www.3com.com/transceivers for availability.

These XFPs are supported in the Switch 5500G 2-Port 10-Gigabit Module (XFP):

Transceiver	Technology	SKU
XFP	LRM*	3CXFP90
XFP	LR	3CXFP92
XFP	SR	3CXFP94
XFP	CX4*	3CXFP95
XFP	ER	3CXFP96

The XRN stacking ports on the Switch 5500G support 48-Gigabits per second bandwidth (96-Gigabits bi-directional) based on multiple CX-4 connections. Special stacking cables are sold for this purpose.

3C17269 Stacking Cable

Cable	SKU
Switch 5500G-EI Stacking Cable 65 cm (2.1 ft)	3C17262
Switch 5500G-EI Stacking Cable 1.5 m (4.9 ft)	3C17263
Switch 5500G-EI Stacking Cable 5m (16.4 ft)	3C17269

Stacking can go to eight units high. This dictates how many 10G connections you can have coming into to your 5500Gs in a stack configuration, which is 16 10-Gigabit ports for a stack of eight.

3.5 3COM SWITCH 7750

The Switch 7750 modular chassis has an available 10-Gigabit module for providing high bandwidth connections.

3C16875A 1-Port 10-Gigabit XENPAK Module

Type of Connection	Module	SKU
XENPAK-based	Switch 7750 1-Port 10-Gigabit XENPAK Module	3C16875A
XFP-based	Not Available	N/A

These are the supported XENPAKs in this module:

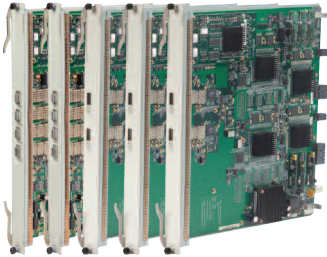| Transceiver	Technology	SKU
XENPAK	LX4	3CXENPAK91
XENPAK	LR	3CXENPAK92
XENPAK	SR	3CXENPAK94
XENPAK	CX4	3CXENPAK95
XENPAK	ER	3CXENPAK96

* Available 2nd half calendar year 2007. Check www.3com.com/transceivers for availability.

3.6 3COM SWITCH 8800

The Switch 8800 modular chassis has multiple available 10-Gigabit modules for providing high bandwidth connections.

Type of Connection	Module	SKU	Use
XENPAK-based	Switch 8800 1-Port 10-Gigabit XENPAK Module	3C17511	1 port 10-Gigabit, wirespeed, IPv4 only. XENPAK transceiver sold separately.
XENPAK-based	Switch 8800 1-Port 10-Gigabit XENPAK Advanced Module	3C17525	1 port 10-Gigabit, wirespeed, IPv4 only. Supports advanced MPLS features of the Advanced Feature License. XENPAK transceiver sold separately.
XFP-based	Switch 8800 2-Port 10-Gigabit XFP Module	3C17512	2 ports 10-Gigabit, wirespeed, IPv4 only. XFP transceivers sold separately.
XFP-based	Switch 8800 4-Port 10-Gigabit XFP Module	3C17526	4 ports 10-Gigabit, IPv4 only. XFP transceivers sold separately.
XFP-based	Switch 8800 2-Port 10-Gigabit XFP Module Advanced	3C17527	2 ports 10-Gigabit, wirespeed. Supports advanced MPLS features of the Advanced Feature License. XFP transceivers sold separately.
XFP-based	Switch 8800 4-Port 10-Gigabit XFP Quad IPv6 Module	3C17536	4 ports 10-Gigabit, wirespeed, IPv6 ready. XFP transceivers sold separately.
XFP-based	Switch 8800 2-Port 10-Gigabit XFP IPv6 Module	3C17537	2 ports 10-Gigabit, wirespeed, IPv6 ready. XFP transceivers sold separately.

3C17511 and 3C17525
1-Port 10-Gigabit XENPAK and XENPAK Advanced Modules

3C17512, 3C17526, 3C17527, 3C17536 and 3C17537
2-Port and 4-Port 10-Gigabit XFP, XFP Advanced and XFP IPv6 Modules

These are the supported XENPAKs in the 3C17511 and 3C17525 modules:

Transceiver	Technology	SKU
XENPAK	LX4	3CXENPAK91
XENPAK	LR	3CXENPAK92
XENPAK	SR	3CXENPAK94
XENPAK	CX4	3CXENPAK95
XENPAK	ER	3CXENPAK96

These XFPs are supported in the 8800 XFP-based modules:

Transceiver	Technology	SKU
XFP	LRM*	3CXFP90
XFP	LR	3CXFP92
XFP	SR	3CXFP94
XFP	CX4*	3CXFP95
XFP	ER	3CXFP96

* Available 2nd half calendar year 2007. Check www.3com.com/transceivers for availability.

4.0 SWITCH CONNECTION OPTIONS

Switch at One End	Switch at Other End	10G Connection Options
Switch 3870	**Switch 3870**	**Stacking** Use 10G stacking cables with built-in stacking ports for unit to unit connection; loop back for resilient stacking. Maximum distance is 1.3 m (4.2 ft). Use 3C17462 or 3C17463 cables depending on required cabling distance. Bandwidth is 10G each direction, or 20G bi-directional and 40G with a resilient connection. **CX4** Use CX4 connection. Maximum distance is 15 m (49 ft). Each 3870 requires one 3C17461 module and one 3CXENPAK95 transceiver. Use 3C17775, 3C17776 or 3C17777 cables depending on required cabling distance, or use a longer standards-based InfiniBand CX4 compatible cable acquired from a third party. **Fiber** Use an LX4, LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. Each 3870 requires one 3C17461 XENPAK module and one matched XENPAK transceiver.
Switch 3870	**Switch 4200G**	**CX4** Use CX4 connection. Maximum distance is 15 m (49 ft). The 3870 requires one 3C17461 module and one 3CXENPAK95 transceiver. The 4200G requires no module but one 3CXENPAK95 transceiver. Use 3C17775, 3C17776 or 3C17777 cables depending on required cabling distance, or use a longer standards-based InfiniBand CX4 compatible cable acquired from a third party. **Fiber** Use an LX4**, LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. The 3870 requires one 3C17461 module and one matched XENPAK transceiver. There are two alternatives for the 4200G: a) use a matched LX4, LR, SR or ER XENPAK transceiver; or b) install the 3C17666 XFP module and use a matched LR, SR. or ER XFP transceiver. [** With the XFP format, there is no available LX4 option]
Switch 3870	**Switch 4500G**	**CX4 Option 1** Use CX4 connection. Maximum distance is 2 m (6.5 ft). The 3870 requires one 3C17461 module and one 3CXENPAK95 transceiver. The 4500G requires one 3C17767 module but no transceiver. Use 3C17775, 3C17776 or 3C17777 cables depending on required cabling distance; longer cables are not supported on this 4500G CX4 connection. **CX4 Option 2** A CX4 variation of the above is using CX4 cables to connect to a 4500G with a 3C17766 or 3C17768* module and the CX4 3CXFP95* XFP transceiver. Maximum distance is 15 m (49 ft). **Fiber** Use an LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements. The 3870 requires one 3C17461 module and one matched XENPAK transceiver. The 4500G requires one 3C17766 or 3C17768* XFP module and one matched XFP transceiver.
Switch 3870	**Switch 5500G**	**CX4** Use CX4 connection. Maximum distance is 15 m (49 ft). The 3870 requires one 3C17461 module and one 3CXENPAK95 transceiver. There are two alternatives for the 5500G: a) install the 3C17261 XENPAK module and use the CX4 3CXENPAK95 XENPAK transceiver; or b) install the 3C17268 XFP module and use CX4 3CXFP95* XFP transceiver. Use 3C17775, 3C17776 or 3C17777 cables depending on required cabling distance or use a longer standards-based InfiniBand CX4 compatible cable acquired from a third party. **Fiber** Use an LX4, LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements. The 3870 requires one 3C17461 XENPAK module and one matched XENPAK transceiver. There are two alternatives for the 5500G: a) install the 3C17261 XENPAK module and the matched LX4, LR, SR or ER XENPAK transceiver; or b) install the 3C17268 XFP module and the matching LR, SR or ER XFP transceiver. Note with the XFP format, there is no available LX4 option.

* Available 2nd half calendar year 2007. Check www.3com.com/transceivers for availability.

Switch at One End	Switch at Other End	10G Connection Options
Switch 3870	**Switch 7750**	**CX4** Use CX4 connection. Maximum distance is 15 m (49 ft). The 3870 requires one 3C17461 XENPAK module and one 3CXENPAK95 transceiver. The 7750 requires one 3C16875A XENPAK module and one 3CXENPAK95 transceiver. Use 3C17775, 3C17776 or 3C17777 cables depending on required cabling distance, or use a longer standards-based InfiniBand CX4 compatible cable acquired from a third party. **Fiber** Use an LX4, LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements. The 3870 requires one 3C17461 XENPAK module and one matched XENPAK transceiver. The 7750 requires one 3C16875A module and one matched LX4, LR, SR or ER XENPAK transceiver.
Switch 3870	**Switch 8800**	**CX4** Use CX4 connection. Maximum distance is 15 m (49 ft). The 3870 requires one 3C17461 module and one 3CXENPAK95 transceiver. There are two alternatives for the 8800: a) install one 3C17511 or 3C17525 XENPAK module and one 3CXENPAK95 transceiver; or b) install one 3C17512, 3C17526, 3C17527, or 3C17536 XFP module and one 3CXFP95* XFP transceiver. Use 3C17775, 3C17776 or 3C17777 cables depending on required cabling distance or use a longer standards-based InfiniBand CX4 compatible cable acquired from a third party. **Fiber** Use an LX4, LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements. The 3870 requires one 3C17461 module and one matched XENPAK transceiver. There are two alternatives for the 8800: a) install one 3C17511 or 3C17525 XENPAK module and one matched XENPAK transceiver; or b) install one 3C17512, 3C17526, 3C17527 3C17536 or 3C17537 XFP module and one matched XFP transceiver. Note with the XFP format, there is no available LX4 option.
Switch 4200G	**Switch 4200G**	**CX4** Use CX4 connection. Maximum distance is 15 m (49 ft). Each 4200G requires one 3CXENPAK95 transceiver. Use 3C17775, 3C17776 or 3C17777 cables depending on required cabling distance, or use a longer standards-based InfiniBand CX4 compatible cable acquired from a third party. **Fiber with XENPAK – XENPAK** Use an LX4, LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. Each 4200G requires one matched XENPAK transceiver. **Fiber with XFP – XFP** Use an LRM*, LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. Each 4200G requires one 3C17666 XFP module and one matched XFP transceiver. **Fiber with XENPAK – XFP** Use an LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. One 4200G requires one matched XENPAK transceiver. One 4200G requires one 3C17666 XFP module and one matched XFP transceiver.

* Available 2nd half calendar year 2007. Check www.3com.com/transceivers for availability.

Switch at One End	Switch at Other End	10G Connection Options
Switch 4200G	**Switch 4500G**	**CX4 Option 1** Use CX4 connection. Maximum distance is 2 m (6.5 ft). The 4200G requires only one 3CXENPAK95 transceiver. The 4500G requires one 3C17767 module but no transceiver. Use 3C17775, 3C17776 or 3C17777 cables depending on desired length. Note that longer cables are not supported on the 4500G connection. **CX4 Option 2** A CX4 variation of the above is using CX4 cables to connect to a 4500G with a 3C17766 or 3C17768* module and the CX4 3CXFP95* XFP transceiver. Maximum distance is 15 m (49 ft). **Fiber with XENPAK – XFP** Use an LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. The 4200G requires only one matched XENPAK transceiver. The 4500G requires one 3C17766 or 3C17768* and one corresponding XFP transceiver. **Fiber with XFP - XFP** Use a fiber connection with the 4200G being XFP-based and the 4500G being XFP-based. LRM*, LR, SR and ER can be supported. The 4200G requires one 3C17666 module and one corresponding XFP transceiver. The 4500G requires 3C17766 or 3C17768* and one corresponding XFP transceiver.
Switch 4200G	**Switch 5500G**	**CX4** Use CX4 connection. Maximum distance is 15 m (49 ft). The 4200G requires one 3CXENPAK95 transceiver. There are two alternatives for the 5500G: a) install the 3C17261 XENPAK module and the CX4 3CXENPAK95 XENPAK transceiver; or b) install the 3C17268 XFP module and the CX4 3CXFP95* XFP transceiver. Use 3C17775, 3C17776 or 3C17777 cables depending on required cabling distance, or a longer standards-based InfiniBand CX4 compatible cable acquired from a third party. **Fiber with XENPAK - XENPAK** Use an LX4, LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. The 4200G requires one corresponding XENPAK transceiver. The 5500G requires one 3C17261 XENPAK module and one corresponding XENPAK transceiver. **Fiber with XENPAK - XFP** Use an LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. The 4200G requires one corresponding XENPAK transceiver. The 5500G requires one 3C17268 and one corresponding XFP transceiver. **Fiber with XFP - XFP** Use an LRM*, LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. The 4200G requires one 3C17666 XFP module and one corresponding XFP transceiver. The 5500G requires one 3C17268 XFP module and one corresponding XFP transceiver. **Fiber with XFP – XENPAK** Use an LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. The 4200G requires one 3C17666 XFP module and one corresponding XFP transceiver. The 5500G requires one 3C17261 XENPAK module and one corresponding XENPAK transceiver.
Switch 4200G	**Switch 7750**	**CX4** Use CX4 connection. Maximum distance is 15 m (49 ft). The 4200G requires one 3CXENPAK95 transceiver. The 7750 requires one 3C16875A XENPAK module and one CX4 3CXENPAK95 XENPAK transceiver. Use 3C17775, 3C17776 or 3C17777 cables depending on required cabling distance, or use a longer standards-based InfiniBand CX4 compatible cable acquired from a third party. **Fiber with XENPAK – XENPAK** Use an LX4, LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. The 4200G requires one corresponding XENPAK transceiver. The 7750 requires one 3C16875A XENPAK module and one corresponding XENPAK transceiver. **Fiber with XFP - XENPAK** Use an LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. The 4200G requires one 3C17666 XFP module and one corresponding XFP transceiver. The 7750 requires one 3C16875A XENPAK module and one corresponding XENPAK transceiver.

* Available 2nd half calendar year 2007. Check www.3com.com/transceivers for availability.

Switch at One End	Switch at Other End	10G Connection Options
Switch 4200G	**Switch 8800**	**CX4** Use CX4 connection. Maximum distance is 15 m (49 ft). The 4200G requires one 3CXENPAK95 transceiver. There are two alternatives for the 8800: a) install one 3C17511 or 3C17525 XENPAK module and one 3CXENPAK95 transceiver; or b) install one 3C17512, 3C17526, 3C17527, or 3C17536 XFP module and one 3CXFP95* XFP transceiver. Use 3C17775, 3C17776 or 3C17777 cables depending on required cabling distance, or a longer standards-based InfiniBand CX4 compatible cable acquired from a third party. **Fiber with XENPAK – XENPAK** Use an LX4, LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. The 4200G requires one corresponding XENPAK transceiver. The 8800 requires one 3C17511 or 3C17525 module and one corresponding XENPAK transceiver. **Fiber with XENPAK – XFP** Use an LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. The 4200G requires one 3C17666 XFP module and one corresponding XFP transceiver. The 8800 requires one 3C17512, 3C17526, 3C17527, 3C17536 or 3C17537 XFP module and one corresponding XFP transceiver. **Fiber with XFP - XFP** Use an LRM*, LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. The 4200G requires one 3C17666 XFP module and one corresponding XFP transceiver. The 8800 requires one 3C17512, 3C17526, 3C17527, 3C17536 or 3C17537XFP module and one corresponding XFP transceiver. **Fiber with XFP - XENPAK** Use an LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. The 4200G requires one 3C17666 XFP module and one corresponding XFP transceiver. The 8800 requires one 3C17511 or 3C17525 module and one corresponding XENPAK transceiver.
Switch 4500G	**Switch 4500G**	**CX4 Option 1** Use CX4 connection. Maximum distance is 2 m (6.5 ft). Each 4500G requires one 3C17767 module but no transceiver. Use 3C17775, 3C17776 or 3C17777 cables depending on desired length. Note that longer cables are not supported on the 4500G connection. **CX4 Option 2** A CX4 variation of the above is using CX4 cables to connect to the 4500G with a 3C17766 or 3C17768* module and the CX4 3CXFP95* XFP transceiver. Maximum distance is 15 m (49 ft). **Fiber** Use an LRM*, LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. Each 4500G requires 3C17766 or 3C17768* and one corresponding XFP transceiver.
Switch 4500G	**Switch 5500G**	**CX4 Option 1** Use CX4 connection. Maximum distance is 2 m (6.5 ft). The 4500G requires one 3C17767 module but no transceiver. There are two alternatives for the 5500G: a) install the 3C17261 XENPAK module and use the CX4 3CXENPAK95 XENPAK transceiver; or b) install the 3C17268 XFP module and use CX4 3CXFP95* XFP transceiver. Use 3C17775, 3C17776 or 3C17777 cables depending on required cabling distance, or a longer standards-based InfiniBand CX4 compatible cable acquired from a third party. **CX4 Option 2** A CX4 variation of the above is using CX4 cables to connect to a 4500G with a 3C17766 or 3C17768* module and the CX4 3CXFP95* XFP transceiver. Maximum distance is 15 m (49 ft). **Fiber with XFP – XFP** Use an LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. The 4500G requires one 3C17766 or 3C17768* module and one corresponding XFP transceiver. The 5500G requires one 3C17268 and one corresponding XFP transceiver. **Fiber with XFP – XENPAK** Use an LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. The 4500G requires one 3C17766 or 3C17768* module and one corresponding XFP transceiver. The 5500G requires one 3C17261 XENPAK module and one corresponding XENPAK transceiver.

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Switch at One End	Switch at Other End	10G Connection Options
Switch 4500G	**Switch 7750**	**CX4 Option 1** Use CX4 connection. Maximum distance is 2 m (6.5 ft). The 4500G requires one 3C17767 module but no transceiver. The 7750 requires one 3C16875A XENPAK module and one CX4 3CXENPAK95 XENPAK transceiver. Use 3C17775, 3C17776 or 3C17777 cables depending on required cabling distance, or use a longer standards-based InfiniBand CX4 compatible cable acquired from a third party. **CX4 Option 2** A CX4 variation of the above is using CX4 cables to connect to a 4500G with a 3C17766 or 3C17768* module and the CX4 3CXFP95* XFP transceiver. Maximum distance is 15 m (49 ft). **Fiber with XFP – XENPAK** Use an LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. The 4500G requires one 3C17766 or 3C17768* module and the one corresponding XFP transceiver. The 7750 requires one 3C16875A XENPAK module and one corresponding XENPAK transceiver.
Switch 4500G	**Switch 8800**	**CX4** Use CX4 connection. Maximum distance is 2 m (6.5 ft). The 4500G requires one 3C17767 module but no transceiver. There are two alternatives for the 8800: a) install one 3C17511 or 3C17525 XENPAK module and one 3CXENPAK95 transceiver; or b) install one 3C17512, 3C17526, 3C17527, or 3C17536 XFP module and one 3CXFP95* XFP transceiver. Use 3C17775, 3C17776 or 3C17777 cables depending on required cabling distance, or a longer standards-based InfiniBand CX4 compatible cable acquired from a third party. **CX4 Option 2** A CX4 variation of the above is using CX4 cables to connect to a 4500G with a 3C17766 or 3C17768* module and the CX4 3CXFP95* XFP transceiver. Maximum distance is 15 m (49 ft). **Fiber with XFP - XENPAK** Use an LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. The 4500G requires one 3C17766 or 3C17768* XFP module and the one corresponding XFP transceiver. The 8800 requires one 3C17511 or 3C17525 XENPAK module and one corresponding XENPAK transceiver. **Fiber with XFP - XFP** Use an LRM*, LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. The 4500G requires one 3C17766 or 3C17768* module and the one corresponding XFP transceiver. The 8800 requires one 3C17512, 3C17526, 3C17527, 3C17536 or 3C17537 XFP module and one corresponding XFP transceiver.

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Switch at One End	Switch at Other End	10G Connection Options
Switch 5500G	**Switch 8800**	**CX4** Use CX4 connection. Maximum distance is 15 m (49 ft). There are two alternatives for each 5500G: a) install the 3C17261 XENPAK module and the CX4 3CXENPAK95 XENPAK transceiver; or b) install the 3C17268 XFP module and the CX4 3CXFP95* XFP transceiver. There are two alternatives for the 8800: a) install one 3C17511 or 3C17525 XENPAK module and one 3CXENPAK95 transceiver; or b) install one 3C17512, 3C17526, 3C17527, 3C17536 or 3C17537 XFP module and one 3CXFP95* XFP transceiver. Use 3C17775, 3C17776 or 3C17777 cables depending on required cabling distance, or a longer standards-based InfiniBand CX4 compatible cable acquired from a third party. **Fiber with XENPAK – XENPAK** Use an LX4, LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. The 5500G requires one 3C17261 XENPAK module and one corresponding XENPAK transceiver. The 8800 requires one 3C17511 or 3C17525 XENPAK module and one corresponding XENPAK transceiver. **Fiber with XENPAK – XFP** Use an LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. The 5500G requires one 3C17261 XENPAK module and one corresponding XENPAK transceiver. The 8800 requires one 3C17512, 3C17526, 3C17527, C17536 or 3C17537 XFP module and one corresponding XFP transceiver. **Fiber with XFP – XFP** Use an LRM*, LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. The 5500G requires one 3C17268 and one corresponding XFP transceiver. The 8800 requires one 3C17512, 3C17526, 3C17527, 3C17536 or 3C17537 XFP module and one corresponding XFP transceiver. **Fiber with XFP – XENPAK** Use an LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. The 5500G requires one 3C17268 and one corresponding XFP transceiver. The 8800 requires one 3C17511 or 3C17525 XENPAK module and one corresponding XENPAK transceiver.
Switch 7750	**Switch 7750**	**CX4** Use CX4 connection. Maximum distance is 15 m (49 ft). Each 7750 requires one 3C16875A XENPAK module and one CX4 3CXENPAK95 XENPAK transceiver. Use 3C17775, 3C17776 or 3C17777 cables depending on required cabling distance or use a longer standards-based InfiniBand CX4 compatible cable acquired from a third party.
Switch 7750	**Switch 8800**	**CX4** Use CX4 connection. Maximum distance is 15 m (49 ft). The 7750 requires one 3C16875A XENPAK module and one CX4 3CXENPAK95 XENPAK transceiver. There are two alternatives for the 8800: a) install one 3C17511 or 3C17525 XENPAK module and one 3CXENPAK95 transceiver; or b) install one 3C17512, 3C17526, 3C17527, 3C17536 or 3C17537 XFP module and one 3CXFP95* XFP transceiver. Use 3C17775, 3C17776 or 3C17777 cables depending on required cabling distance, or a longer standards-based InfiniBand CX4 compatible cable acquired from a third party. **Fiber with XENPAK – XFP** Use an LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. The 7750 requires one 3C16875A XENPAK module and one corresponding XENPAK transceiver. The 8800 requires one 3C17512, 3C17526, 3C17527, 3C17536 or 3C17537 XFP module and one corresponding XFP transceiver. **Fiber with XENPAK – XENPAK** Use an LX4, LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. The 7750 requires one 3C16875A XENPAK module and one corresponding XENPAK transceiver. The 8800 requires one 3C17511 or 3C17525 XENPAK module and one corresponding XENPAK transceiver.

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Switch at One End	Switch at Other End	10G Connection Options
Switch 8800	**Switch 8800**	**CX4** Use CX4 connection. Maximum distance is 15 m (49 ft). There are two alternatives for the 8800: a) install one 3C17511 or 3C17525 XENPAK module and one 3CXENPAK95 transceiver; or b) install one 3C17512, 3C17526, 3C17527, 3C17536 or 3C17537 XFP module and one 3CXFP95* XFP transceiver. Use 3C17775, 3C17776 or 3C17777 cables depending on required cabling distance, or a longer standards-based InfiniBand CX4 compatible cable acquired from a third party. **Fiber with XENPAK – XENPAK** Use an LX4, LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. Each 8800 requires one 3C17511 or 3C17525 XENPAK module and one corresponding XENPAK transceiver. **Fiber with XFP – XFP** Use an LRM*, LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. Each 8800 requires one 3C17512, 3C17526, 3C17527, 3C17536 or 3C17537 XFP module and one corresponding XFP transceiver. **Fiber with XENPAK – XFP** Use an LR, SR or ER connection over compatible fiber depending on available fiber and distance requirements; both ends must match. One 8800 requires one 3C17511 or 3C17525 XENPAK module and one corresponding XENPAK transceiver. One 8800 requires one 3C17512, 3C17526, 3C17527, 3C17536 or 3C17537 XFP module and one corresponding XFP transceiver.

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5.0 FREQUENTLY ASKED QUESTIONS

Q. Can one end of a connection be XENPAK-based and the other end of the connection be XFP-based?

A. Yes. This is a valid configuration provided that the media connection is the same at either end. Also, the media connection type must be supported by the two transceiver technologies.

For example, for an SR fiber connection, there exist both XENPAK and XFP flavors of SR transceivers. If one end were XENPAK SR and the other end were XFP SR, then this would be a valid connection.

Q. What are the differences between XENPAK, XFP and X2?

A. These are all 10-Gigabit "plug-in" transceiver technologies available and shipping today. In size, XENPAK is the largest size, followed by X2 and then XFP. XENPAK was the first to market and, because of this, today has the most connection options. XFP, being the smallest, gives the highest density for 10-Gigabit in modules and fixed switches.

Different vendors have chosen to commercialize different 10-Gigabit transceiver flavors. 3Com offers both XENPAK and XFP. X2 is a XENPAK alternative shipped by Cisco and HP.

Q. Can I connect a 3Com switch with an XENPAK or XFP interfaces to a Cisco switch with X2 interfaces?

A. Yes. Again, this is a valid configuration provided that the media connection is the same at either end. Also, the media connection type must be supported by the two transceiver technologies.

For example, for an SR fiber connection, there exist XENPAK, XFP and X2 flavors of SR transceivers. If one end were XENPAK SR in a 3Com switch and the other end were X2 SR in a Cisco switch, then this would be a valid connection.

Q. If a connection is the same fiber, such as multimode, can the media connection types be different?

A. No. Both ends of the 10-Gigabit link must match in connection type for the connection to work. Even if the transceiver is of the same type, the connection type must also match.

For example, SR and LRM both work over multimode fiber. Yet it will not work for one end of the connection to be SR and the other end to be LRM. Both ends must match for the connection to work properly.

Q. Is 10-Gigabit more cost-effective than using multiple 1-Gigabit connections?

A. A single 10-Gigabit connection can be more cost effective than using multiple 1-Gigabit connections. The exact comparison depends on the required number of Gigabit ports versus the required downlink bandwidth.

Take the simple example of a customer wanting 24 Gigabit ports for local connections and 10-Gigabits of bandwidth to connect to a core. With a 5500G-EI configuration, this is how the two scenarios would compare (list prices in $US, as of May 2007):

Using Gigabit Ports	Using 10-Gigabit
1. 1x Switch 5500G-EI 24 @ $4,995 2. 1x Switch 5500G-EI 24 SFP @ 7,995 3. 10x Gigabit transceivers SX @ 495 ea 4. 10x fiber cable runs Total: $17,940 plus cost of 10 cable runs	1. 1x Switch 5500G-EI 24 @ $4,995 2. 1x XENPAK module @ 2,995 3. 1x XENPAK transceiver SR @ 2,495 ea 4. 1x fiber cable runs Total: $10,485 plus cost of one cable run

The challenge in the configuration above is having 10 available fiber capable switch ports to make a 10-Gigabit connection; this caused the configuration to require a second SFP-based switch. If only 14 Gigabit ports and 10-Gigabits of uplink bandwidth were required, only one switch would be needed:

Using Gigabit Ports	Using 10-Gigabit
1. 1x Switch 5500G-EI 24 SFP @ $7,995 2. 10x FE copper transceivers @ 195 ea 3. 10x Gigabit transceivers SX @ 495 ea 4. 10x fiber cable runs Total: $14,895 plus cost of 10 cable runs	1. 1x Switch 5500G-EI 24 @ $4,995 2. 1x XENPAK module @ 2,995 3. 1x XENPAK transceiver SR @ 2,495 ea 4. 1x fiber cable runs Total: $10,485 plus cost of one cable run