Redpaper

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IBM System z Qualified WDM: Huawei OptiX OSN 6800 and OSN 3800 Release V100R004

This IBM® Redpaper™ is one in a series that describes System z® qualified optical Wavelength Division Multiplexing (WDM) vendor products for GDPS® solutions with Server Time Protocol (STP). The products that we describe in this series are also the IBM supported solutions for non-GDPS applications. Non-GDPS applications include the protocols that are needed for cross-site connectivity of a multisite Parallel Sysplex® or one of the remote copy technologies that we describe in this paper. GDPS qualification testing is carried out at the IBM Vendor Solutions Connectivity (VSC) Lab in Poughkeepsie, NY, USA.

IBM and Huawei Technologies Co. Ltd. successfully completed qualification testing of the Huawei OptiX OSN 6800 and OSN 3800 platform. In this Redpaper publication, we describe the applicable environments, protocols, and topologies that are qualified and supported by System z for connecting to the Huawei OptiX OSN 6800 and OSN 3800 platform hardware and software at release level V100R004.

For current information about qualified WDM vendor products, registered users can visit the Library at the Resource Link™ web site:

https://www.ibm.com/servers/resourcelink/lib03020.nsf/pages/systemzQualifiedWdmProductsForGdpsSolutions?OpenDocument&pathID=

IBM Redbooks® publications for System z qualified WDM vendor products are at:

http://www.redbooks.ibm.com/cgi-bin/searchsite.cgi?query=qualified+AND+wdm&SearchOrder=1&SearchFuzzy=

System z GDPS qualification overview

GDPS is an enterprise-wide continuous availability (CA) and disaster recovery (DR) automation solution that can manage recovery from planned and unplanned outages across distributed servers and System z servers. GDPS can be configured in either a single site or in a multisite configuration. It is designed to manage remote copy configuration between storage subsystems, automate Parallel Sysplex operational tasks, and perform failure recovery from a single point-of-control, thereby improving application availability. Historically, this solution was known as a Geographically Dispersed Parallel Sysplex™. Today, GDPS continues to be applied as a general term for a suite of business continuity solutions, which includes those that do not require a dispersed or multisite sysplex environment.

GDPS supports the following forms of remote copy in multisite solutions:

- IBM System Storage® Metro Mirror, a synchronous form of remote copy previously referred to as Peer-to-Peer Remote Copy (PPRC)
- IBM System Storage Global Mirror, an asynchronous form of remote copy for System z and distributed systems
- IBM System Storage z/OS® Global Mirror, an asynchronous form of remote copy for System z, previously referred to as Extended Remote Copy (XRC)

Depending on the form of remote copy that is implemented, the GDPS solution is referred to as:

- GDPS/Metro Mirror
- GDPS/Global Mirror
- GDPS/z/OS Global Mirror

GDPS also offers two solutions that combine the technologies of Metro Mirror with either Global Mirror or z/OS Global Mirror. This combination allows customers to meet requirements for continuous availability with zero data loss locally within metropolitan distances for most failures along with providing a disaster recovery solution in the case of a region-wide disaster.

The solutions are:

- GDPS Metro/Global Mirror (GDPS/MGM), which is a cascading data replication solution for both System z and distributed systems data
- GDPS Metro/z/OS Global Mirror (GDPS/MzGM), which is a multitarget data replication solution for System z data

The GDPS solution is also independent of disk vendor, if the vendor meets the specific levels of Metro Mirror, Global Mirror, and z/OS Global Mirror architectures.

For more information about GDPS, visit the GDPS web site:

http://www.ibm.com/systems/z/advantages/gdps/index.html

IBM only supports WDM products that are qualified by System z for use in GDPS solutions. To obtain this qualification, WDM vendors obtain licensed IBM patents, intellectual property, and know-how that are related to the GDPS architecture, which gives vendors access to the proprietary IBM protocols and applications that are used in a GDPS environment. These proprietary items include Sysplex Timer®, InterSystem Channel (ISC), Server Time Protocol (STP), Metro Mirror, Global Mirror, and z/OS Global Mirror.

Licensing of IBM patents also provides the WDM vendor with technical information that pertains to future IBM releases. Qualified vendors typically license this information for an

extended period, which allows them to subscribe to the latest GDPS architecture changes and to be among the first to market with offerings that support these features.

Licensing: We recommend that you check with your WDM vendor for current licensing status.

In addition, IBM tested and qualified these vendor products with the same test environment and procedures that were used to test the protocols that provide the required connectivity of a GDPS configuration. This testing includes functionality, recovery, and, in some cases, performance measurements. Having access to these test facilities allows IBM to configure a fully functional sysplex and to simulate failure and recovery actions that cannot be tested as part of a working customer environment.

IBM has the facilities to test and qualify these products with both current and previous generation equipment within the IBM Vendor Solutions Connectivity (VSC) Lab in Poughkeepsie, NY, USA. With this qualification testing, IBM can reproduce any concerns that might arise while using this equipment in a customer's application.

Figure 1 shows the GDPS test environment that is used for WDM vendor qualification.

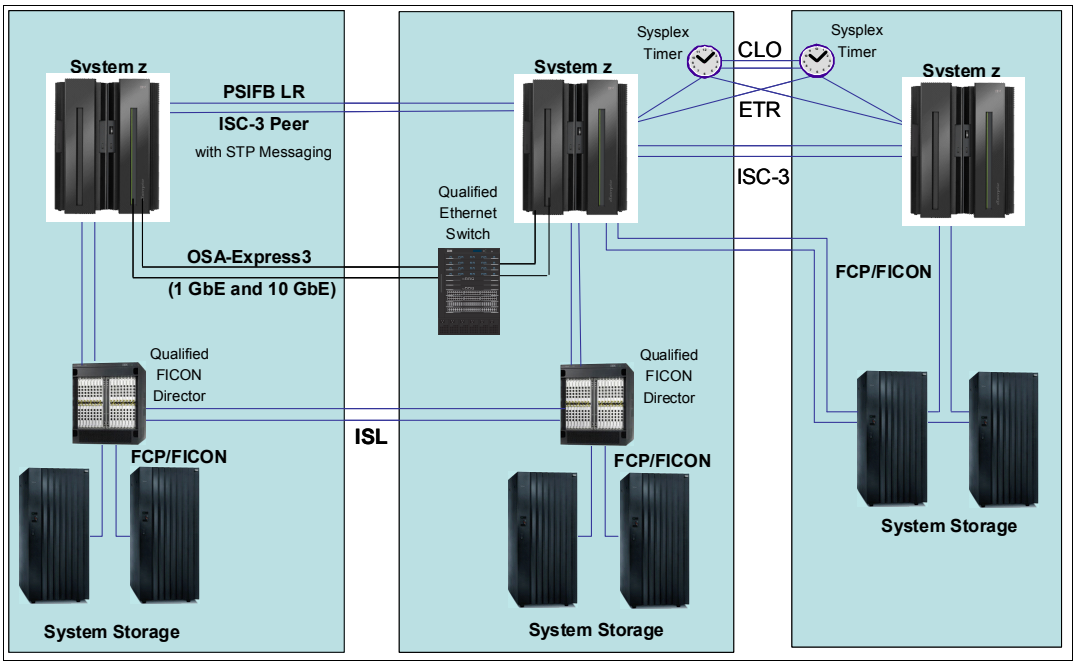

Figure 1 VSC Lab environment

Qualification testing

The VSC Lab contains System z hardware with software applications that test the interoperability of WDM products within a GDPS. A typical qualification test cycle is three to four weeks in length.

The hardware that was used for testing purposes includes (but is not limited to) the following components:

- IBM System z servers enabled for STP
- IBM 9037 Model 2 Sysplex Timers
- IBM System Storage

- IBM 9032 ESCON® Directors
- IBM System z qualified FICON® Directors
- IBM Ethernet Products

WDM links of varying distances are deployed using spools of single-mode fiber in lengths from 5 km to 50 km. Multiple spools are interconnected to test WDM link protocols up to the maximum supported distances. To achieve the maximum distances that are qualified for GDPS protocols, vendors can use optical amplifiers and dispersion compensation units, inserted at various link points, to condition the signals on the fiber links that are connected to the WDM equipment.

Operating system and application software is installed to create and to stress test the GDPS environment. The software used in the test environment includes, but is not limited to:

- z/OS, Linux® on System z, and Parallel Sysplex software exploiters
- Coupling Facility Control Code (CFCC)
- IBM proprietary software and microcode utility test suites

As part of the GDPS qualification test, IBM proprietary software and microcode utility test suites drive the various GDPS components and protocols to the full data rate of each link type that is transported by the WDM equipment. This level of testing ensures that maximum channel utilization is achieved and tested to levels well beyond typical customer environments.

The test suites are used for verification of System z architecture functionality. During these functionality tests, for a test to be classified as successful, zero errors are detected by the attached subsystems. Any errors that are detected during this testing are captured and analyzed by the test suites.

The test suites are also used for verification of System z architecture recovery by creating various fault and error conditions. The recovery tests check for the correct detection of a fault or error condition by the attached subsystems, and ensure that the recovery adheres to System z architecture rules.

Some of the recovery tests performed for each link type are:

- Link state change interrupt detection and recovery: Links are deliberately broken and re-established to ensure that detection and error recovery occur correctly.
- Link error threshold and link synchronization error detection and recovery: Errors are deliberately injected, at the application and channel subsystem levels, into the link protocol data streams to ensure that detection and error recovery take place correctly.
- Link service and maintenance package recovery: Link hardware maintenance actions are performed to ensure that link state change detection and recovery take place correctly.
- Link protection schemes and recovery: Vendor-specific protection methods are tested to ensure that the expected link errors are detected and that recovery takes place correctly.
- STP timing link recovery: STP timing links are broken to ensure that changes to the Coordinated Timing Network (CTN) behave correctly when the break occurs and when the link or links are reconnected.

GDPS components and protocols

The IBM technologies that we discuss in this section are functional components of GDPS and are tested during the qualification process. Customers can also use these components in

environments that do not require a full GDPS solution. The testing provides a level of assurance that these components function when used with a qualified WDM platform.

Components

The following GDPS components are tested during the qualification process:

- IBM System z servers
- IBM Parallel Sysplex
- IBM System Storage
- IBM System Storage Metro Mirror (PPRC)
- IBM System Storage Global Mirror
- IBM System Storage z/OS Global Mirror (XRC)
- Optical Wavelength Division Multiplexer (WDM)
- IBM Ethernet Products

Protocols

Table 1 lists the GDPS connectivity protocols and their data transfer rates. Not all protocols were tested on the Huawei OptiX OSN 6800 and OSN 3800 platform. For a complete list of the protocols and interface cards that were qualified, see Table 2 on page 11.

Table 1 GDPS supported protocols

Protocol	Data transfer rate
Enterprise Systems Connection (ESCON)	200 Mbps[a]
Control Link Oscillator (CLO)	8 Mbps
External Time Reference (ETR)	8 Mbps
Fibre Connection (FICON)	1 Gbps
Fibre Connection (FICON) Express2	1, 2 Gbps
Fibre Connection (FICON) Express4	1, 2, 4 Gbps
Fibre Connection (FICON) Express8	2, 4, 8 Gbps
Fibre Channel FC100/ 200/ 400/ 800	1/ 2/ 4/ 8 Gbps
Inter-Switch Link (ISL) FC100/ 200/ 400/ 800/ 1000	1/ 2/ 4/ 8/ 10 Gbps
InterSystem Channel-3 (ISC-3) Compatibility Mode	1 Gbps
InterSystem Channel-3 (ISC-3) Peer Mode	2 Gbps
InterSystem Channel-3 (ISC-3) Peer Mode[b]	1 Gbps
STP (ISC-3 Peer Mode with STP message passing)	2 Gbps
STP (ISC-3 Peer Mode with STP message passing)[b]	1 Gbps
STP (PSIFB LR 1x IB-SDR with STP message passing)	2.5 Gbps
STP (PSIFB LR 1x IB-DDR with STP message passing)	5 Gbps
Ethernet	1, 10 Gbps

a. Effective channel data rate of an ESCON channel is affected by distance.
b. Requires RPQ 8P2197. This RPQ provides an ISC-3 Daughter Card that clocks at 1.062 Gbps in peer mode.

Often, these supported protocols are used in non-GDPS environments as well. The robust testing that is performed during the qualification process must provide customers with a high level of confidence when using these System z qualified optical WDM vendor products in non-GDPS environments.

Server Time Protocol

Server Time Protocol (STP) is designed to provide the capability for multiple servers and Coupling Facilities to maintain time synchronization with each other without requiring an IBM Sysplex Timer. STP can help provide functional and economic benefits when compared to the Sysplex Timer. STP allows concurrent migration from an External Timer Reference (ETR) network and can coexist with an ETR network.

STP is a message-based protocol in which STP timekeeping information is passed over externally defined coupling links: InterSystem Channel-3 (ISC-3) Peer Mode and Parallel Sysplex InfiniBand (PSIFB) links. ISC-3 links in Peer mode and PSIFB Long Reach (LR) are the only coupling links that can be used to transport STP messages between data centers over a WDM.

The STP design introduced a concept called Coordinated Timing Network (CTN), which is a collection of servers and Coupling Facilities that are time synchronized to a time value called Coordinated Server Time (CST). The CST represents the time for the entire network of servers. A CTN can be configured as either an STP-only CTN or a Mixed CTN. For more information, refer to *Server Time Protocol Planning Guide*, SG24-7280, *Server Time Protocol Implementation Guide*, SG24-7281, and *Server Time Protocol Recovery Guide*, SG24-7380.

Figure 2 shows a multisite STP-only CTN.

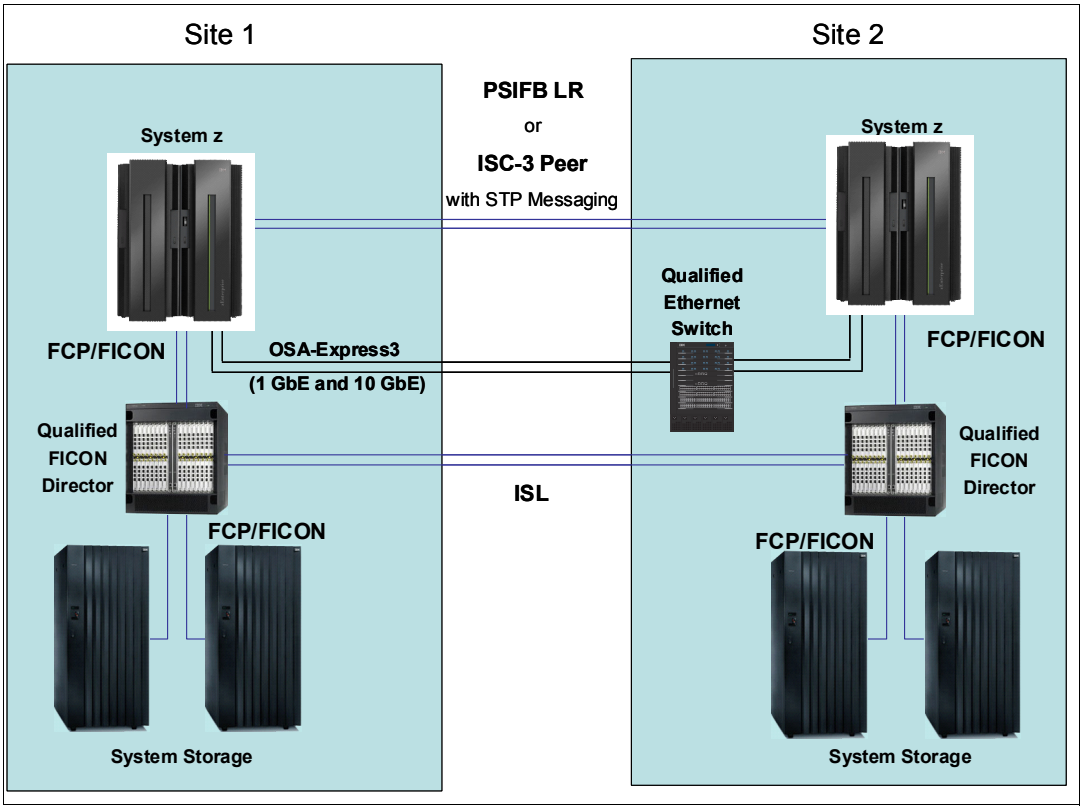

Figure 2 Multisite STP-only CTN

IBM Sysplex Timer

The IBM Sysplex Timer is a mandatory component of an ETR network and an STP Mixed CTN. The Sysplex Timer provides an External Time Reference (ETR) to synchronize the time-of-day (TOD) clocks on attached System z servers in a GDPS/PPRC environment.

Figure 3 shows a multisite ETR network.

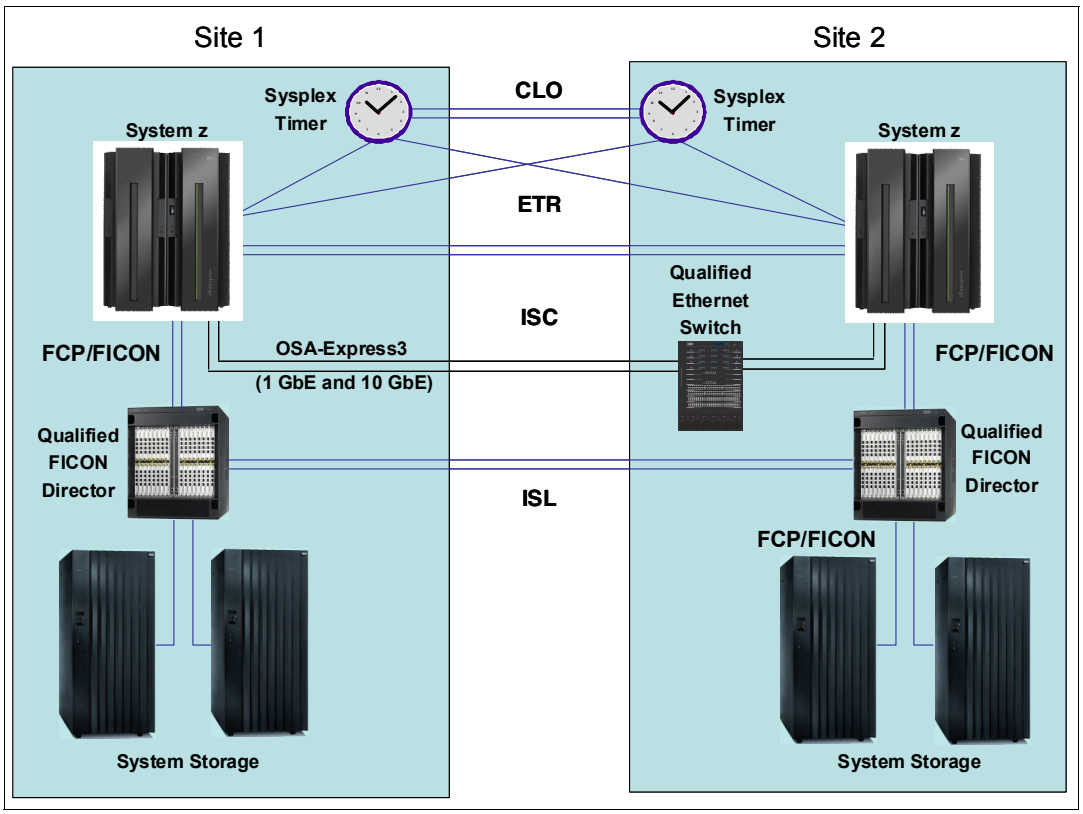

Figure 3 Multisite ETR network with Sysplex Timers

The Sysplex Timer uses two link types:

- External Time Reference (ETR)

  ETR links are connections between the Sysplex Timer and the System z server ETR ports that provide TOD clock sychronization between multiple servers.

- Control Link Oscillator (CLO)

  CLO links are connections between two Sysplex Timer units in an Expanded Availability configuration that allow synchronization of the Sysplex Timer timing signals.

GDPS connectivity considerations with WDM

When planning WDM intersite connectivity for GDPS environments, consider the following items:

- Differential Delay: The difference in distance or latency between a transmit fiber and a receive fiber in a single fiber pair of a timing link must adhere to the following requirements:
  - To ensure correct server time synchronization, the end-to-end lengths of the transmit and receive fibers within an individual STP link (ISC-3 Peer Mode with STP messaging or PSIFB) must not exceed the equivalent of *900 meters* differential delay between

transmit and receive paths of the link. This stipulation includes all DWDM components, optical amplifiers (OAs), dispersion compensation units (DCUs), dark fiber links, and any time division multiplexing (TDM)-based aggregation.

– To ensure correct Sysplex Timer and server time synchronization, the end-to-end lengths of the transmit and receive fibers within an individual ETR or CLO link must be equal (within *10 meters*). This stipulation includes all DWDM components, optical amplifiers (OAs), dispersion compensation units (DCUs), and dark fiber links.

Note: OAs and DCUs might contain significant lengths of fiber that must be included in the differential delay calculation for timing links.

- If both Coupling Facility data and STP timing information must be transmitted between two servers, you cannot select a subset of coupling links to be used only for STP timing information.
- Protection schemes for individual timing links or for fiber trunks transporting timing link, must be bidirectional to ensure that the correct differential delay is maintained.
- WDM configurations must have high availability topologies to ensure that there are no single points of failure.
- Fiber trunk protection schemes must be designed with two trunk switching modules and four site-to-site fiber pairs that are carried over at least two diverse routes. STP, ETR, and CLO links must connect using separate trunk switching modules to ensure that a fiber trunk protection event does not interrupt all timing links simultaneously.
- TDM-based aggregation WDM hardware can be used for STP links (ISC-3 Peer Mode or PSIFB LR with STP message passing) only if it is specifically qualified for STP usage.
- GDPS WDM configuration must be a point-to-point fixed dark fiber network.

For more information about the STP recovery process, refer to the *Server Time Protocol Recovery Guide*, SG24-7380.

Technical description

The Huawei OptiX OSN 6800 and OSN 3800 platform is a scalable, high speed fiber-optic data transport system. It has a modular chassis that can be interconnected to form an optical network that supports International Telecommunications Union (ITU)-specific wavelengths. The wavelengths are multiplexed onto a single pair of fibers using optical wavelength division multiplexing (WDM).

The optical network that connects the Huawei OptiX OSN 6800 and OSN 3800 can be configured in a two site point-to-point, multisite ring or meshed network (for GDPS IBM qualifies point-to-point topologies only).

A fully configured point-to-point network can consist of up to 80 protected ITU wavelengths over multiple fiber pairs (trunks) that are connected between data sites. Multiple client interfaces can be aggregated onto a single wavelength with the use of Muxponder interface cards.

The Huawei OptiX OSN 6800 and OSN 3800 platform was qualified using software release level V100R004. It has a modular chassis that can house multiple optical interface cards depending on the chassis. Multiple Huawei OptiX OSN 6800 and OSN 3800 chassis can be interconnected to support larger quantities of client interfaces.

Interface cards and modules

This section includes a detailed list of the Huawei OptiX OSN 6800 and OSN 3800 optical interface cards and modules that are qualified by System z GDPS Testing.

Optical interface cards and modules:

- Transponder cards

  Transponder cards connect client equipment to the WDM platform. The Transponder card converts client optical signals to an ITU-compliant DWDM wavelength for transmission to the remote site.

  Huawei OptiX OSN 6800 and OSN 3800 Transponder cards have pluggable client optical transceivers.

  The qualified Huawei OptiX OSN 6800 and OSN 3800 Transponder card types are:

  - TN12LWXS, Wavelength Conversion Board
  - TN12LSX, 10Gbps Wavelength Conversion Board

- Muxponder Cards

  The Huawei OptiX OSN 6800 and OSN 3800 supports the aggregation of client signals. Muxponder cards use time division multiplexing (TDM) to aggregate multiple client optical interfaces for transport over a single ITU specific wavelength.

  Muxponder cards have pluggable client optical transceivers that support various client protocols and fiber types.

  The qualified Huawei OptiX OSN 6800 and OSN 3800 Muxponder card types are:

  - TN11LOM: 8-port Wavelength Conversion Board
  - TN11TQM/TN11NS2: 4-port ODU1 to OTU2 Tributary and Line Unit

- Optical Filter Modules

  The Optical Filter Modules are optical components that combine (multiplex) or separate (demultiplex) multiple optical signals onto a fiber link.

  Reconfigurable optical add-drop multiplexer (ROADM) allows adding or dropping of optical signals at the wavelengths layer without an optical-electrical-optical conversion in multiple directions in an optical cross-connect system.

  The main component of the ROADM is the Wavelength Selective Switch (WSS), which combines the multiplexing/demultiplexing functionality with per-wavelength optical signal switching.

- Optical amplifier (OA)

  The optical amplifier module provides in-line optical amplification of multiple ITU-specific wavelengths within a fiber. For some extended distances, the use of these erbium doped fiber amplifiers (EDFAs) might be required. EDFAs cannot be used to amplify CWDM signals.

- Dispersion Compensation Unit (DCU)

  The Dispersion Compensation Unit provides compensation to chromatic dispersion fiber impairment, which causes signal degradation and limits the transmission distance.

  The qualified Huawei OptiX OSN 6800 and OSN 3800 Dispersion Compensation Unit type is:

  - FBG-DCM, Fiber Bragg Grating-based DCM

Note: OAs and DCUs contain significant lengths of fiber, which must be included in the differential delay calculation for timing links.

Topologies and protection schemes

System z qualifies a two-site point-to-point WDM network topology and protection against failures in site-to-site fiber links or failures in individual components within the WDM network for GDPS.

GDPS is a high-availability solution that can utilize several protection schemes. Some restrictions apply for particular protocols, for example, Sysplex Timer (ETR/CLO) and STP (ISC-3 Peer Mode and PSIFB LR) links.

Important: Protection schemes must guarantee the correct differential delay for individual timing links:

- STP links must not exceed the equivalent of *900 meters* differential delay between transmit and receive paths of the link.
- ETR and CLO links must not exceed the equivalent of *10 meters* differential delay between transmit and receive paths of the link.

Protection schemes

The Huawei OptiX OSN 6800 and OSN 3800 platform provides the following protection schemes:

- Unprotected

  An unprotected Transponder/Muxponder card is connected to one client interface and to one site-to-site fiber link only. A failure of the Transponder/Muxponder card or the site-to-site fiber link results in a loss of client communications.

- Client-based protection

  Client-based protection uses at least two client interfaces that are connected to the WDM. These interfaces are arranged so that the Transponder/Muxponder cards that connect the two sites are distributed over two diverse site-to-site fiber links. The client device ensures that a failure of a WDM module or of a single site-to-site fiber link does not result in a total loss of client communications.

  GDPS timing links (ETR, CLO, and STP) are qualified for use in a client-based protection scheme if they are using separate paths (routes).

Optical path: For simplicity, we do not show all components in the optical path in the diagrams in this section.

Figure 4 on page 11 shows a high-level view of the client-based protection scheme. In this case, a client device has two separate site-to-site connections: one through Card A and the other through Card B. Transponder Card and Muxponder Card-based schemes for the Huawei OptiX OSN 6800 and OSN 3800 are shown separately.

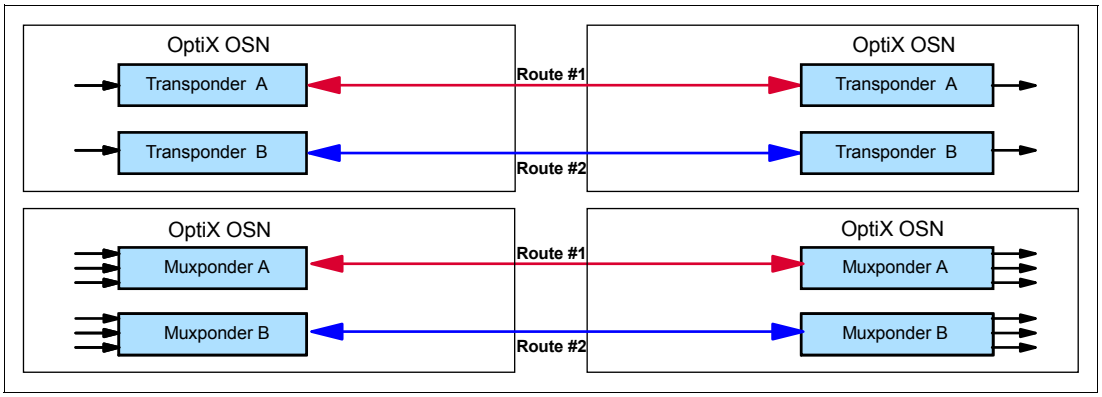

Figure 4 Client-based protected scheme

Protection scheme intermix

All protection schemes can be intermixed within the same Huawei OptiX OSN 6800 and OSN 3800 chassis or network on a per client interface basis.

Interface card specifications

Table 2 lists the specifications of the qualified Huawei OptiX OSN 6800 and OSN 3800 interface cards and tested protocols.

Huawei OptiX OSN 6800 and OSN 3800 interface cards do not support auto-negotiation of link speeds. For System z FICON and FCP client links, the desired link speed must be configured in the WDM card client interface at both ends of the link.

For some extended distances, the use of optical amplifiers and dispersion compensation units might be required. Refer to the WDM vendor documentation for distance and link budget specifications.

Table 2 Qualified client interface card details

Card Type / Protocol	Fiber type	Light source	Qualified distance[a,b]
TN12LWXS[c], Wavelength Conversion Board[d]			
CLO (8 Mbps)	MM	1310 nm	40 km
ETR (8 Mbps)	MM	1310 nm	100 km
TN12LSX, 10Gbps Wavelength Conversion Board[d]			
ISL (10 Gbps)[e]	SM	1310 nm	100 km
ISL (10 Gbps)[e]	MM	850 nm	100 km
TN11LOM, 8-port Wavelength Conversion Board[d]			
FICON (1, 2, 4 Gbps)	SM	1310 nm	200 km
FICON (1, 2 , 4 Gbps)	MM	850 nm	200 km
Fibre Channel (1, 2, 4 Gbps)	SM	1310 nm	200 km
Fibre Channel (1, 2, 4 Gbps)	MM	850 nm	200 km
ISL (1, 2, 4 Gbps)[e]	SM	1310 nm	200 km
ISL (1, 2, 4 Gbps)[e]	MM	850 nm	200 km
ISC-3 Compatibility Mode (1 Gbps)	SM	1310 nm	40 km

Card Type / Protocol	Fiber type	Light source	Qualified distance[a,b]
ISC-3 Peer Mode (2 Gbps)	SM	1310 nm	100 km, 200 km
STP (ISC-3 Peer Mode with STP messaging)[f]	SM	1310 nm	100 km, 200 km
TN11TQM/TN11NS2, 4-port ODU1 to OTU2 Tributary and Line Unit[d]			
ESCON/SBCON (200 Mbps)	MM	1310 nm	100 km
FICON (1, 2 Gbps)	SM	1310 nm	200 km
FICON (1, 2 Gbps)	MM	850 nm	200 km
Fibre Channel (1, 2 Gbps)	SM	1310 nm	200 km
Fibre Channel (1, 2 Gbps)	MM	850 nm	200 km
ISL (1, 2 Gbps)[e]	SM	1310 nm	200 km
ISL (1, 2 Gbps)[e]	MM	850 nm	200 km
SM = single-mode fiber (9/125 micron) MM = multimode fiber (50/125 or 62.5/125 micron)			

a. Qualified distance is based on the VSC Lab test environment, which is a physical point-to-point topology without any intermediate nodes besides OAs and DCUs.
b. Requires RPQ 8P2263 or 8P2340 for distances over 100 km.
c. ETR/CLO links require the use of a single port per channel client card.
d. Protocol and wavelength support is dependent on a pluggable client interface transceiver.
e. Protocol is configured as Fibre Channel protocol on WDM.
f. Multiple STP links supported on the same card.

ISL-supported distances: Consult your SAN switch vendors for qualified ISL-supported distances.

References

For more information about System z connectivity, see:

- System z I/O connectivity home page

  http://www.ibm.com/systems/z/hardware/connectivity/index.html
- *IBM System z Connectivity Handbook*, SG24-5444

  http://www.redbooks.ibm.com/abstracts/sg245444.html?Open
- *FICON Planning and Implementation Guide*, SG24-6497

  http://www.redbooks.ibm.com/abstracts/sg246497.html?Open
- *Getting Started with InfiniBand on System z10 and System z9*, SG24-7539

  http://www.redbooks.ibm.com/abstracts/sg247539.html?Open

For more information about GDPS, see:

- GDPS home page

  http://www.ibm.com/systems/z/advantages/gdps/index.html
- *GDPS Family An Introduction to Concepts and Capabilities*, SG24-6374

  http://www.redbooks.ibm.com/abstracts/sg246374.html?Open

For more information about STP, see:

- Parallel Sysplex home page

  http://www.ibm.com/systems/z/advantages/pso/index.html
- *Server Time Protocol Planning Guide*, SG24-7280

  http://www.redbooks.ibm.com/abstracts/sg247280.html?Open
- *Server Time Protocol Implementation Guide*, SG24-7281

  http://www.redbooks.ibm.com/abstracts/sg247281.html?Open
- *Server Time Protocol Recovery Guide*, SG24-7380

  http://www.redbooks.ibm.com/abstracts/sg247380.html?Open

For more information about optical communication, refer to:

- *Understanding Optical Communications*, SG24-5230

  http://www.redbooks.ibm.com/abstracts/sg245230.html?Open

For current information about qualified WDM vendor products, registered users can visit the Library at the Resourcelink web site:

https://www.ibm.com/servers/resourcelink/lib03020.nsf/pages/systemzQualifiedWdmProductsForGdpsSolutions?OpenDocument&pathID=

For current information about qualified vendor switches and directors for IBM System z FICON and FCP channels, registered users can visit the Library at the Resourcelink web site:

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IBM Redbooks publications on System z-qualified WDM vendor products are at:

http://www.redbooks.ibm.com/cgi-bin/searchsite.cgi?query=qualified+AND+wdm&SearchOrder=1&SearchFuzzy=

For more information about the Huawei OptiX OSN 6800 and OSN 3800 platform, visit:

http://www.huawei.com/transport_network/products/dwdm/Optical.do?card=1

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