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Introduction

This paper takes you on a small mainframe journey to show you how its data transportation or fiber optic standards evolved into what it became today: high performance FICON.

Let’s begin our story over 25 years ago when the existing bus and tag technology had become a huge and complex cable system because of the many copper wires that were required to move data in parallel between the mainframe and the peripherals, 1-byte at a time. The need for change became inevitable.

Enterprise Systems Connection (ESCON) was, therefore, introduced in September 1989 with great promise and high expectations. Throughout the early ‘90s, by the time ESCON was considered mature enough by passing significant testing and proof of concept certifications, it became more and more responsible for data transportation in mainframe environments as it showed a great performance improvement by offering a serial bit-by-bit approach with optical fiber. As a result, ESCON was soon considered the standard storage networking technology developed for the mainframe environment, serving in most of the world’s data centers.

When introduced by IBM’s S/390 server in 1997, FICON took ESCON to the next level by mapping its I/O protocol onto a Fibre Channel (FC) transport: a dominant technology used in storage networks then and now. This introduced greater flexibility and faster physical link rates for mainframe network layouts—increasing I/O capacity and the possible distance span. Although it was clearly a technically superior product compared to ESCON, for almost four years the technology was only used by IBM for tape drives and printers. In 2001, FICON was finally introduced in disk storage environments.

The introduction of FICON was meant to combine the advantages of an FC infrastructure, with the reliability of the mainframe world. With the introduction of IBM’s z10, a new improvement to FICON was born—high performance FICON or zHPF.

We’ll take you from here to uncover zHPF piece by piece—looking at it from different angles to discover not only the generalities it incorporates but also the innovations it brings. Our first step introduces you to the general FICON specifications, as a fiber optic standard including zHPF, to compare this technology to ESCON. Our next step sheds light on the actual way in which the FICON protocol operates, and we will compare the “general” way to the zHPF way, which will be brought to you in the zHPF section, where our journey ends.

General FICON introduction

Fiber Connectivity, known as FICON, is an IBM proprietary name. It is a naming convention for an FC protocol, consistent with the ANSI standards “FC-FB-x” (single-byte command code sets mapping protocol). Within the FC standard, FICON and zHPF for System z are defined as level-4 protocols or FC-4. This protocol is used to map both cabling infrastructure and protocol onto standard FC services and infrastructure. The mapping layer specifies the signal, cabling, and transmission speeds. The topology is fabric, utilizing FC switches or directors.

Looking closer at the FC-FB-x protocols, we can replace the “x” value with 2, 3, 4, and most recently 5. We know FC-SB-2 protocol as the “initial” protocol standard for FICON. After that the FC-SB-3 protocol was created to provide an increased level of I/O connectivity capability, and the ability to have multiswitch fabrics, coupled with functions to prevent accidental and incorrect network configuration changes. The FC-SB-4 standard defines a new mode of operation that significantly improves the performance of certain types of data transfer operations compared to the FC-SB-3 protocol, and was initiated to support zHPF. The FC-SB-5 standard expands on some of the high performance capabilities introduced in the FC-SB-4 standard. As stated in the introduction, we’ll take a deeper dive into the modes of operation later in this paper.

Let’s have a look at some specifications of FICON first.
FICON specifications: physical and logical

The table 1 provides the physical specifications of both technologies and the table 2 shows you the differences in logical specifications between ESCON and FICON/zHPF.

**Table 1. Comparing physical specifications of ESCON and FICON/zHPF**

<table>
<thead>
<tr>
<th></th>
<th>ESCON</th>
<th>FICON/zHPF</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interface</strong></td>
<td>Physical</td>
<td>ANSI FC-PH/PC-PI-2</td>
</tr>
<tr>
<td><strong>Bandwidth</strong></td>
<td>Bandwidth</td>
<td>200 Mb/s</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2/4/8 Gb/s¹</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4/8/16 Gb/s²</td>
</tr>
<tr>
<td><strong>Direction</strong></td>
<td>Unidirection</td>
<td>Single mode/9 μm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 km, 20 km (with RPQ)</td>
</tr>
<tr>
<td><strong>Cable</strong></td>
<td>Multimode/62.5 μm</td>
<td>Single mode/9 μm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Multimode/50 or 62.5 μm</td>
</tr>
<tr>
<td><strong>Distance</strong></td>
<td>Long wave</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Single mode/9 μm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 km, 20 km (with RPQ)</td>
</tr>
<tr>
<td></td>
<td>Short wave</td>
<td>3 km</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OM1 (62.5/125 μm multimode fiber)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>300 m (1 Gb/s)/150 m (2 Gb/s)/70 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4 Gb/s)/21 m (8 Gb/s)/33 m (10 Gb/s)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OM2 (50/125 μm multimode fiber)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>500 m (1 Gb/s)/300 m (2 Gb/s)/150 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4 Gb/s)/50 m (8 Gb/s)/82 m (10 Gb/s)/35 m (16 Gb/s)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OM3 &amp; OM3+ (50/125 μm laser optimized multimode fiber)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>860 m (1 Gb/s)/500 m (2 Gb/s)/380 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4 Gb/s)/150 m (8 Gb/s)/300 m (10 Gb/s)/100 m (16 Gb/s)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OM4 (50/125 μm laser optimized multimode fiber)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>400 m (4 Gb/s)/190 m (8 Gb/s)/550 m (10 Gb/s)/125 m (16 Gb/s)</td>
</tr>
<tr>
<td><strong>Connector</strong></td>
<td>ESCON connector</td>
<td>LC-Duplex</td>
</tr>
<tr>
<td><strong>Topology</strong></td>
<td>Point-to-point</td>
<td>Point-to-point</td>
</tr>
<tr>
<td></td>
<td>Switched point-to-point</td>
<td>Switched point-to-point</td>
</tr>
</tbody>
</table>

FICON can use FC fiber optic cables with either short wavelength (multimode; 62.5 or 50-micrometer core) or long wavelength (single mode; 9-micrometer core). Long wavelength is used in the majority of applications because of its superior optical power budget and bandwidth. FICON cannot use copper FC cables.

¹ For the 8 Gb/s Channel Adapters (CHAs) used in the HP XP7 Storage.
² For the 16 Gb/s Channel Adapters (CHAs) used in the HP XPT Storage.
### Table 2. Comparing logical specifications of ESCON and FICON/zHPF

<table>
<thead>
<tr>
<th></th>
<th>ESCON</th>
<th>FICON/zHPF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel command word (CCW) handling</td>
<td>Handshaking.</td>
<td>Pipelining. Protocol interlock is reduced.</td>
</tr>
<tr>
<td>The number of concurrent I/Os</td>
<td>One I/O is executed at once per channel.</td>
<td>Multiple I/Os are executed concurrently per channel.</td>
</tr>
<tr>
<td>Addressing</td>
<td>1024 devices per channel.</td>
<td>16,384 devices per channel.</td>
</tr>
<tr>
<td>Data transfer</td>
<td>Half-duplex.</td>
<td>Full-duplex.</td>
</tr>
</tbody>
</table>

Each FICON channel port can handle multiple concurrent data transfers in full duplex mode. Information for active exchanges is transferred in FC sequences mapped as FICON information units (IUs), which consist of one to four FC frames. Each FICON exchange may transfer one or many such IUs. FICON channels use five classes of IUs to conduct information transfers between a channel and a control unit. They are: data, command, status, control, command and data, and link control.

In FICON/zHPF, the interlock between the host and RAID is lowered in terms of the protocol, and the multiple I/O process and bidirectional data transfer are supported to realize high throughput.

Meanwhile, the number of the connectable devices per channel is increased considerably as an improvement of connectivity. The next section in this paper explains this in further detail.

**ESCON and FICON/zHPF address range comparison**

Conventionally, the number of device addressing per channel port is limited to 1024 in ESCON. In FICON/zHPF, the number is increased to 16,384; we’ll illustrate this by the following figures.

**Figure 1. ESCON address range**

- For 1 single channel port (CHL), max. 1,024 devices (DEVs) because of Unit Address limitation on ESCON CHL port.
- To cover the address range of a large direct access storage device (DASD) subsystem, 16,384 DEVs: System generation needs to be divided every 1,024 DEVs (4 control units [CUs]) in case of ESCON connectivity.
FICON operation design took advantage of the observation that a frame rarely arrives out of order in mainframe environments, and precious time and resources were lost in the multiple unnecessary checks. The idea grew to develop a technology to send multiple frames and to have checks less frequently, for “packages” or multiple IUs.

The actual frames and sequences are sent over the FC-2 layer or the FC physical level where the communication is connectionless: frames and sequences may arrive out of order, and at that level there is no acknowledgement of arrival. It’s the FC-4 layer or the FC-SB-2/FC-SB-3 protocol layer that handles the traffic and performs the checks.

FICON uses two FC exchanges for a channel or CU connection: One for each direction. So, while a FC exchange is capable of carrying a command and response on a single exchange (and all other FC-4 protocols work that way) the response to a FICON IU is always on a different exchange from the IU to which it is a response. The two exchanges that implement a connection are called an exchange pair. The relation between the exchange pair exists at the FC-4 layer.

Additionally, the integrity of customer data carried within one or more IUs is protected by a cyclic redundancy check (CRC) contained in the last frame of an IU classified as an ending IU within each data transfer. This is in addition to the standard FC CRC used to verify the integrity of each individual FC frame. As such, the FICON CRC has the capability of detecting missing or out-of-sequence frames and IUs.

This design has proven to be very effective and innovative.

However, an even newer innovative technology has been implemented in zHPF, bringing a fresh operation design.

**zHPF FICON**

**Introduction**

As previously mentioned in this paper, zHPF or high performance FICON for “System z” is an enhancement of the FICON channel architecture; which also means compatibility with certain standards:

- Fibre Channel Physical and Signaling standard (FC-FS)
- Fibre Channel Switch Fabric and Switch Control Requirements (FC-SW)
- Fibre Channel Single-Byte-4 (FC-SB-4) and Fibre Channel Single-Byte-5 (FC-SB-5) standards

Enhancements have been made to the z architecture and the FICON interface architecture to deliver improvements for online transaction processing (OLTP) workloads. zHPF was initially implemented exclusively in System z10. It is also supported by all newer mainframe models, including all zEnterprise Servers (z114, z196, zBC12, and zEC12). When zHPF is exploited by the FICON channel, the z/operating system (z/OS), and the CU; the FICON channel overhead is reduced. This is achieved by simplification of the protocol, and by reducing the number of IUs processed, resulting in more efficient use of the fiber link.
The FICON Express8S, FICON Express8, FICON Express4, and FICON Express2 features support both the existing FICON architecture and the zHPF architecture.

The zHPF for System z journey:

- In October 2008, the initial zHPF on System z10 with FICON Express4 and FICON Express2 channels was announced: maximum of 31k zHPF I/Os/sec, 2.2 times the FICON protocol, single track limit for zHPF data transfers.
- FICON Express8 channels on System z10 was introduced in July 2009: maximum of 52k zHPF I/Os/sec, 64K byte limit for zHPF data transfers.
- In July 2010, additional support on zEnterprise 196 was introduced, which also brought extension to multitracks of zHPF data transfers which we will expand on later in this paper.
- In July 2011, with the new FICON Express8S channel on zEnterprise 196 and zEnterprise 114, a hardware data router was introduced for more efficient zHPF data transfers. FICON Express8S channel is the first channel with hardware specifically designed to support zHPF. It’s also available for the zEC12. FICON Express8, FICON Express4, and FICON Express2 have a firmware-only zHPF implementation.
- In July 2013 the zBC12 was announced, supporting FICON Express2/4/8 channels, and additionally also supporting the FICON Express8S channel from October 2013.

The HP XP7 Storage supports both the existing FICON architecture and the zHPF architecture.

From the z/OS point of view, the existing FICON architecture is called command mode, and zHPF architecture is called transport mode. A parameter in the operation request block (ORB) is used to determine whether the FICON channel is running in command or transport mode. The value of this mode depends on the CU supporting zHPF and settings in the z/OS. For this last one, the setting in the operating system (an IECIOSxx parameter and SETIOS commands in z/OS) can enable or disable zHPF—the default is disabled. For queued sequential access method (QSAM) and basic sequential access method (BSAM), the option SAM_USE_HPF (YES ) must be specified or defaulted.

Let’s have a closer look at what exactly transport mode stands for.

**FICON FC-SB-4 and FC-SB-5 protocol specifications**

Transport mode is a mode of operation, defined by the FC-SB-4 standard, which significantly improves the performance of certain types of data transfer operations compared to the FC-SB-3 protocol and thus command mode. The protocol and functions specified by FC-SB-3 continues to be supported in FC-SB-4 and FC-SB-5.

FC-SB-5 expands on the FC-SB-4 standard to specify enhancements to the transport-mode protocols which increase the efficiency and expand the capabilities of transport-mode operations. Additionally, link-control protocols are defined that utilize new CU discovery protocols that enhance the I/O configuration and link initialization process. Data transfer transport mode is inherently the same in both standards, and that is the focus of this topic in this white paper.

In transport mode, communication between the channel and CU takes place using a single bidirectional exchange and utilizes fewer handshakes to close exchanges, to transmit device commands and to provide device status compared with the FC-SB-3 protocol. Performance improvement is most significant with I/O operations that are performing small block data transfers (such as, multiple CCWs with data transfers of 25 KB or less) because of the reduction in overhead relative to transfer size. Certain types of complex I/O operations still need to use the existing FC-SB-3 protocol.

During link initialization both the channel and the CU indicate whether they support zHPF or not.

Similar to the existing FICON channel architecture, the application or access method provides the channel program (CCWs) and parameters in the ORB (ORB -> Bit 13 in byte 1 indicates whether the channel program needs to be handled in command mode or transport mode.).
The way zHPF (transport mode) manages CCW operation is significantly different from the CCW operation for command mode. While in command mode each single CCW is sent to the CU for execution, in transport mode all CCWs are sent over the link in one single frame to the CU. This single frame is also referred to as a transport-command IU (introduced by transport mode operations), which is sent from a channel to a CU using the FCP link-level protocol. Transport-data IUs are used to transport data for read and write operations as specified by FCP link-level protocols. After completion of the operation, the channel end and device end (CE/DE) status is sent by the CU to indicate the completion of the read operation in a transport-status IU. Have a look at the arrows in matching colors in figure 3 to refer to these IUs in the zHPF read operation.

**Figure 3.** zHPF read operation/transport mode

Less overhead is generated compared to the existing FICON architecture. Figure 4 shows a general FICON operation. Instead of the CCWs being sent to the CU in a single frame in transport mode, command mode sends each single CCW to the CU.

**Figure 4.** FICON read operation/command mode
A zHPF (transport mode) write operation is shown in figure 5. The same reduction of frames and open exchanges as with the zHPF read operation (figure 3).

![Figure 5. zHPF write operation/transport mode](image)

The channel sends all the required CCWs and write operations of 4 KB of data in one frame (transport-command IU) to the CU. The CU responds with a single transfer (XFER) ready (transport-response IU) when it is ready to receive the data. The channel then sends the 16 KB of data to the CU (transport-data IU). If the CU successfully received the data and finished the write operation, then the CE/DE status (transport-status IU) is sent by the CU to indicate the completion of the write operation.

This new operation design can be as efficient and innovative; an optimal implementation of the FICON/zHPF interface cards is the foundation of a FICON environment.

**zHPF Multitrack operations**

The above-described zHPF processes the data for only 1 track at a time. Another mode of operation which is an expansion of zHPF is also available: zHPF Multitrack. The Multitrack operation enables sending and receiving data for multiple tracks, reducing the overhead other than data processing. In those cases where an I/O performs in multiple tracks at a time (for example, when in a single track, zHPF implementation multiple tracks were being processed), the transport command had to be repeated for each track, heavily affecting performance.

To execute data transfers in zHPF Multitrack mode, both the host and storage need to support the function. In order to know which functions a storage subsystem supports, the host needs to issue a "performance subsystem function" (PSF) command to the storage subsystem. Either the installation of the zHPF license key on the storage subsystem or issuing a state change interrupt (SCI) will have the host read out this information. It’s more specifically the “read feature codes order” (RDFC) request or command, which is part of the request chain the PSF function launches to the storage system, which will provide the host with a list of the supported functions. In this regard, since a zHPF Multitrack function support bit is added in a parameter of this response, on the storage side this bit can be set to “on” at the zHPF Multitrack function support.
In order to enable support for zHPF Multitrack operations, certain functions need to be modified. Let's briefly go over the most important function changes:

- **Receivable data size expansion**
  
  With the Multitrack function support, the dataset size is expanded up to 4 GB; far larger than the current size of 64 KB for a track. In order to set the buffer size on the receiving side to the appropriate value, the receiving side needs to be notified of the size of the dataset. In general, this can either be done by process login (PRLI) processing, or by a “Transfer-Ready” frame as a response to I/O activation. However, since zHPF operations do not require the “Transfer-Ready” response, the receivable buffer size needs to notify by PRLI only. The buffer size can maximally be set to 1 MB because of Data External Buffer (DXBF) capacity that can be reserved.

- **Transport-data IU format change**
  
  In the transport-data IU of a single-track operation, data for only 1 track is stored for both operations: Prefix (write operation) and Prefix Read (read operation). For a Multitrack operation, data for multiple tracks needs to be stored in a transport-data IU; therefore, a change in format was implemented. In order to indicate the offset position of a CRC, a CRC Offset Block or COB can be added to the transport-data IU of a write operation. If required, the CRC position can also be determined from a value in the count part and from the device command words (DCW) words count of the receiving frame which also gives you the data length of a track.

- **Prefix/Prefix Read parameter change**
  
  In a Multitrack operation the counters for the locate part were expanded for the “Prefix” (E7) and for the “Prefix Read” (EA) parameters. While the counter is fixed x01 in a single-track operation, it can be selected within the range of x01 to xFF for zHPF Multitrack operations, indicating the number of tracks. Storage systems use the number specified in these counters, to determine the number of tracks of data to be sent and received.

This operation design is both efficient and innovative; an optimal implementation of the FICON/zHPF interface cards is the foundation of a FICON environment. The next section will introduce you to the hardware design of FICON/zHPF interface cards on HP XP7 Storage, and will bring clarity on the effects of your path connectivity to the interfaces.

### Storage hardware and interface specifications

#### The HP XP7 Storage hardware specifications for FICON/zHPF

The HP XP7 Storage hardware supports both open systems and mainframe channel interfaces or channel adapters (CHA). We’ll focus on the FICON channel interfaces which control the data transfer between the mainframe host and the cache memory. The following table provides an overview of the available interfaces and their specifications.

**Table 3. Mainframe connection interface or CHA specifications**

<table>
<thead>
<tr>
<th></th>
<th>Mainframe Fiber 8 Gb/s</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Short wave</td>
</tr>
<tr>
<td>Model</td>
<td>16 MS8</td>
</tr>
<tr>
<td>Number of PCB</td>
<td>2</td>
</tr>
<tr>
<td>Host interface</td>
<td>FICON</td>
</tr>
<tr>
<td>Data transfer rate (Gb/s)</td>
<td>2/4/8</td>
</tr>
<tr>
<td>Maximum cable length</td>
<td>500 m/380 m/150 m</td>
</tr>
</tbody>
</table>

The HP XP7 Storage FICON Adapter PCB is an 8-port adapter, combined in sets of two as a feature and, therefore, implemented in pairs in the HP XP7 Storage and referred to as the mainframe fiber 16-port adapter.

1 Indication of cable length limitations when 50/125 μm laser optimized multimode fiber cable (OM3) is used.
Starting with the sixth generation XP Storage system (the HP XP P9500 Storage), the microprocessors or processor blades (also often referred to as CHP) are no longer physically implemented on the FICON Adaptor PCB itself, but on separate PCB boards now. The benefit in doing so is that each HTP can access all MP PCBs. When I/Os are received the HTP distributes these I/Os to the MP PCBs that have the logical device (LDEV) ownership: an innovative new technology.

This LDEV ownership means that the MPs or processor blades now keep a local directory on their internal processor memory (PM) of the LDEVs it “owns.” This ownership can be assigned automatically or manually using the GUI. If one processor blade should fail, the LDEVs of that processor can be taken over by another MP. This “operating” one accesses the failed processor blades’ PM for information on the LDEVs through the shared memory.

The HP XP7 Storage Mainframe fiber adapter board can be used for either regular FICON protocol or for zHPF. Like for the XP Storage FICON adapters, no different hardware is needed for zHPF; the innovative LDEV ownership management method is adopted for zHPF technology in this manner too.

What this new way of operating also helps reduce is the need to thoroughly validate and spread cabling in order to improve performance, as it did for the fifth generation XP Storage system (HP XP24000/XP20000 Disk Array) FICON Adapter PCB. You can, however, decide to spread your host connectivity and cabling onto different physical PCBs for redundancy in case of a hardware component failure. Also, since 1 HTP controls 2 ports, using ports on different HTPs will increase the throughput performance of one path compared to using ports of the same HTP. Let’s have a closer look at this.

**Performance compared to the number of host paths**

The zHPF environment has the same trend as the FICON environment. In reality you can create three topologies of possible cable connections as illustrated in the following three cases. These help you to visualize the performance impact better.

Considering the structures and performance, we recommend you to set paths based on the following priorities when configuring alternate paths.

Priority 1: set paths to modules/clusters (case 1)
Priority 2: set paths to packages (case 2)
Priority 3: set paths to HTPs (case 3)
Case 1
In this case, even if the two paths are connected to “the FICON PCB” (considered 16-port), each path has 8 Channel Paths (CHPs) and a HTP available to perform the I/Os independently. Therefore, the front-end performance may be doubled compared to having only one path.

Figure 7. Two-path connection case (1)

Case 2
In this case, each path has a separate HTP available to handle its I/Os independently. On the other hand, only one set of 8 CHPs handle the I/Os for the two paths. Therefore, the “actual” number of CHPs that each path has available is 4 instead of 8 like case 1, which means that the performance may be less than that of case 1.

Figure 8. Two-path connection case (2)

Case 3
In this case, the number of CHPs for each path is 4, like in case 2. However, this time only one HTP handles the two paths I/Os. It means the HTP busy rate may be higher than that of case 2.

Figure 9. Two-path connection case (3)

Depending on your available resources and target environment, you can build on these cases to improve the performance according to best-case scenario.
**Performance facts**

When the conventional FICON and the HP XP7 Storage system are connected point-to-point, the performance limit is 14,000 IOPS due to channel bottleneck. However, when zHPF and the HP XP7 Storage system are connected point-to-point, the limit becomes 28,000 IOPS, which is the channel limit. A performance limit close to a one-port performance limit of HP XP7 Storage system can be achieved. The performance value of HP XP7 Storage system in case of one port is the performance value of 1 PCB. When multiple zHPF paths (or FICON paths for that matter) are connected to 1 PCB, you can design performance by considering the contents described in the preceding section.

Figure 10 shows the effect of zHPF reducing the channel “overhead”: Small block sizes have the biggest benefit. For a 4 KB block, the channel performance is doubled on FICON Express4 cards in a z10 (FICON 14,000 IOPS -> zHPF 28,000 IOPS), and even quadrupled on FICON Express8S cards in a z196 (FICON 23,000 IOPS -> zHPF 92,000 IOPS).

**Figure 10. FICON performance graph**

Besides showing the evolution in IOPS, the graph also draws our small “journey through the timeline of the mainframe world” to oversee where FICON came from and stands now: zHPF or high performance FICON for System z. As a conclusion to our paper, let’s look at the requirements for zHPF in the final section.

**zHPF requirements**

zHPF was initially available on System z10 host with z/OS 1.8 with PTFs or higher. Later this has remained supported for a while with IBM Lifecycle Extension for z/OS 1.8, plus PTFs. Meanwhile this lifecycle extension has expired, and PTFs are no longer available.

zHPF is now available on z/OS 1.12, plus PTFs. For users who have not yet completed their migration to z/OS v1.12 (or z/OS v1.11), there is an IBM Lifecycle Extension for z/OS 1.10 to continue to receive corrective service for z/OS v1.10 up through September 30, 2014. zHPF is supported with Systems zEC12, z196, z114, z10 EC, and z10 BC. The following interface cards are supported for zHPF: FICON Express8S, FICON Express8, FICON Express4, and FICON Express2. The applicable FICON interface cards support both the existing FICON architecture and the zHPF architecture. In addition to this, make sure you implement the necessary configuration changes to successfully implement zHPF; HCD must have CHPID type FC (required for FICON channels) defined for all the CHPIDs that are defined to the 2,107 CU which also supports zHPF. For z/OS, once the PTFs are installed in the LPAR, you must then set ZHPF=YES in IECIOSxx in SYS1.PARMLIB or issue the SETIOS ZHPF=YES command (ZHPF=NO is the default setting). It is highly recommended to first make the required configuration changes and pre-requisites prior to entering the ZHPF=YES setting.

You were already introduced to the XP Storage hardware specification for FICON/zHPF. The HP XP7 Storage Mainframe fiber 16-port adapter is required to use zHPF with HP XP7 Storage—the same card that is needed for FICON. For zHPF, an additional activation license, called the Compatible High Performance FICON connectivity license (included in the HP XP7 Mainframe Performance Advanced Suite), is required on HP XP7 Storage.

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4 Some interface cards are no longer supported with the zEnterprise but can still be carried forward, for example, FICON Express4.
For more information

- HP XP7 Storage
- HP XP7 Mainframe Performance Advanced Suite