IBM DS8910F Model 993 Rack-Mounted Storage System Release 9.1

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IBM DS8910F Model 993 Rack-Mounted Storage System Release 9.1

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Preface

This IBM Redpaper publication presents and positions the DS8910F Model 993 storage system.

This modular system can be integrated into a 16U contiguous space of an IBM z15™ model T02 or IBM z14® Model ZR1 with Feature Code 0937 and IBM LinuxONE III model LT2 or LinuxONE Rockhopper II model LR1 with Feature Code 0938.

The DS8910F Model 993 allows you to take advantage of the performance boost of all-flash systems and advanced features while limiting data center footprint and power infrastructure requirements.

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1

IBM DS8910F model 993 introduction

This chapter gives a brief overview of the IBM DS8910F model 993 and positioning, and it includes the following topics:

1

1.1 DS8910F overview

The IBM DS8900 family offers a new all-flash array model, DS8910F model 993 to meet the demand for higher-speed storage in a smaller footprint.

The DS8910F model 993 adds a modular rack-mountable enterprise storage system to the 533x all-flash machine type family. As such, it does not come in its own rack, but can be integrated into a standard 19-inch wide rack that conforms to EIA 310D specifications. The standard 19-inch wide rack installation (Feature Code 0939), requires a minimum of 15U contiguous space to mount the modules, or 16U if the optional 1U KVM is included.

Figure 1-1 shows the DS8910F model 993 with the maximum configuration (two pairs of High-Performance Flash Enclosure (HPFE) Gen2) that requires 19U contiguous space, not including the optional KVM.
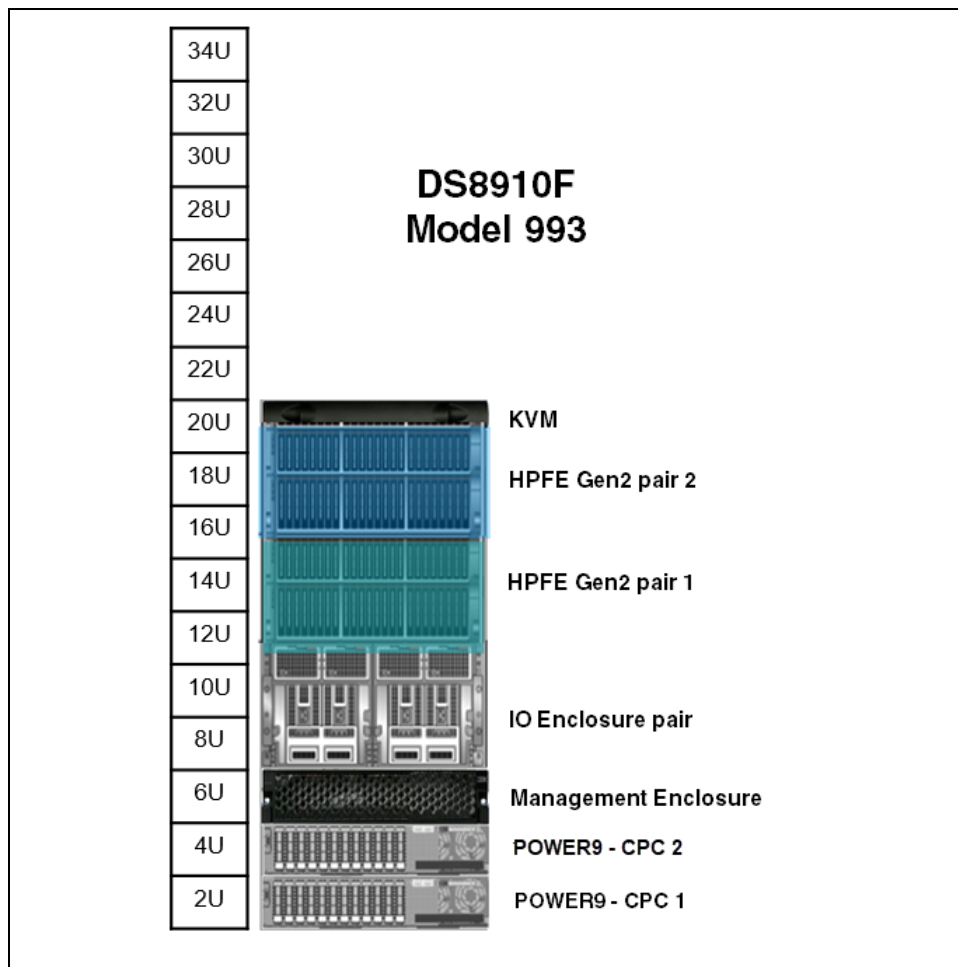
Figure 1-1   DS8910F model 993 for 19-inch form factor racks (maximum configuration)

The DS8910F model 993 is designed for clients with small capacity requirements who want to boost performance, in particular in mainframe environments.

The DS8910F Rack Mounted Storage System supports continuous operation, data security, and data resiliency. For high-availability, the hardware components are redundant.

The modular system can be integrated into a 16U contiguous space of an IBM z15 model T02 or IBM z14 Model ZR1 with Feature Code 0937and IBM LinuxONE III (model LT2) or LinuxONE II (model LR1) with Feature Code 0938. Model 993 does not share the keyboard display of the z15. Figure 1-2 shows a DS8910F integrated into an z15 model T02 or LinuxONE III (model LT2) rack.

Figure 1-2   DS8910F model 993 integrated into z15 model T02 or LinuxONE III LT2

Model 993 shares the display a0937 and keyboard of IBM z14, as shown in Figure 1-3.

Figure 1-3   DS8910F model 993 integrated into IBM z14 ZR1 or LinuxONE II LR1

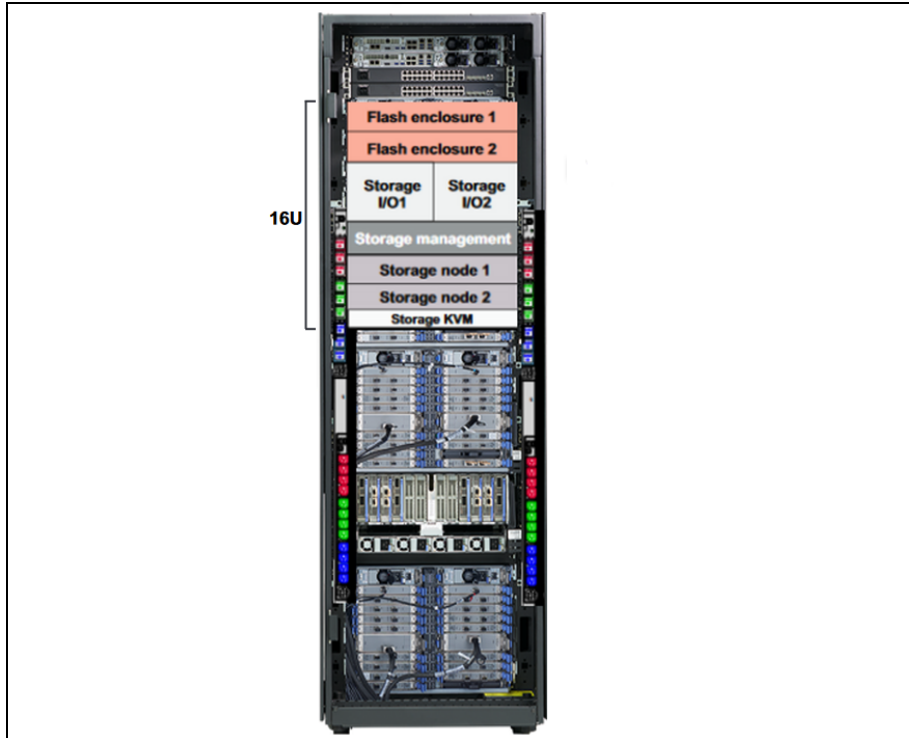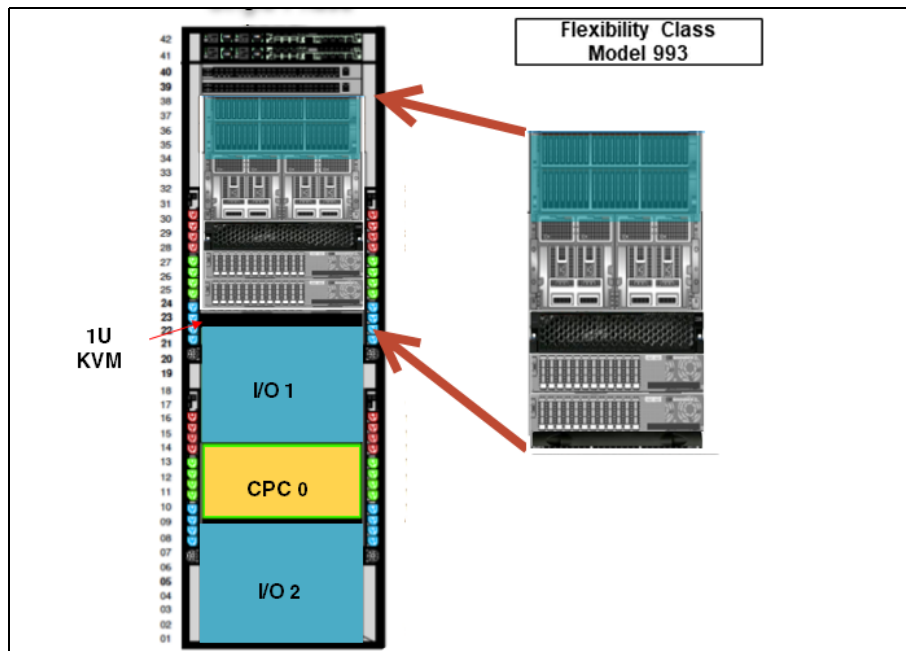When integrated in either of those IBM Z® racks, only one HPFE Gen2 enclosure pair is supported. The added 1U KVM brings the total to 16U contiguous space.

For more information about how to integrate the DS8910F, see Chapter 3, "IBM DS8910F installation and integration" on page 29.

The DS8910F enables you to take advantage of the DS8900 advanced features and reduces data center footprint and power infrastructure requirements. The modular system contains IBM POWER9™ processor nodes, an I/O enclosure, High-Performance Flash Enclosure Gen2, a management enclosure (which includes the Hardware Management Consoles (HMCs)), Ethernet Switches, and Rack Power Control [RPCs]).

For more information about the DS8910F architecture, hardware, and components, see Chapter 2, "IBM DS8910F hardware configuration" on page 7.

The DS8910F provides a mid-level product with the same advanced functions as larger DS8900 family systems, with support for IBM Z or distributed hosts. It is an ideal replacement for older IBM Storage systems, small-capacity DS8700, and DS8800 systems with comparable capacity requirements.

1.2 Product highlights

The DS8910F delivers the following hardware features:

► Eight-core processors with options of 96 GB and 256 GB memory combinations per Processor Complex.

► Support for up to 32 FCP / IBM FICON® Ports (16 Gbps 4-port host adapter or 32 gigabit Fibre Channel (GFC) 4-port Encryption of Data In Flight (EDiF) host adapter).

► Support for up to two HPFE Gen2 pairs that can be populated with high-performance or high-capacity drive sets, and a maximum storage capacity of 1.47 PB raw capacity that is based on the 15.36 TB high-capacity (Tier 2) flash drives.

► The following performance-optimized flash drive (Tier 0) sets:

  – 800 GB
  – 1600 GB
  – 3200 GB

► The following capacity-optimized flash drive set options:

  – 3.84 TB (Tier 1)
  – 1.92 TB (Tier 2)
  – 7.68 TB (Tier 2)
  – 15.36 TB (Tier 2)

► Power intelligent power distribution units (iPDUs) supply power to the storage system.

► Backup Power Modules (BPMs) provide power to the non-volatile dual inline memory module (NVDIMM) when electrical power is removed.

► Requires a minimum for 15U contiguous space in a conforming 19-inch rack (another 1U for the optional KVM and 4U for the second HPFE enclosure pair).

► Same advanced functions as for the other DS8900F models.

Functions are licensed as for the others DS8900F models:

► Base Function

The Base Function license is required for each DS8910F storage system. The licensed functions include Database Protection, Encryption Authorization, IBM Easy Tier®, the Operating Environment License, and Thin Provisioning.

► z-synergy Services

The z-synergy Services include IBM z/OS® functions that are supported on the storage system. The licensed functions include transparent cloud tiering, High-Performance FICON® for IBM Z, SuperPAV, HyperPAV, PAV, and z/OS Distributed Data Backup.

► Copy Services

Copy Services features help you implement storage solutions to keep your business running 24 hours a day, 7 days a week by providing data duplication, data migration, and disaster recovery functions. The licensed functions include Global Mirror, Metro Mirror, Metro/Global Mirror, Point-in-Time Copy/IBM FlashCopy®, z/OS Global Mirror, Safeguarded Copy, and z/OS Metro/Global Mirror Incremental Resync (RMZ).

► IBM Copy Services Manager (CSM) on the HMC license:

IBM CSM facilitates the use and management of Copy Services functions such as the remote mirror and copy functions (Metro Mirror and Global Mirror) and the point-in-time function (FlashCopy). IBM CSM is available on the HMC, which eliminates the need to maintain a separate server for Copy Services functions.

You can use the DS8000 Storage Management GUI and the DS command-line interface (DS CLI) to manage and logically configure the storage system.

2

IBM DS8910F hardware configuration

This chapter describes the hardware components and modules of the IBM DS8910F. It also provides insights into the architecture and individual components and a comparison between the DS8910F model 993 and the previous DS8882F model 983.

This chapter includes the following topics:

- ► 2.1, "DS8910F machine types" on page 8
- ► 2.2, "DS8910F hardware components" on page 8

2.1 DS8910F machine types

Several machine type options are available for the DS910F. Table 2-1 lists the available hardware machine types and their corresponding function authorization machine types.

Table 2-1   Available hardware and function-authorization machine types

Hardware		Licensed functions	
Hardware machine type	Available hardware models	Corresponding function authorization machine type	Available function authorization models
5331 (1-year warranty period)	993	9046 (1-year warranty period)	LF8
5332 (2-year warranty period)		9047 (2-year warranty period)	
5333 (3-year warranty period)		9048 (3-year warranty period)	
5334 (4-year warranty period)		9049 (4-year warranty period)	

The machine types for the DS8910F specify the service warranty period. The warranty is used for service entitlement checking when notifications for service are called home. The DS8910F model 993 reports 2107 as the machine type to attached host systems.

2.2 DS8910F hardware components

The DS8910F is an entry-level, high-performance storage system that includes only High-Performance Flash Enclosure Gen2. The DS8910F hardware components are consistent with the rest of the DS8900 all-flash family.

The modular system contains processor nodes, an I/O Enclosure, High-Performance Flash Enclosure Gen2, and a management enclosure (which includes the Hardware Management Consoles (HMCs0, Ethernet Switches, and RPCs).

The DS8910F storage system features 8-core processors and supports one High-Performance Flash Enclosure Gen2 pair with integration into an z15 model T02, LinuxONE III model LT2, IBM z14 Model ZR1, or LinuxONE II model LR1 rack. It supports up to two High-Performance Flash Enclosure Gen2 pair with the standard 19-inch wide rack installation, with up to 96 Flash Tier 0, Flash Tier 1, or Flash Tier 2 drives. It supports up to 512 GB system memory, four zHyperLink adapters, and up to 32 host adapter ports.

The DS8910F consists of six modules with z15 model T02, LinuxONE III model LT2, IBM z14 Model ZR1, or LinuxONE II model LR1 integration and six or eight modules with a standard conforming 19-inch rack. For more information about installing into a conforming 19-inch rack, see Chapter 3, "IBM DS8910F installation and integration" on page 29.

The DS8910F includes the following components:

► Two 2U IBM POWER® processor nodes (central processor complexes (CPCs))
► Up to two High-Performance Flash Enclosure (HPFE) Gen2 pairs
► One 5U I/O enclosure pair

- ► One 2U management enclosure
- ► Optional 1U KVM (Feature Code 1765) with customer rack configuration
- ► 1U KVM when integrated into z15 model T02/LinuxONE III model LT2

> **Note:** Two KVM cables are included with the DS8910F model 993 to connect the HMCs to the z KVM for sharing the display and keyboard with IBM z14 model ZR1 or LinuxONE II model LR1.

Figure 2-1 shows the DS8910F eight modules that make up the 19U of contiguous space, and the order in which they must be installed. An optional 1U display can be added that make up the 20U of contiguous space.
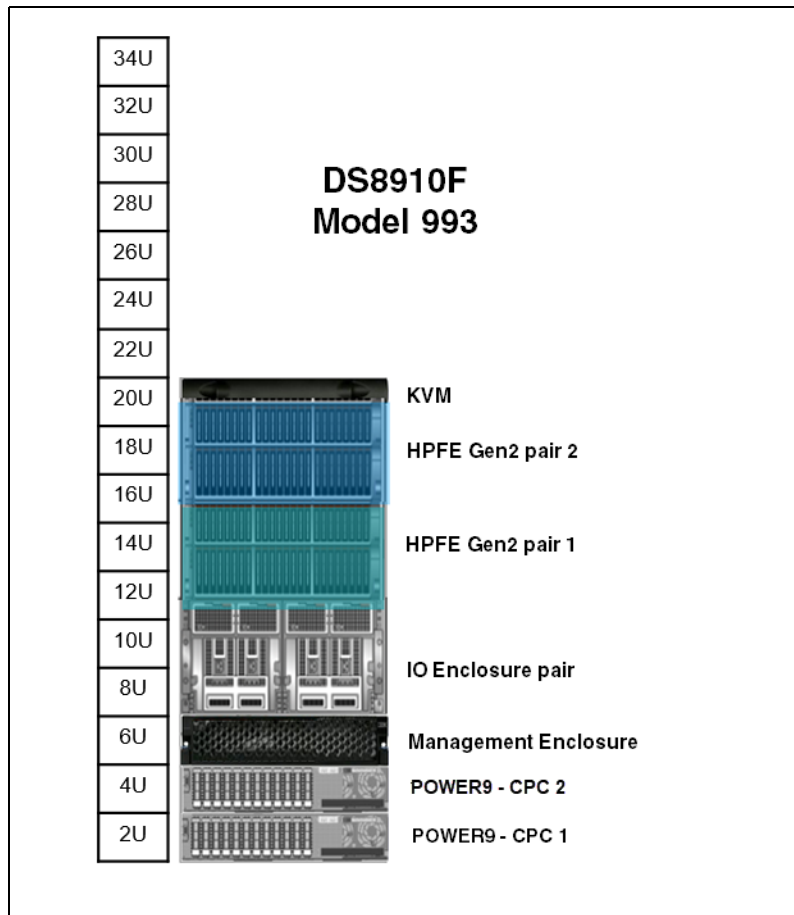
Figure 2-1   DS8910F Eight 2U modules

2.2.1 High-Performance Flash Enclosure Gen2 pair

The upper four modules that make up the DS8910F are the HPFE Gen2 pairs. The HPFE Gen2 is a 2U flash enclosure that is installed in pairs. DS8910F supports one HPFE Gen2 pair when installed into an z15 model T02, LinuxONE III model LT2, IBM z14 Model ZR1, or LinuxONE II model LR1 rack. The DS8910F occupies 16U of contiguous reserved space, when including the 1U KVM.

The HPFE Gen2 pair contains two 2U 24-slot serial-attached SCSI (SAS) flash drive enclosures. Each of the two enclosures contains the following components:

► Two power supplies with integrated cooling fans

► Two SAS expander modules with two x4 SAS ports each

► One midplane or backplane for plugging components that accommodate the flash drives, SAS expander modules, and power supplies

► A total of twenty-four 2.5-inch flash drives (or drive fillers)

The two 2U HPFE Gen2 modules are positioned as the upper two modules in the DS8910F.

For more information about the High-Performance Flash Enclosure Gen2, see *IBM DS8000 High-Performance Flash Enclosure Gen2 (DS8000 R9.0)*, REDP-5422.

Figure 2-2 shows views of HPFE Gen2 front (upper) and rear (lower).

Figure 2-2   HPFE Gen2 front (upper) and rear (lower)

DS8910F flash drives

The DS8910F provides a choice of the following drives with the HPFE Gen2:

► 2.5-inch High-Performance Flash Tier 0 drives:
  – 800 GB
  – 1.6 TB
  – 3.2 TB
► 2.5-inch High Capacity Flash Tier 1 drives: 3.84 TB
► 2.5-inch High Capacity Flash Tier 2 drives:
  – 1.92 TB
  – 7.68 TB
  – 15.36 TB

Note: Intermix of High-Performance Flash Tier 0 drives with High Capacity Flash Tier 1 and Flash Tier 2 drives is not supported in an HPFE Gen2 pair. All flash drives in DS8910F are Full Drive Encryption (FDE) capable.

Flash drives are ordered in drives sets of 16. The HPFE Gen2 pair can contain 16, 32, or 48 flash drives (1, 2 or 3 drive sets). All flash drives in an HPFE Gen2 pair must be the same type. Half the drive set is installed in each enclosure of the pair.

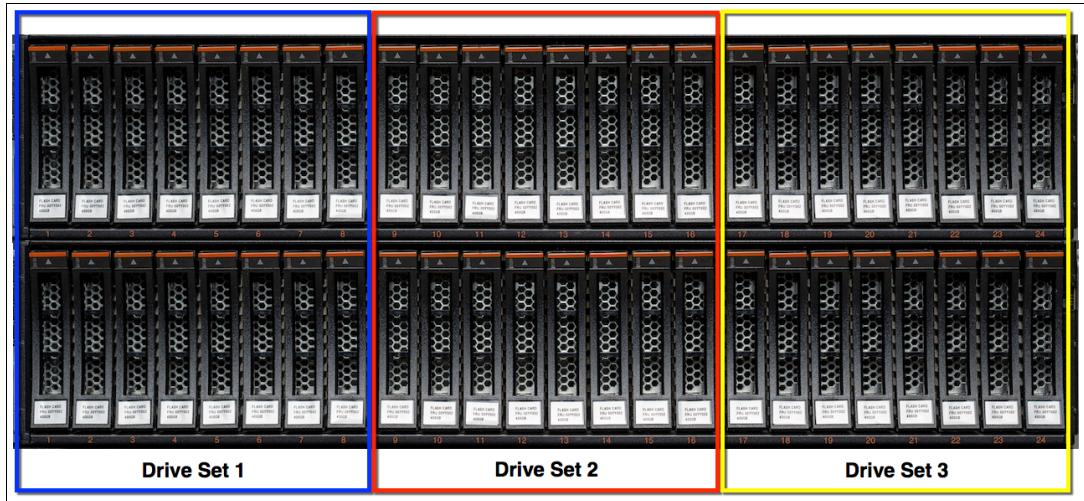Figure 2-3 shows the HPFE Gen2 flash drive installation order.

Figure 2-3   Flash drive set installation order

Table 2-2 lists the DS8910F feature codes for flash drive sets for HPFE Gen2.

Table 2-2   DS8910F feature codes for flash-drive sets for HPFE Gen2

Feature code	Disk size	Drive type	RAID support
1611	800 GB	Flash Tier 0	5, 6, 10
1612	1.6 TB	Flash Tier 0	6 and 10[a,b]
1613	3.2 TB	Flash Tier 0	6 and 10[a,b]
1622	1.92 TB	Flash Tier 2	6 and 10[b]
1623	3.84 TB	Flash Tier 1	6 and 10[a,b]
1624	7.68 TB	Flash Tier 2	6 and 10[a,b]
1625	15.36 TB	Flash Tier 2	6 and 10[a,b]

a. RAID 5 is not supported for drives larger than 1 TB, and requires a Request for Price Quote (RPQ).
b. RAID 6 is the default and preferred RAID type for all drives larger than 1 TB.

Within a High-Performance Flash Enclosure Gen2 pair, no intermix of High-Performance Flash (Tier 0) with High Capacity Flash (Tier 1 and Tier 2) is supported.

Storage enclosure fillers

Storage enclosure fillers fill empty drive slots in the storage enclosures.

The fillers ensure sufficient airflow across populated storage. For HPFE Gen2, one filler feature provides a set of 16 fillers (Feature Code 1699).

RAID capacities for DS8910F

Use the following information to calculate the physical and effective capacity for the HPFE Gen2.

The default and preferred RAID type for all drives larger than 1 TB is RAID 6. RAID 5 is not supported for drives larger than 1 TB, and requires an RPQ.

Table 2-3 lists the DS8910F effective RAID capacities.

Table 2-3 RAID capacities for HPFE Gen2

Flash Tier 0, Flash Tier 1, and Flash Tier 2 drive size (drive set size)	Rank type	Effective capacity of one rank in number of extents						
		RAID 10 arrays		RAI 5 arrays			RAID 6 arrays	
		3+3	4+4	5+P	6+P	7+P	5+P+Q	6+P+Q
800 GB (12.8 TB)	FB Lg Ext	2163	2885	3608	4330	5053	3608	4330
	FB Sm Ext	138462	184701	230938	277174	323395	230935	277159
	CKD Lg Ext	2426	3236	4047	4857	5667	4046	4857
	CKD Sm Ext	128604	171551	214497	257433	300385	214488	257438
1.6 TB (25.6 TB)	FB Lg Ext	4331	5776	N/A	N/A	N/A	7221	8666
	FB Sm Ext	277204	369691	N/A	N/A	N/A	462163	554647
	CKD Lg Ext	4857	6478	N/A	N/A	N/A	8099	9719
	CKD Sm Ext	257467	343369	N/A	N/A	N/A	429258	515155
1.92 TB (30.7 TB)	FB Lg Ext	5198	6932	N/A	N/A	N/A	8666	10400
	FB Sm Ext	332703	443689	N/A	N/A	N/A	554668	665647
	CKD Lg Ext	5830	7775	N/A	N/A	N/A	9720	11665
	CKD Sm Ext	309014	412009	N/A	N/A	N/A	515174	618257
3.2 TB (51.2 TB)	FB Lg Ext	8667	11557	N/A	N/A	N/A	14447	17337
	FB Sm Ext	554691	739673	N/A	N/A	N/A	924653	1109623
	CKD Lg Ext	9720	12962	N/A	N/A	N/A	16204	19445
	CKD Sm Ext	515197	687009	N/A	N/A	N/A	858812	1030627
3.84 TB (61.4 TB)	FB Lg Ext	10401	13869	N/A	N/A	N/A	17338	20806
	FB Sm Ext	665686	887667	N/A	N/A	N/A	1109645	1331623
	CKD Lg Ext	11665	15555	N/A	N/A	N/A	19445	23336
	CKD Sm Ext	618289	824465	N/A	N/A	N/A	1030630	1236812
7.68 TB (123 TB)	FB Lg Ext	20807	27744	N/A	N/A	N/A	34680	41617
	FB Sm Ext	1331653	1775623	N/A	N/A	N/A	2219583	2663551
	CKD Lg Ext	23336	31116	N/A	N/A	N/A	38897	46677
	CKD Sm Ext	1236838	1649196	N/A	N/A	N/A	2061542	2473901
15.36 TB (246 TB)	FB Lg Ext	41404	55207	N/A	N/A	N/A	69010	82812
	FB Sm Ext	2649892	3533275	N/A	N/A	N/A	4416655	5300023
	CKD Lg Ext	46438	61918	N/A	N/A	N/A	77399	92880
	CKD Sm Ext	2461216	3281701	N/A	N/A	N/A	4102175	4922665

2.2.2 DS8910F 5U I/O enclosure

The DS8910F I/O enclosure holds the I/O adapters and provides connectivity between the I/O adapters and the processor nodes. DS8910F has one pair of 5U I/O enclosure logical names I/O bay 02 and 03. I/O adapters are installed in pairs in the two I/O bays for redundancy.

The I/O adapters in the I/O enclosures can be flash RAID adapters or host adapters. Each I/O enclosure supports two Flash RAID adapter pairs, and four host adapters pairs (32 ports). Host adapters are 4-port 16 Gbps or 4-port 32 Gbps (gigabit Fibre Channel (GFC)).

The DS8910F I/O enclosure supports at minimum configuration one pair of flash device adapter. At maximum configuration, two pairs of flash device adapter are supported. The I/O enclosure configuration contains the following components:

► Up to four pairs of 4-port 16 Gbps or 4-port 32 GFC host adapters
► Power control network (PCN) adapter
► Redundant power supply units (PSUs)
► Redundant fans for enclosure cooling
► Up to two pairs of flash device adapter
► Four zHyperLink adapters

Figure 2-4 shows the DS8910F I/O enclosure maximum configuration with a flash RAID adapter pair, and four host adapter pairs.
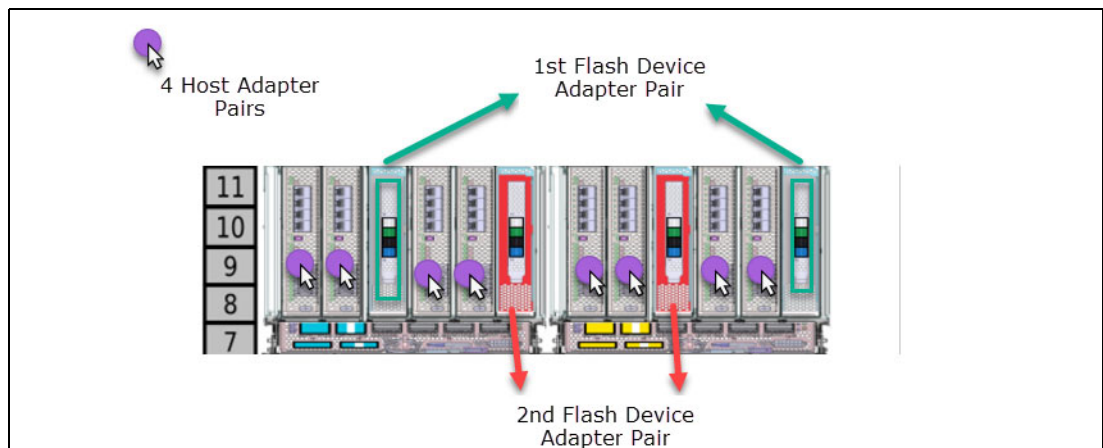

Figure 2-4   DS8910F I/O enclosure configuration

PCIe connectivity is from the 4-port PCIe adapters in the processor nodes to the base PCIe I/O expander. A separate PCIe connection to each base is used, which provides redundant access to each I/O bay and shared access to the flash device and host adapters. Failover occurs during code load, or during node failure and service actions.

The minimum configuration supports one flash device adapter pair (one adapter in each I/O bay) and up to four host adapter pairs (four adapters in each I/O bay).

Note: For continued availability during a logical I/O enclosure or a host adapter failure, ensure that host connectivity has a redundant path to a different host adapter in the other logical I/O enclosure.

Figure 2-5 shows the PCIe connectivity from the processor nodes to the DS8910F 5U I/O enclosures. Two connections are available: one from each processor node to each I/O enclosure.
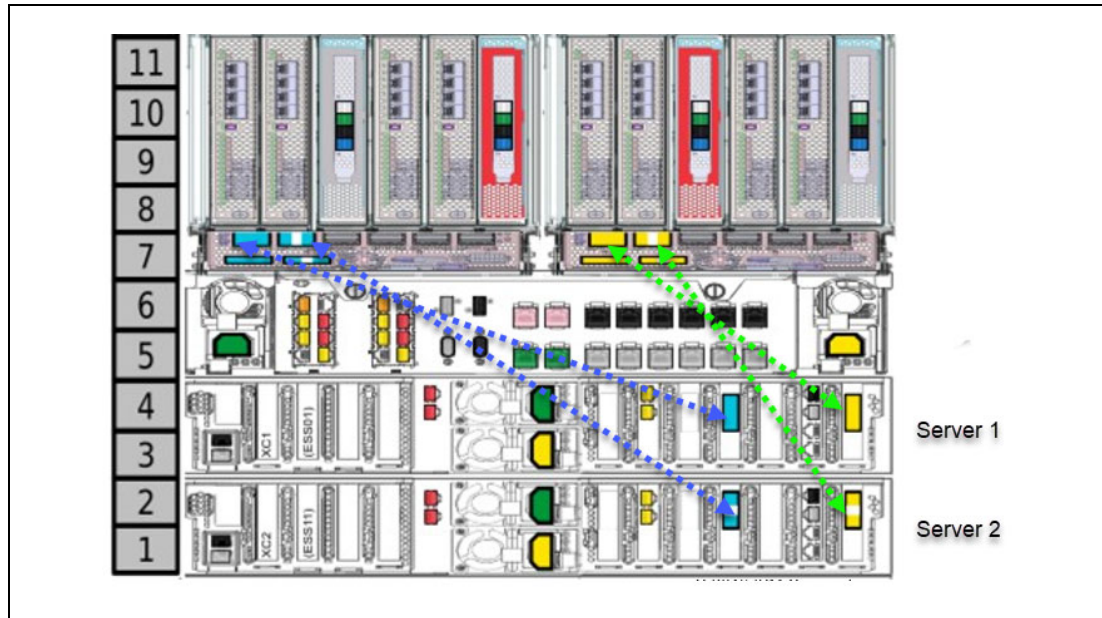

Figure 2-5   DS8910F PCIe connectivity to 5U I/O enclosure

zHyperLink connections

Up to four zHyperLink connections with IBM Z hosts can be used to provide low latency for random reads and writes. Each zHyperLink connection requires a zHyperLink I/O adapter to connect the zHyperLink cable to the storage system. Each zHyperLink I/O adapter (Feature Code 3500) has one port, but you must order them in sets of two. Table 2-4 lists the feature codes for the available zHyperLink cables.

Table 2-4   Feature codes for zHyperLink cables

Feature code	Cable type	Cable length	zHyperLink I/O adapter features
1450	OM4 50/125 micrometer, multimode, MTP connectors	40 m (131 ft.)	3500
1451	OM4 50/125 micrometer, multimode, MTP connectors	150 m (492 ft.)	3500
1452	OM4 50/125 micrometer, multimode, MTP connectors. For model 993 installed in z15 model T02 or IBM z14 Model ZR1 rack	3 m (9.8 ft.)	3500

Figure 2-6 on page 15 shows the zHyperLink adapter locations for connecting to IBM Z host system. When configuring host connections T3 ports are connected first, then T4 ports.
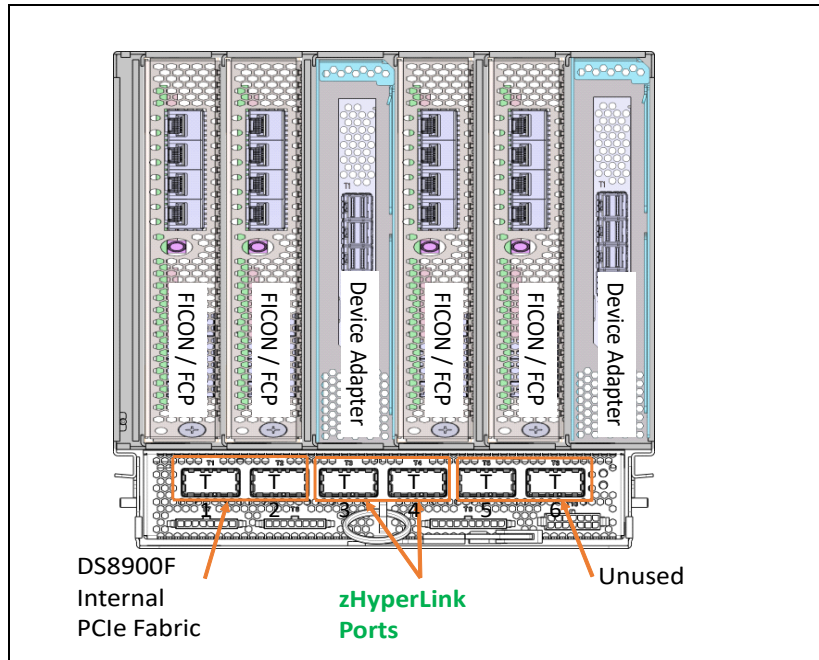
Figure 2-6   DS8910F zHyperLink connections

Fibre Channel (SCSI-FCP and FICON) host adapters and cables

The DS8910F Fibre Channel (FC) host adapters enable attachment to FC (SCSI-FCP) and FICON servers, and SAN fabric components. They can also be used for remote mirror and copy control paths between DS8000 series storage systems.

The DS8910F host adapters are 4-port 16 Gbps or 4-port 32 GFC, which is similar to those adapters in other DS8900 models. The DS8910F host adapters can be longwave or shortwave.

Supported protocols include the following types:

▶   SCSI-FCP upper layer protocol (ULP) on point-to-point and fabric
▶   FICON ULP on point-to-point and fabric topologies

Note: The 16 Gbps or 32 GFC (Encryption of Data In Flight (EDiF)) Encryption capable host adapters do not support arbitrated loop topology at any speed.

Fibre Channel port identification

The DS8910F host adapters are installed as pair in the two I/O enclosures. Up to four 4-port 16 Gbps or GFC pairs can be installed in DS8910F. The host adapter plug order is shown in Figure 2-7.
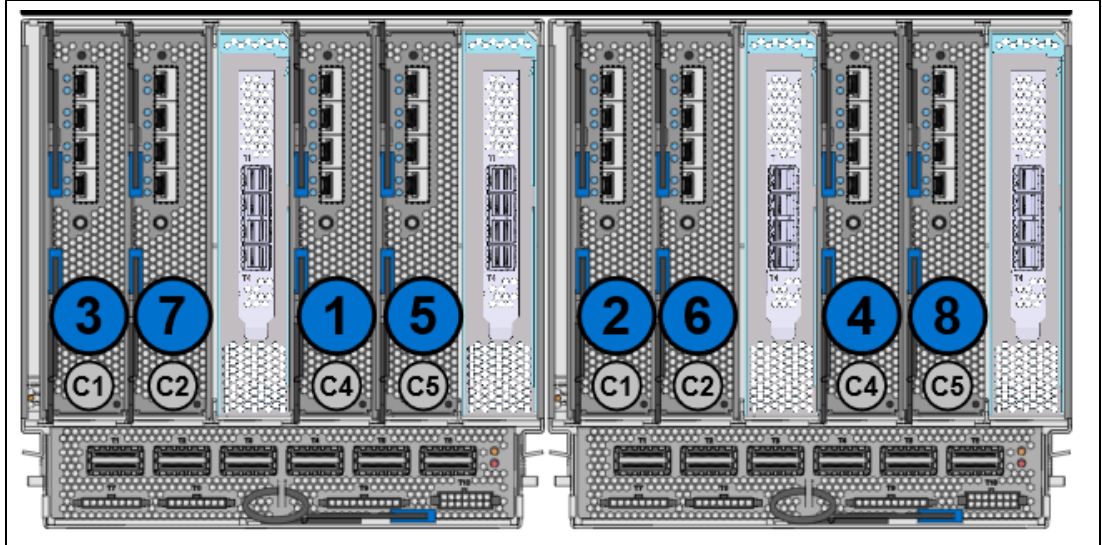

Figure 2-7   DS8910F Host adapter plug order

The following installation order is used:

1. All 32 GFC host adapters
2. The 16 Gbps host adapters
3. The Long Reach host adapters
4. The Short Reach host adapters

The DS8910F FC ports can be identified by the physical host adapter port location code and the FC port ID. Figure 2-8 shows the fiber port IDs for host adapters that are installed in I/O enclosure 1B3.

	cpssebay02 Adapter ID-1502 Location-1B3					
Slot 0	1	2	3	4	5	
Adapter ID						
B10	B11	1812	B13	B14	1815	
Logical name						
Port cpssfc020	cpssfc021	vra022	cpssfc023	cpssfc024	vra025	
0	cpssfc0200	cpssfc0210		cpssfc0230	cpssfc0240	
1	cpssfc0201	cpssfc0211		cpssfc0231	cpssfc0241	
2	cpssfc0202	cpssfc0212	daPair 10	cpssfc0232	cpssfc0242	daPair 11
3	cpssfc0203	cpssfc0213		cpssfc0233	cpssfc0243	
		Slot 8	Slot 9	Slot 6	Slot 7	
		1928	1929			
		syncio028	syncio029			

Figure 2-8   Fiber port IDs for the host adapters in I/O enclosure 1B3

Figure 2-9 shows the FC port IDs that are assigned to the host adapters that are installed in I/O enclosure 1B4. Slot numbers that are shown are logical; therefore, slot 0 is physical slot 1 in 1B4.

cpssebay03 Adapter ID-1503 Location-1B4						
Slot 0	1	2	3	4	5	
Adapter ID						
B18	B19	181A	B1B	B1C	181D	
Logical name						
Port	cpssfc030	cpssfc031	vra032	cpssfc033	cpssfc034	vra035
0	cpssfc0300	cpssfc0310		cpssfc0330	cpssfc0340	
1	cpssfc0301	cpssfc0311		cpssfc0331	cpssfc0341	
2	cpssfc0302	cpssfc0312	daPair 11	cpssfc0332	cpssfc0342	daPair 10
3	cpssfc0303	cpssfc0313		cpssfc0333	cpssfc0343	
			Slot 8	Slot 9	Slot 6	Slot 7
			1938	1939		
			syncio038	syncio039		

Figure 2-9 Fibre Channel port IDs for the host adapters in I/O enclosure 1B4

Figure 2-10 shows the FC ports that are displayed from the Storage Manager GUI. The FC port logical ID, frame number, I/O enclosure, and host adapter slot are shown with other FC port properties. For example, looking at port ID I0232 and referencing Figure 2-8 on page 16, the port is in I/O enclosure 1B3 slot 4 port 2.

Fibre Channel Ports

≡ Actions ▼   ▽ Filter   ⬇

ID	Frame	I/O Enclosure	Host Adapter	State		Protocol	WWPN	Type	Speed	
I0232	1	3	4	✔ Unconfigured	↑	Undefined	50:05:07:63:09:13:94:62	Long Wave	32 Gbps	
I0231	1	3	4	✔ Unconfigured		Undefined	50:05:07:63:09:13:54:62	Long Wave	32 Gbps	
I0233	1	3	4	✔ Unconfigured		Undefined	50:05:07:63:09:13:D4:62	Long Wave	32 Gbps	
I0230	1	3	4	✔ Unconfigured		Undefined	50:05:07:63:09:13:14:62	Long Wave	32 Gbps	
I0303	1	4	1	✔ Unconfigured		Undefined	50:05:07:63:09:18:D4:62	Long Wave	32 Gbps	
I0302	1	4	1	✔ Unconfigured		Undefined	50:05:07:63:09:18:94:62	Long Wave	32 Gbps	
I0301	1	4	1	✔ Unconfigured		Undefined	50:05:07:63:09:18:54:62	Long Wave	32 Gbps	
I0300	1	4	1	✔ Unconfigured		Undefined	50:05:07:63:09:18:14:62	Long Wave	32 Gbps	

[Close]

Figure 2-10 Fibre Channel port IDs from Storage Manager GUI

Fibre Channel cables

An FC cable is required to attach each FC adapter port to a server or fabric component port. The FC cables can be 50 or 9 μm, OM3 or higher fiber graded, single, or multimode cables.

For more information about DS8910F host adapter and FC cable features, see 3.1.3, "Planning for host connectivity" on page 34.

Flash RAID adapters

Up to two pairs of the flash RAID adapter can be installed in DS8910F to connect to two pairs of HPFE. The main processor is a RAID engine that provides RAID and sparing management to the flash drives in the HPFE Gen2 flash enclosures.

The flash RAID adapter has four SAS ports, which provide connectivity from the RAID adapter to the HPFE Gen2 enclosures.

The flash RAID adapters are installed as a pair, one in each of the logical I/O enclosures. This installation is known as a *device adapter pair* (DA pair). Logical configuration should be balanced across the DA pair for load balancing and the highest throughput.

The redundant DA pair ensures continued availability if a flash RAID adapter or logical I/O enclosure fails.

2.2.3 IBM POWER9-based servers

A pair of POWER9 processor-based servers, also known as *processor nodes*, are at the heart of all the IBM DS8900F models. The DS8910F model 993 shares the processor nodes that are used in the DS8910F model 994.

The two POWER9 processor-based servers share the load of receiving and moving data between the attached hosts and the storage arrays. However, they are also redundant, so that if either server fails, the system operations fail over to the remaining server and continue to run without any host interruption.

The DS8910F configuration uses two POWER9 processor-based servers (9009-22A), each with two 4-core Single Chip Modules (3.4 - 3.9 GHz) and 96 GB or 256 GB processor memory.

The DS8910F processor node is a 2U high enclosure, and features the following configuration:

- ► DDR4 Registered DIMM (RDIMM) slots
- ► One storage cage with two hard disk drives
- ► Two PCIe x16 Gen3 slots
- ► Four PCIe x8 Gen3 slots
- ► Two power supplies with integrated cooling

The two 2U processor nodes are positioned under the I/O enclosure and the management enclosure. Figure 2-11 shows the front view of the DS8910F processor node.

Figure 2-11   DS8910F processor node front view

For more information about the server hardware that is used in the DS8910F models 993 and 994, see *IBM Power Systems S922, S914, and S924 Technical Overview and Introduction*, REDP-5497.

Processor memory

The DS8910F configuration offers up to 512 GB of total system memory. Each processor node contains half of the total system memory. All memory that is installed in each processor node is accessible to all processors in that node. The absolute addresses that are assigned to the memory are common across all processors in the node. The set of processors is referred to as a *symmetric multiprocessor* (SMP) system.

The IBM POWER9 processor that is used in the DS8910F operates in simultaneous multithreading (SMT) mode, which runs multiple instruction streams in parallel. The number of simultaneous instruction streams varies according to processor and Licensed Internal Code (LIC) level. SMT mode enables the POWER9 processor to maximize the throughput of the processor cores by offering an increase in core efficiency.

DS8910F memory upgrades can be performed non-disruptively 96 - 256 GB per node.

Caching is a fundamental technique for reducing I/O latency. As with other modern caches, the DS8910F processor nodes contain volatile memory that is used as a read and write cache, and non-volatile dual inline memory module (NVDIMM) that is used to maintain and back up a second copy of the write cache.

If power is lost, the NVDIMMs are supplied "hold up" power from one Backup Power Module (IBM BPM). BPMs retain NVDIMM data when electrical power is removed, either from an unexpected power loss, or from a normal system shutdown. The 2.5-inch Smart BPM is installed in the vacant drive location D7 (which is inside the CPC cage).

Two cables connect to the system board, which is next to the NVDIMM slots (C22 and C36), as shown in Figure 2-12.
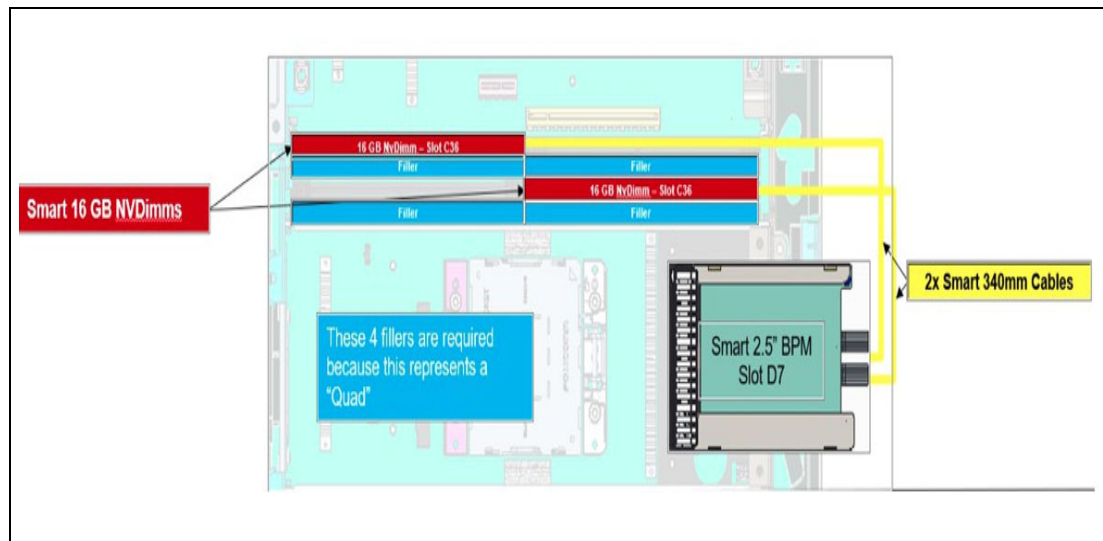

Figure 2-12   DIBM IBM BPM8910F 2.5-inch Smart BPM location in each processor node

The NVS scales to the processor memory that is installed, which also helps to optimize performance. DS8910F NVS is 4 GB for 96 GB processor nodes and 16 GB per node for 256 GB processor nodes. Figure 2-13 show the top view of a processor node with 256 GB memory.
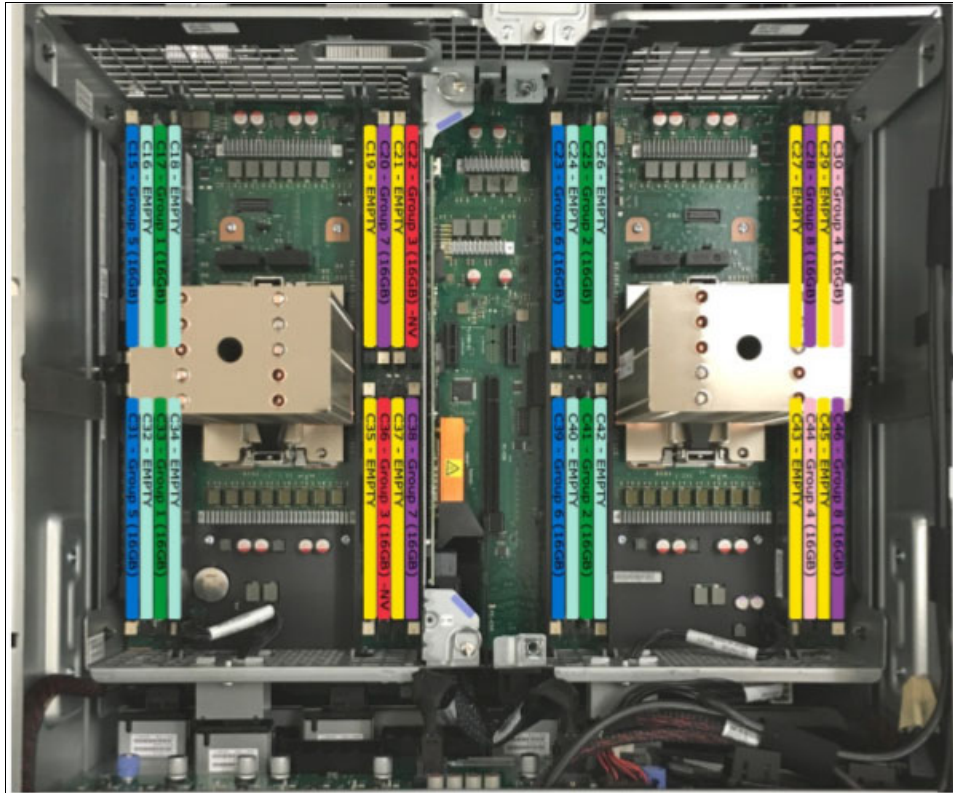

Figure 2-13   DS8910F processor node with two 4-core CPCs and 256 GB of memory

Flexible service processor

Each IBM POWER9 processor complex is managed by a service processor that is called a *flexible service processor* (FSP). The FSP is an embedded controller that is based on an IBM PowerPC® processor.

The FSP controls power and cooling for the processor nodes. The FSP performs predictive failure analysis for installed processor hardware, and performs recovery actions for processor or memory errors. The FSP monitors the operation of the firmware during the boot process and can monitor the operating system for loss of control and take corrective actions.

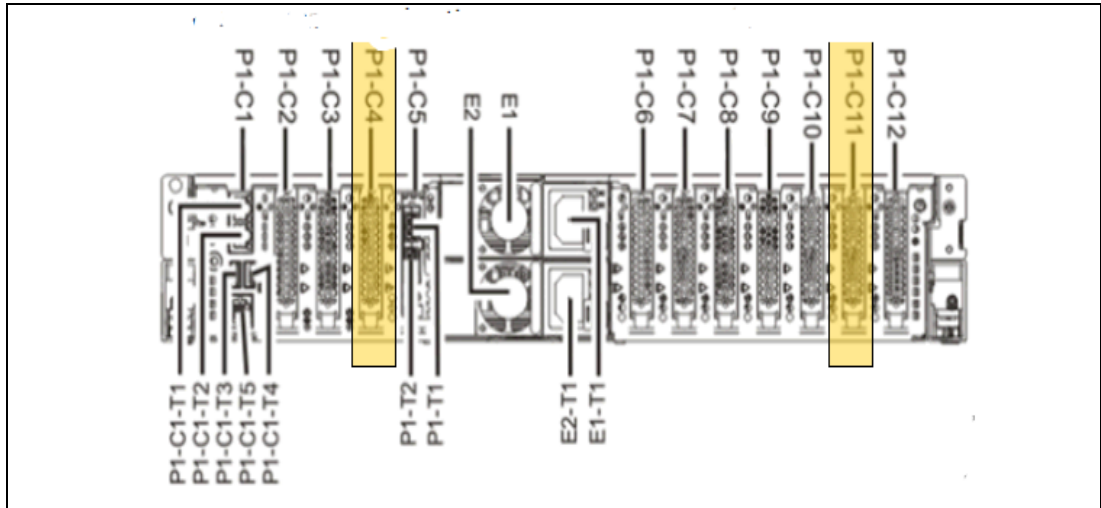Figure 2-14 shows the rear view of the DS8910F processor node and slot C1 is the FSP.

Figure 2-14   DS8910F server rear view

The following adapters are installed in the processor nodes, as shown in Figure 2-14:

► Peripheral Component Interconnect Express adapter

   Each DS8910F processor node contains two single port PCIe3 adapters. These adapters allow point-to-point connectivity between the processor nodes and the I/O enclosure and I/O adapters. Adapters are installed in slots C6 and C12.

► Ethernet connections

   Each IBM POWER9 processor complex has a single 4-port 1 Gb Ethernet adapter that is installed in slot C11. The upper two ports connect to the internal network switches, as described in "Ethernet switches" on page 24. The lower two unused connections are available for Transparent Cloud Tiering (TCT). These connections are the lower two ports of the LPAR Ethernet adapter and were the original low-speed TCT connections.

► TCT connections

   An optional high-speed Ethernet adapter feature can be ordered for TCT, which provides two 10 Gbps LC connections and two RJ-45 1 Gbps connections. For DS8910 model 993, the 10 Gbps adapter (Feature Code 3602) is installed in slot C4 of each processor node.

   These ports are the two high-speed and two low-speed TCT connections, which are an optional chargeable hardware feature. In summary, six TCT connections are available: two low-speed included, and optionally, two high speed and two low speed.

2.2.4 Management enclosure

The DS8910F management enclosure is a 2U chassis that contains the following components:

► Two HMCs
► Two Ethernet switches
► Two power control cards (RPCs)
► Two PSUs to power the management enclosure components
► One Local/Remote switch assembly
► Internal cabling for communications and power for each of the components

The DS8910F management enclosure is unique and does not exist in other DS8900 models.

Because the DS8910F system modules can be mounted in any conforming rack, the management enclosure is designed to create a compact container for all essential system management components.

Figure 2-15 shows the layout of the components of the management enclosure.
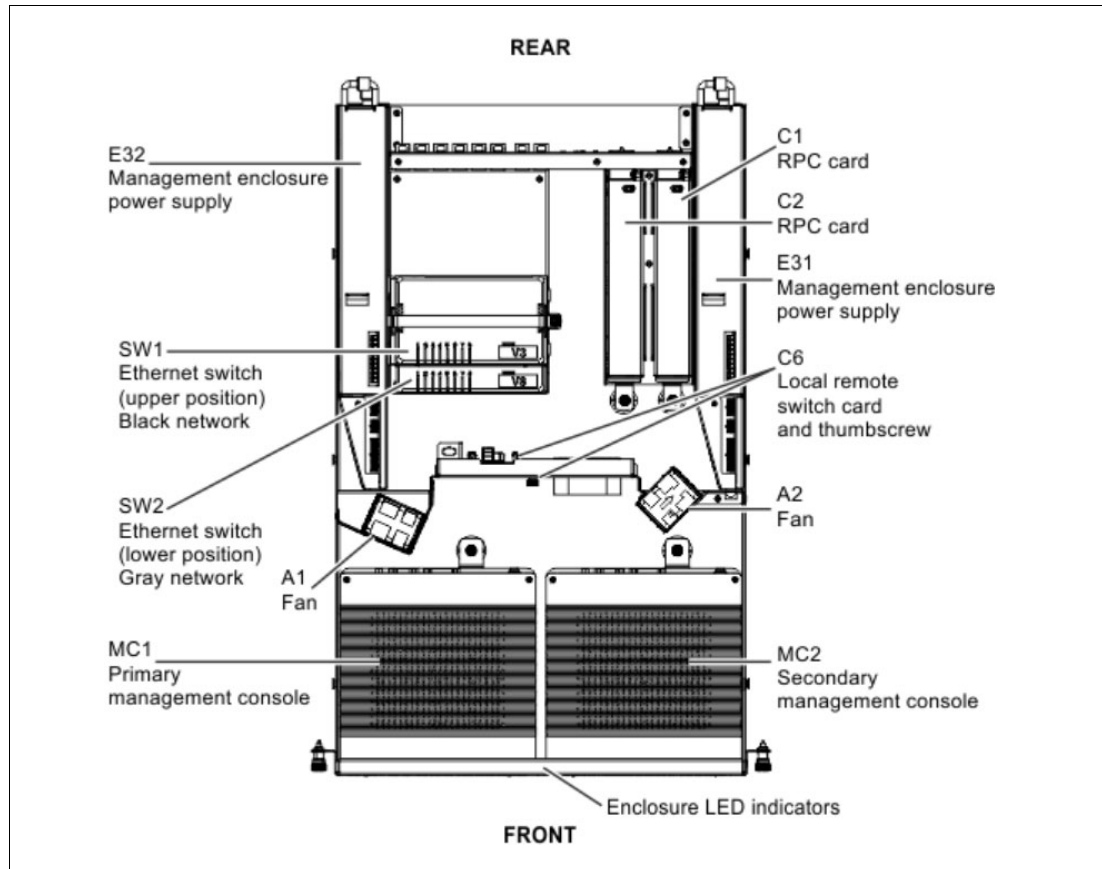

Figure 2-15   DS8910F management enclosure component layout

The management enclosure provides internal communications to all of the modules of the DS8910F system. The management enclosure also provides external connectivity by using two Ethernet cables from each HMC for remote management. It also provides keyboard/mouse and video connectivity from each HMC for local management. Cables are routed from the management consoles to the rear of the management enclosure through a cable management arm (CMA).

Figure 2-16 shows the front view of the 2U management enclosure.

Figure 2-16   DS8910F management enclosure (front view)

Figure 2-17 shows the rear view of the DS8910F management enclosure, the rear tailgate connectors, and the installed components.

Figure 2-17   DS8910F management enclosure (rear view)

Hardware Management Consoles

The management console is also referred to as the HMC. It supports the DS8910F hardware and firmware installation and maintenance activities.

The HMC connects to the customer network and provides access to functions that can be used to manage the DS8910F. Management functions include logical configuration, problem notification, Call Home for service, remote service, and Copy Services management.

Management functions can be performed from the DS8000 Storage Management GUI, DS command-line interface (DS CLI), or other storage management software that supports the DS8910F.

Clients who use the DS8900 advanced functions, such as Metro Mirror or FlashCopy, can communicate to the storage system with IBM Copy Services Manager (CSM).

The management console provides connectivity between the DS8910F and Encryption Key Manager servers, if used.

The management console also provides the functions for remote call home and remote support connectivity.

To provide continuous availability of access to the management console functions, the DS8910F order must include the second management console.

Note: Release 9.1 introduces a new hardware enhanced HMC with increased memory (32 GB versus 8 GB) and internal storage (256 GB versus 120 GB). Figure 2-18 shows the front view of the new HMC.
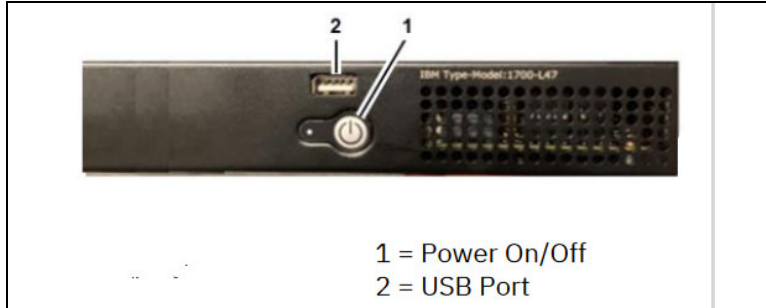

Figure 2-18   New hardware enhanced HMC

Ethernet switches

The DS8910F management enclosure has two 8-port Ethernet switches. The two switches provide two redundant *private* management networks. Each processor node includes connections to each switch to allow each server to access both private networks. These networks cannot be accessed externally, and no external connections are allowed. External client network connection to the DS8910F system is through dedicated connections to each of the management consoles.

Figure 2-19 shows the connections at the rear of the DS8910F management enclosure.
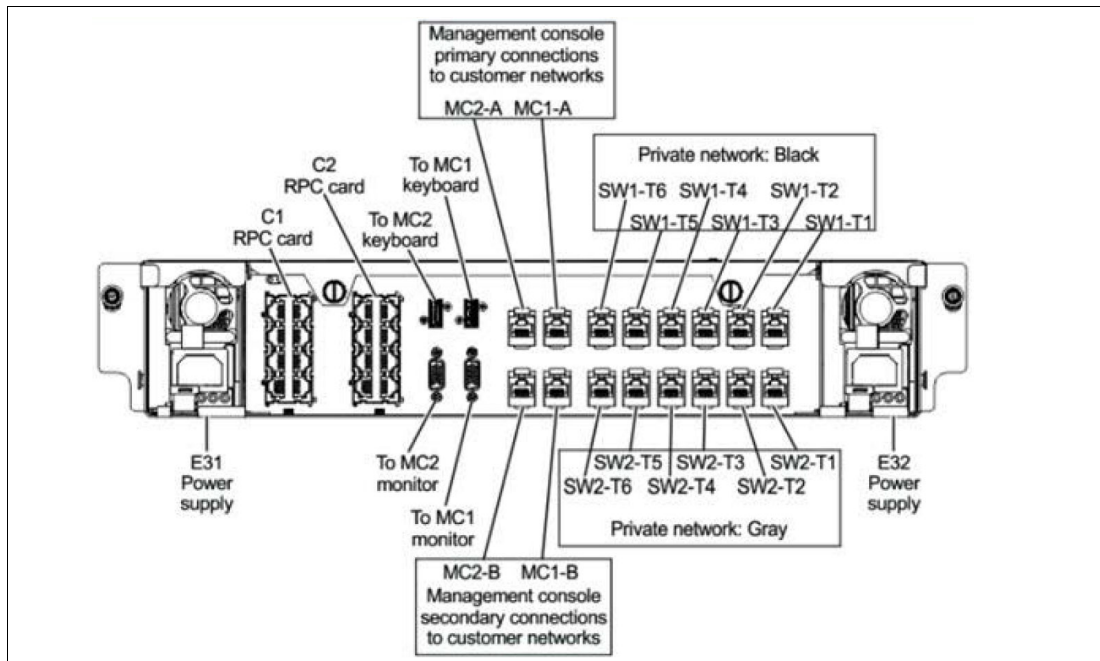

Figure 2-19   Management enclosure connections

2.2.5 Power subsystem

Intelligent power distribution units (iPDUs) supply power to the storage system, and BPMs provide power to the NVDIMM when electrical power is removed. The rack-mounted model 993 standard 19-inch wide rack installation (Feature Code 0939) supports an optional pair of iPDUs, as shown in Figure 2-20. E23 (Green) must connect all the green enclosure power cords, and connect to the gray private network. E24 (Yellow) must connect all the yellow enclosure power cords, and connect to the black private network. Each enclosure connects to the specified output port on the iPDUs.

> **Note:** Only DS8910F model 993 enclosures are allowed to be connected to the optional iPDU pair.

Rack power control is through Ethernet-managed iPDUs and HMC manages system power state and monitoring.
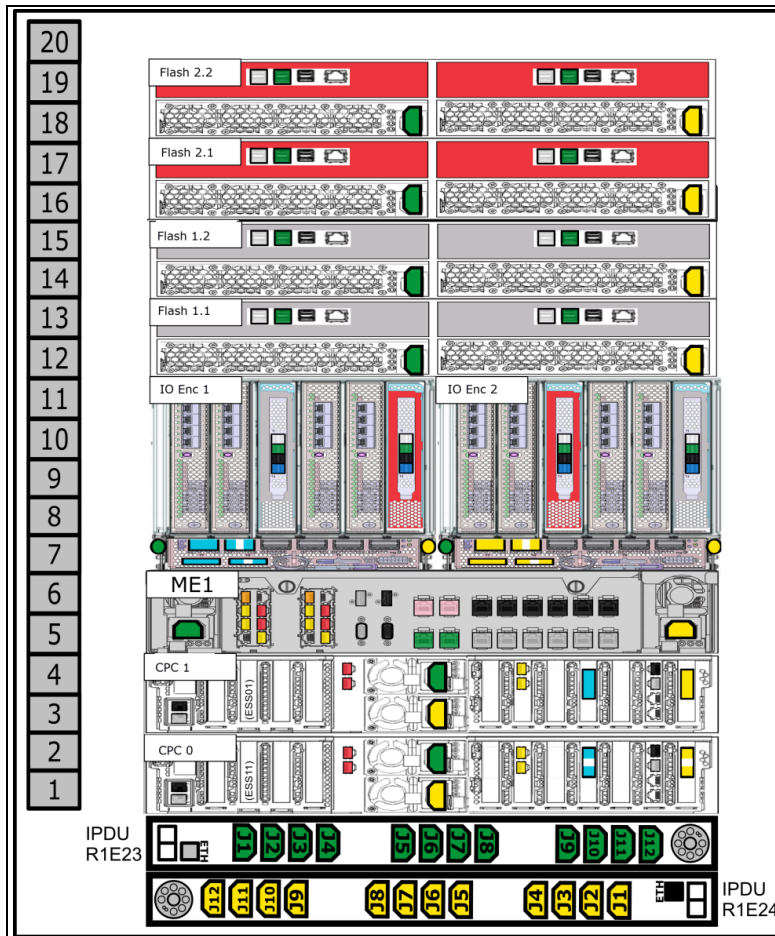

Figure 2-20   DS8910F model 993 customer rack integration

iPDUs provide following benefits:

- ▶ IBM Active Energy Manager(AEM) support
- ▶ IBM Power Line Disturbance (PLD) compliance up to 20 milliseconds
- ▶ Individual outlet monitoring and control
- ▶ Firmware updates
- ▶ Circuit breaker protection

NVDIMM BPM is a Nickel-based hybrid energy storage system with high-power discharge and Fast charge time, as shown in Figure 2-21. BPMs retain NVDIMM data when electrical power is removed because of an unexpected power loss or normal system shutdown. This capability improves data security, reliability, and recovery time.

Figure 2-21   DS8910F NVDIMM BPM

Power input and distribution

The DS8910F model 993 supports single-phase and three-phase power. For z15 model T02, LinuxONE III model LT2, IBM z14 Model ZR1, or LinuxONE II model LR1 rack integration, DS8910F model 993 supports single-phase only and uses the second pair of IBM Z iPDUs (A3 and A4) for input power to its components.

The standard 19-inch wide rack installation (Feature Code 0939) requires the following power connections:

► 15U configuration requires 7x IEC C13 power on two different power distribution units (PDUs) (total 14). Optional monitor adds a C13 on either PDU.

► 19U configuration requires 9x IEC C13 power on two different PDUs (total 18) and monitor adds a C13 on either PDU.

For more information about power input requirements, see 3.1.2, "Planning for power requirements" on page 32.

2.2.6 DS8882F to DS8910F Rack Mounted comparison

The DS8882F is the rack-mounted model 983 that was introduced with the DS8880 family. The new rack-mounted member of the DS8900 family (DS8910F model 993) is redesigned with new IBM POWER9 processor nodes, power, capacity, I/O enclosure, host adapter, and zHyperLink adapter. The DS8882F and DS8910F are compared in Table 2-5.

Table 2-5   DS8882F to DS8910F Rack Mounted comparison

Features	DS8882F	DS8910F
Rack Size	No rack	No rack
Min Size	17[a]	16 including the optional display
Max Size	17[a]	20 including the optional display
CPC	2 IBM POWER8®	2 IBM POWER9

Features	DS8882F	DS8910F
IO Bay Pairs	1 2U	1 5U
Max host adapter ports	Sixteen ports 16 GFC 4-port host adapter	Thirty-two ports 16 GFC 4-port host adapter 32 GFC 4-port EDiF host adapter
Max zHyperLink Ports	0	4
Max Flash Drives	48	96
Max HPFE Gen 2 pair	1	2
4 U UPS single phase per rack	2	0
Display and Keyboard	One 19-inch wide rack mounted (optional)	One 19-inch wide rack mounted (optional) One with z15 model T02 or LinuxONE III model LT2 integration
HMC in management enclosure	2	2
Ethernet Switch in management enclosure	2	2

a. The DS8882F and DS8910F systems, when integrated into IBM z14 model ZR1 or LinuxONE II model LR1, use 16U contiguous space and share the keyboard display unit that is provided by IBM Z.

Figure 2-22 shows a comparison of the DS8882F and DS8910F rack-mounted models with the maximum supported configuration.
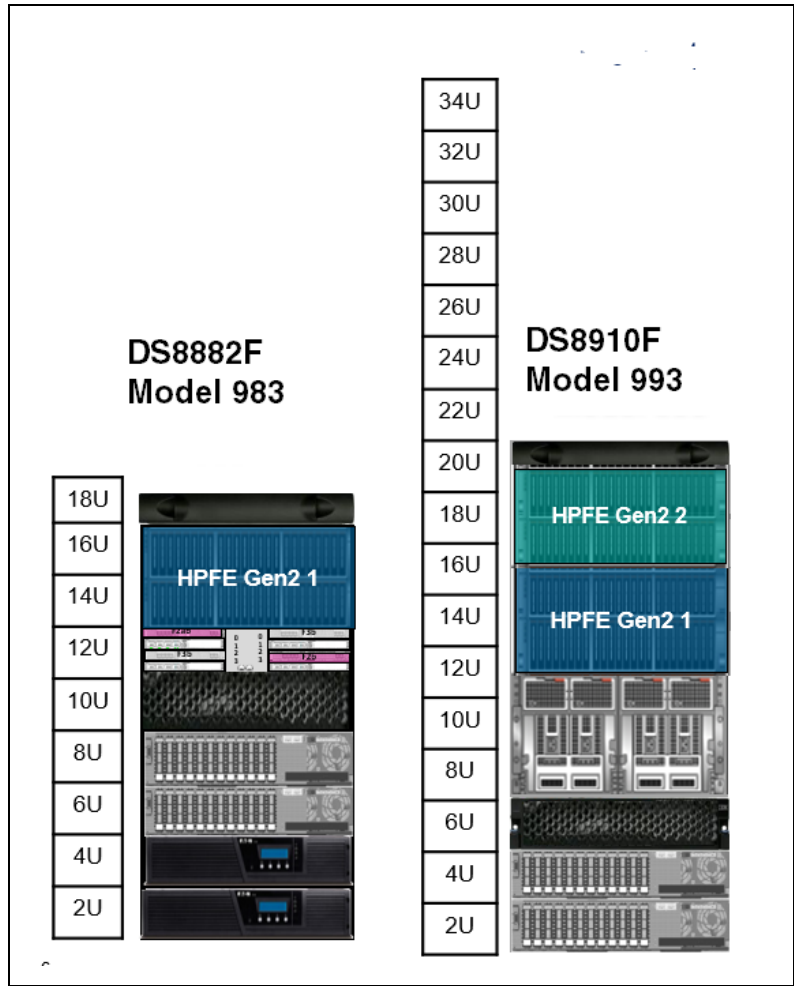

Figure 2-22   DS8882F to DS8910F Rack Mounted comparison

3

IBM DS8910F installation and integration

The DS8910F Rack Mounted storage system can be integrated into 16U contiguous space of the IBM z15 Model T02, LinuxONE III model LT2, IBM z14 model ZR1, LinuxONE II model LR1, or other standard 19-inch wide rack that conforms to EIA 310D specifications.

This chapter provides information about installation and integration and includes the following topics:

3.1 DS8910F integration

The DS8910F Model 993 is a rack-mountable storage system that consists of six or eight modules.

The following rack integration scenarios are available:

► An z15 model T02 and IBM z14 model ZR1: Feature Code 0937

► An IBM LinuxONE III model LT2 and LinuxONE II model LR1: Feature Code 0938

► Other standard 19-inch wide rack that conforms to EIA 310D specifications (Feature Code 0939). The rack must meet the following requirements:

  – 19-inch EIA rails
  – Minimum rail depth of 720 mm
  – Maximum rail depth of 780 mm

The first two scenarios are identical from a DS8910F perspective, and can be considered the same process. For more information about these scenarios, see 3.2, "Integrating the DS8910F into IBM Z entry models" on page 37.

The third scenario is described in 3.3, "Integrating the DS8910F into a standard 19-inch rack" on page 45.

This section provides more information about the first two scenarios.

3.1.1 Planning the DS8910F installation and integration

The DS8910F arrives in boxes on a pallet. The boxes contain all eight modules, which constitute the complete system, and all required cabling and any other features that were ordered.

The system must be assembled into the rack that was designated for the DS8910F. The system must be installed by IBM service representatives.

The designated rack must at minimum have 15U of contiguous dedicated space. The maximum configuration into a standard 19-inch rack requires 19U of contiguous dedicated space. An optional KVM (Feature Code 1765) adds 1U to the configuration.

When ordering the DS8910F, a field merge feature code is required to indicate which rack scenario to use for installing the DS8910F. Feature Code 0937 is the intended installation for an z15 model T02 or IBM z14 model ZR1, and Feature Code 0938 is for an IBM LinuxONE III model LT2 or LinuxONE II model LR1. This choice drives a few unique features for this scenario and excludes others. A minimum of 16U of contiguous space is required. For more information, see 3.2, "Integrating the DS8910F into IBM Z entry models" on page 37.

Conversely, if Feature Code 0939 is selected, other optional features also are available for selection. For more information, see 3.3, "Integrating the DS8910F into a standard 19-inch rack" on page 45. Regardless of which rack scenario is selected for the DS8910F, some common physical planning requirements must be considered, as described next.

Planning for floor loading and rack space

When planning the location of the DS8910F system, consider the requirements that are described in this section that relate to floor types, floor loads, and space.

The six modules each have a specified position within the 15U. No spaces or any other components can be inserted into the 15U of contiguous space. When installing in a z15 or IBM z14 rack, 16U of contiguous space is required (see 3.2, "Integrating the DS8910F into IBM Z entry models" on page 37).

Figure 3-1 shows the six modules that make up the DS8910F and the order that they must be installed.
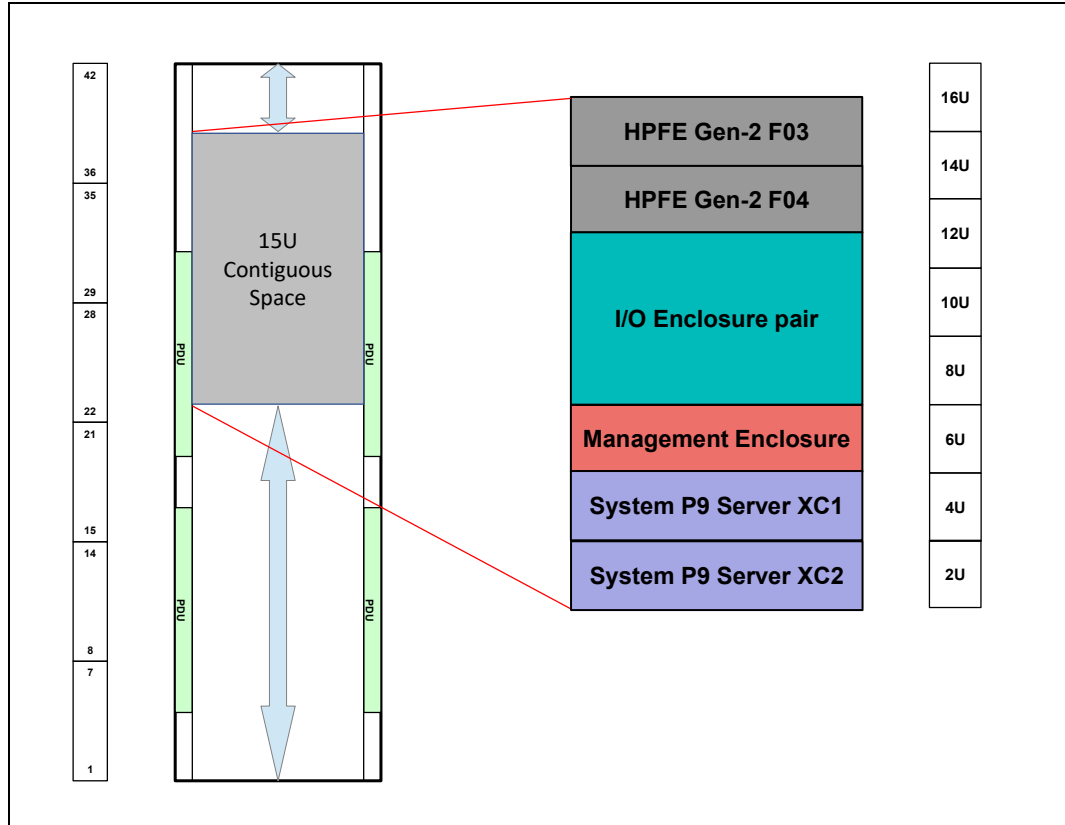

Figure 3-1   DS8910F rack layout

The intended installation site must accommodate the following criteria:

► Weight distribution area that is needed to meet floor load requirements

   The floor of the installation site must meet the floor-load requirements for the IBM Z, or other standard 19-inch wide frame, plus the extra weight of the DS8910F.

► Service clearance requirements

The DS8910F dimensions and weight are listed in Table 3-1.

Table 3-1   DS8910F dimensions and weight

Dimensions		Maximum weight
15U contiguous vertical rack space without optional keyboard and display	66.7 cm (26.25 in.)	246 kg (543 lb)
16U contiguous vertical rack space with optional keyboard and display	71.1 cm (28 in.)	
20U contiguous vertical rack space with optional keyboard, display, and two HPFE Gen2	88.9 cm (35 in.)	
Distance between rack front and rear EIA rails (Depth)	70 cm - 78 cm (27.6 in. - 30.7 in.)	
Width	46.5 cm (18.3 in.)	
Minimum distance from cabinet rear rail to rear door	23 cm (9 in.)	
Minimum distance from cabinet front rail to front door	5 cm (2 in.)	

For more information, see the following documentation:

► *IBM 8562 Installation Manual for Physical Planning (IMPP),* GC28-7011
► *IBM 3907 Installation Manual for Physical Planning (IMPP)*, GC28-6974

3.1.2 Planning for power requirements

The DS8910F requires two independent power outlets for the two power cords that connect to the intelligent power distribution units (iPDUs).

> **Important:** To eliminate a single point of failure, independent power feeds to each DS8910F iPDUs are required. At least one of the feeds must have power conditioning to ensure an acceptable level of power quality, such as specified in standards ANSI C84.1 and EN 50160.
>
> Also, each power source must have its own circuit breaker.

Power connector requirements

The rack-mounted model 993 standard 19-inch wide rack installation (Feature Code 0939) supports an optional pair of iPDUs. A pair of power cables is required for the two iPDUs when it is integrated into 19-inch wide standard rack. DS8910F supports single or three-phase power. Ensure that you order the correct power cords for your outlets, based on the country or region requirements.

If client power distribution units (PDUs) are used, they do not include integrated control or monitoring. When integrated into the IBM Z rack, DS8910F Model 993 uses the second pair of IBM Z iPDUs (A3 and A4) in the IBM Z frame. DS8910F KVM in the z15 model T02 or LinuxONE III model LT2 frame is powered by port 8 of the IBM Z iPDU, A2. IBM z14 model ZR1 or LinuxONE II model LR1 share the display and keyboard with DS8910F model 993.

For more information about power cord feature codes, connector diagrams, and countries and regions in which each connector type is commonly used, see *DS8910F Introduction and Planning Guide*, SC27-9560.

Input power requirements

The DS8910F supports single or three-phase power. However, only single-phase power is supported by integration into an z15 model T02, LinuxONE III model LT2, IBM z14 model ZR1, or LinuxONE II model LR1. Table 3-2 lists the supported input voltages and frequencies.

Table 3-2   DS8910F single-phase input voltages and frequencies

Characteristic	Voltage (single phase)
Nominal input voltages	200-240 RMS V AC
Minimum tolerated input voltage	180 RMS V AC
Maximum tolerated input voltage	256 RMS V AC
System maximum current rating	14.4 Amps
Recommended wall breaker rating (1 ph)	15 - 20 Amps
Steady-state input frequencies	50 ± 3 or 60 ± 3.0 Hz
Power Line Disturbance (PLD) input frequencies	< 20 milliseconds

Table 3-3 lists the supported three-phase input voltages and frequencies.

Table 3-3   DS8910F three-phase input voltages and frequencies

Characteristic	Three-phase delta (3Ø∆)	Three-phase wye (3ØY: LL[Line-to-Line])
Nominal input voltages	Nominal input voltages	380, 400, or 415 RMS V AC
Minimum tolerated input voltage	180 RMS V AC	315 RMS V AC
Maximum tolerated input voltage	256 RMS V AC	456 RMS V AC
System maximum current rating	48 Amps (per PDU cord)	32 Amps (per PDU cord)
Wall breaker rating (3 ph)1	60 - 63 Amps	30 - 32 Amps
Steady-state input frequencies	50 ± 3 or 60 ± 3.0 Hz	50 ± 3 or 60 ± 3.0 Hz
PLD input frequencies (<10 seconds)	50 ± 3 or 60 ± 3.0 Hz	50 ± 3 or 60 ± 3.0 Hz

Power consumption and environmental information

When planning the power requirements, consider the power consumption and other environmental points of the DS8910F.

Table 3-4 lists the DS8910F power consumption and environmental information.

Table 3-4   DS8910F power consumption and environmental information

Measurement	Unit of measure	Value
Peak electric power	Kilowatt (kW)	2.2 kW
Thermal load	British thermal units (BTU) per hour	7464
Capacity of exhaust	Cubic meters per minute (cubic feet per minute or CFM)	44.2 (1500)
Ground leakage current	Milliamperes (mA)	< 21
Temperature	Celsius (Fahrenheit)	16°C to 32°C (60°F to 90°F)
Relative humidity	Percent	20% - 80%
Declared operating A-weighted sound power level	Bels	7.9

3.1.3 Planning for host connectivity

The DS8910F host connectivity is provided by up to four pairs of 16 Gbps or 32 Gbps (gigabit Fibre Channel (GFC)) Encryption of Data In Flight (EDiF) Fibre Channel (FC) host adapters (HAs). The new 32 GFC adapter features hardware (application-specific integrated circuit (ASIC)) EDiF to enable IBM FC Endpoint Security. Table 3-5 lists the feature codes for the DS8910F HAs.

Table 3-5   Feature codes for D8910F Fibre Channel host adapters

Feature Code[a], [b]	Description	Receptacle type
3354	4-port, 16 Gbps shortwave FCP, and FICON host adapter Minimum quantity is 2	LC
3454	4-port, 16 Gbps longwave FCP, and FICON host adapter Minimum quantity is 2	LC
3355	4-port, 32 Gbps longwave FCP, and FICON host adapter, PCIe	LC
3455	4-port, 32 Gbps shortwave FCP, and FICON host adapter, PCIe	LC

a. Longwave and shortwave host adapter intermix is supported if a pair of each is ordered only.
b. The 16 Gbps or 32 Gbps adapter does not support arbitrated loop topology at any speed.

For more information about DS8910F host adapters, see Chapter 2, "IBM DS8910F hardware configuration" on page 7.

To connect the hosts to the DS8910F, FC (SCSI-FCP or FICON) cables must be provided. To connect FC host adapters to a server or fabric port, provide the following cables:

► For shortwave FC host adapters, provide a 50-μm, multimode OM3 or higher fiber optic cable that ends in an LC connector.

► For longwave FC host adapters, provide a 9-μm, single-mode OS1 or higher fiber optic cable that ends in an LC connector.

Table 3-6 lists the FC cables that are available for order from IBM for the DS8910F.

Table 3-6   Feature codes for Fibre Channel cables for the DS8910F

Feature code	Cable type	Cable length	Compatible FC host adapter features
1410	50 μm OM3 or higher FC cable, multimode	40 m (131 ft) LC	Shortwave FC or FICON host adapter (Feature Codes 3353 and 3455)
1411		31 m (102 ft) LC/SC	
1412		2 m (6.5 ft) LC/SC	
1413		3 m (10 ft) LC	
1420	9 μm OS1 or higher FC cable, single mode	31 m (102 ft) LC	Longwave FC or FICON adapter (Feature Codes 3453 and 3355)
1421		31 m (102 f) LC/SC	
1422		2 m (6.5 ft) LC/SC	
1423		3 m (10 ft) LC	

Feature Codes 1413 and 1423 Fibre Channel cables

These cables are short and available for all DS8900 models. The four short cable features are relevant to the DS8910F when integrated into the same rack as the host, such as in the case of the integration into the z15 model T02, LinuxONE III model LT2, IBM z14 model ZR1, or LinuxONE II model LR1.

For more information about host adapter and FC cable features, see the *DS8910F Introduction and Planning Guide*, SC27-9560.

Note: When integrated into IBM Z system rack, it is expected that this system is the host system that connects to the DS8910F.

However, this connection does not exclude the connectivity to other IBM System z® or distributed systems that are outside of this rack.

Also, the DS8910F supports connectivity to other DS8000 systems with Copy Services.

3.1.4 Planning external connectivity

The DS8910F provides external connectivity for the following components:

► Keyboard and monitor to each Hardware Management Console (HMC):

    – ~900 mm (3 feet) of video cable to each HMC is available for a monitor.

    – ~900 mm (3 feet) of USB cable to each HMC is available for a keyboard/mouse function.

> **Note:** A keyboard/mouse and monitor are required for DS8910F installation and service.
>
> A storage KVM is included with the DS8910F with an integration option into a z15 model T02 or LinuxONE III model LT2 rack.
>
> An optional display Feature Code 1765 can be ordered for a customer rack-integrated DS8910F.
>
> When integrated in the IBM z14 model ZR1 or LinuxONE II model LR1 rack, the IBM Z human interface console is shared through the IBM Z KVM switch.

► Ethernet connectivity:

    – ~900 mm (3 feet) of Ethernet cables are provided for remote connectivity to the customer networks.

    – Two Ethernet cables are available to each HMC.

For more information about keyboard and monitor options for connecting to a z15 model T02 and LinuxONE III model LT2 or IBM z14 model ZR1 and LinuxONE II model LR1, see 3.2, "Integrating the DS8910F into IBM Z entry models" on page 37.

For more information about keyboard and monitor options for connection to other standard 19-inch wide rack, see 3.3, "Integrating the DS8910F into a standard 19-inch rack" on page 45.

3.1.5 Planning for safety and service

The DS8910F requires two service representatives to install the modules into the designated rack. The DS8910F can be installed in 15U of contiguous space at any height in the rack. However, because of the weight of the components and accessibility requirements for service, consider the position where the DS8910F is installed in the rack.

Ensure that an approved safety appliance is available for installation and service. Table 3-7 lists the safety equipment that can be ordered with the DS8910F.

Table 3-7   Optional safety equipment

Feature code	Description
1101	5 ft. ladder for servicing components at a height of 35U or more
1102	3 ft. platform ladder for servicing components at a height of 20U or more
1103	Rolling step stool

3.2 Integrating the DS8910F into IBM Z entry models

This section describes the integration of the DS8910F model 993 into an entry model IBM Z in an industry-standard frame form factor.

3.2.1 z15 model T02 and LinuxONE III model LT2

The z15 machine type 8562 is at the time of writing the newest entry model into the IBM Z family of servers. It delivers a single frame-efficient design with a lower cost of entry that can easily coexist with other platforms in a cloud data center.

The z15 model T02 or LinuxONE III model LT2 is delivered in a 19-inch frame with a lower cost of entry, and enables you to increase efficiency with a smaller footprint that easily fits into common data center layouts. The footprint is one tile wide and two floor tiles deep, and supports operating conditions that are defined in Thermal Guidelines for Data Processing Environments, Fourth Edition.

16U Reserved Space (Feature Code 0151) reserves EIA locations A23 - A38. This feature is available with the z15 model T02 and IBM LinuxONE III model LT2. The reserved space is available for integration of the IBM DS8910F Storage Model 993 only. Using this space for any other purpose is not permitted. Figure 3-2 shows the z15 model T02 or LinuxONE III model LT2 rack with the 16U reserved space.
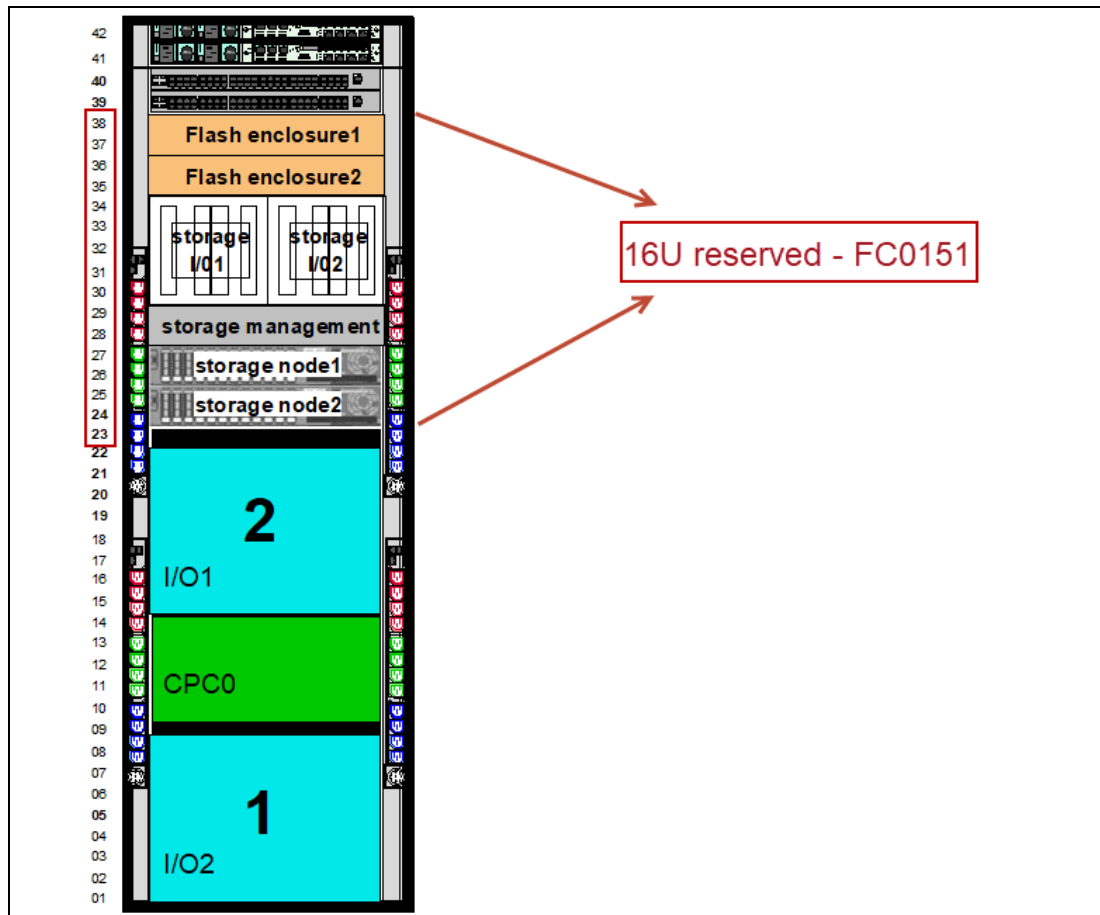

Figure 3-2   z15 model T02 or LinuxONE III LT2 Feature Code 0151 (16U reserved space)

Feature Code 0151 provides the following hardware prerequisites from the z15 perspective (the hardware is preinstalled when ordering this feature code as part of a new build):

► Limits the hardware in the z15 to:
  – One CPC cage.
  – No more than two I/O cages.
  – Single-phase power only.
► Provides the second PDU pair:
  – A second PDU is installed (A3 and A4).
  – A second PDU pair is required for the DS8910F and the second I/O cage.
► Provides the rack enclosure FC cable management system.
► Provides five weight ballast and air flow fillers.

3.2.2 Integrating DS8910F into z15 model T02 or LinuxONE III model LT2

When ordering the DS8910F Model 993 for integration into an existing z15 model T02 or LinuxONE III model LT2, the correct DS8910F field merge feature must be ordered:

► For an existing z15 model T02: Feature Code 0937
► For an existing IBM LinuxONE III model LT2: Feature Code 0938

Feature Codes 0937 or 0938 are used as indicator feature codes, and more feature codes are required to provide the parts that are needed for the integration. The following billable feature codes are required for field integration of the DS8910F Model 993 order:

► Feature Code 0611- z15 model T02 field integration
► Feature Code 0621- IBM LinuxONE III model LT2 field integration

All internal and inter-module cables that are required for the DS8910F are included in the shipping group. Cables must be routed along the spine cable management hardware through the cable clips or along the sides of the rack to ensure proper airflow.

Two IBM service representatives are required to install the DS8910F into the z15 rack. The first z15 machine type 8562 that is installed at your site should be provided with a lift tool that can be used for field integration.

The DS8910F modules and the 1U storage KVM are integrated into 16U contiguous space of the z15 model T02 or LinuxONE III model LT2 rack (A23-A38).

The components must be installed in the specified order that is shown in Figure 3-3.
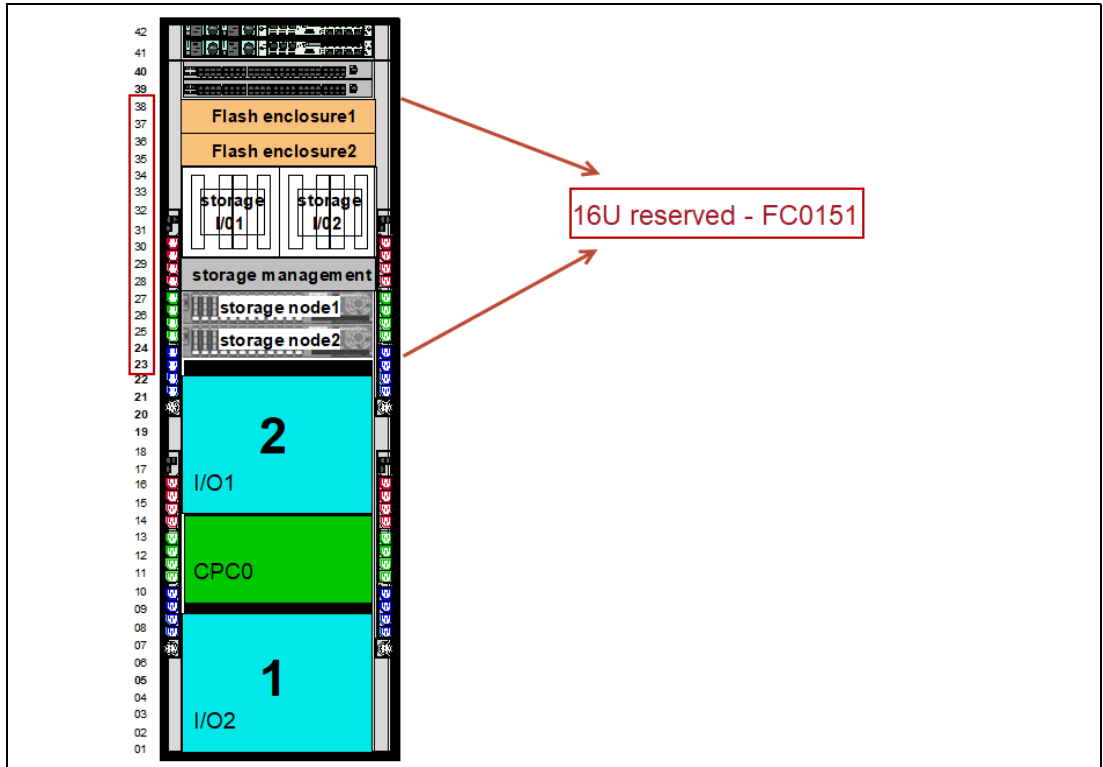

Figure 3-3   Block diagram of z15 model T02 and LinuxONE III LT2: 16U reserved space and DS8910F modules

DS8910F includes the C20 - C13 power cables that are needed to attach to the top two PDUs (A3 and A4). The storage KVM power is connected to port 8 of PDU A2, as shown in Figure 3-4.

> **Note:** Power cords that are plugged into the IBM Z components cannot be unplugged or moved except during servicing. Failure to follow this warning might adversely impact the operation of the z15 machine type 8562, including a possible system outage.
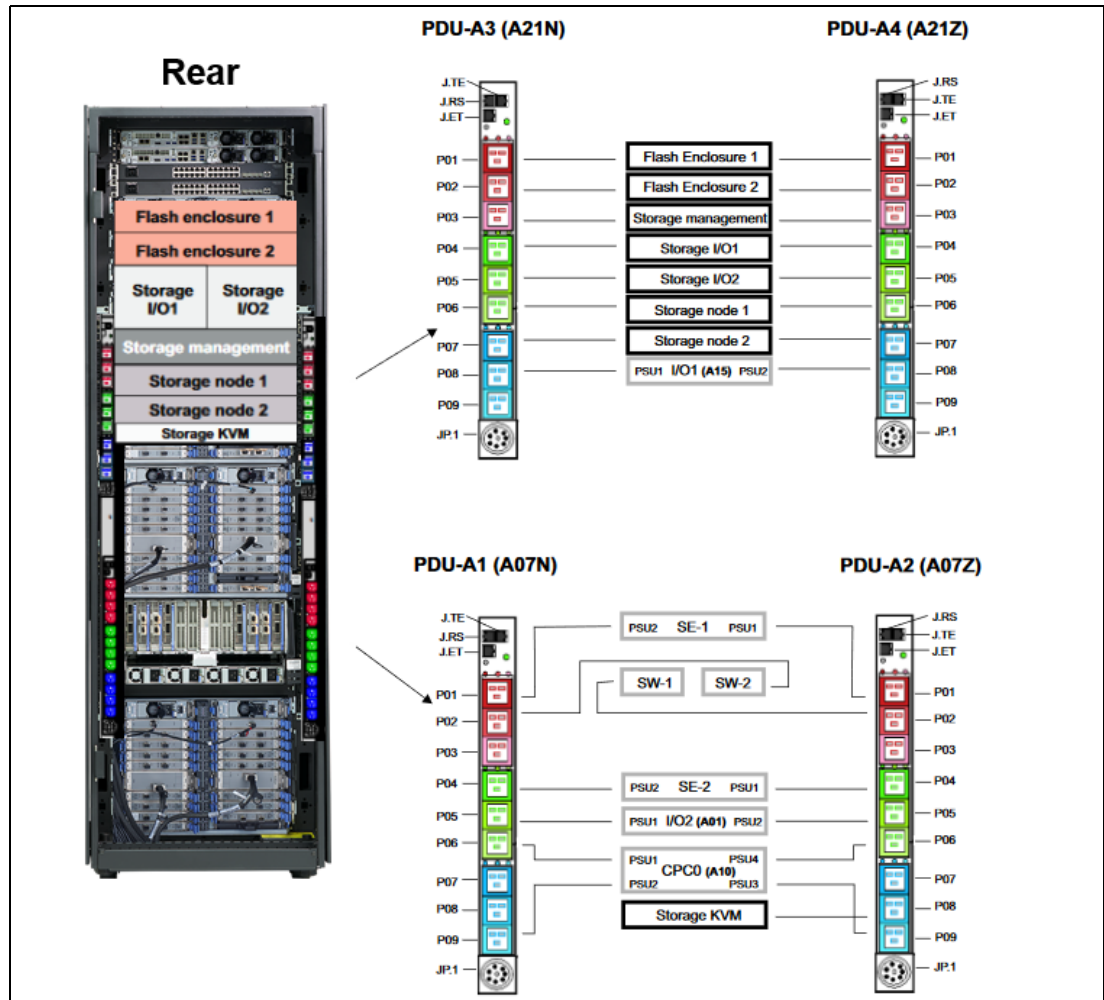
Figure 3-4   z15 model T02 and LinuxONE III LT2 field integration and power connections to DS8910F

3.2.3 IBM z14 Model ZR1 and LinuxONE II Model LR1

In April 2018, IBM announced a new model for the IBM z14 family with a lower cost and point of entry to extend the IBM Z to clients of all sizes.

The 19-inch rack design opened a new opportunity for IBM Z by enabling the integration of the DS8910F enterprise storage system into the IBM z14 model ZR1 or LinuxONE II model LR1 with 16U of reserved space.

Feature Code 0617, 16U reserved space, is required for integration of the DS8910F into the IBM z14 model ZR1 or LinuxONE II model LR1.

Feature Code 0617 provides the following hardware prerequisites from the IBM z14 perspective:

► Limits the hardware in the IBM z14 to:
  – One central processor complex (CPC) cage.
  – No more than two I/O cages.
  – Single-phase power only.
► Provides the second PDU pair:
  – A second PDU is installed as part of Feature Code 0617.
  – A second PDU pair is required for DS8910F and the second I/O cage.
► Provides the rack enclosure FC cable management system.
► Provides a set of weight ballast and air flow fillers.

Figure 3-5 shows a block diagram and the front view of an IBM z14 model ZR1 with Feature Code 0617.
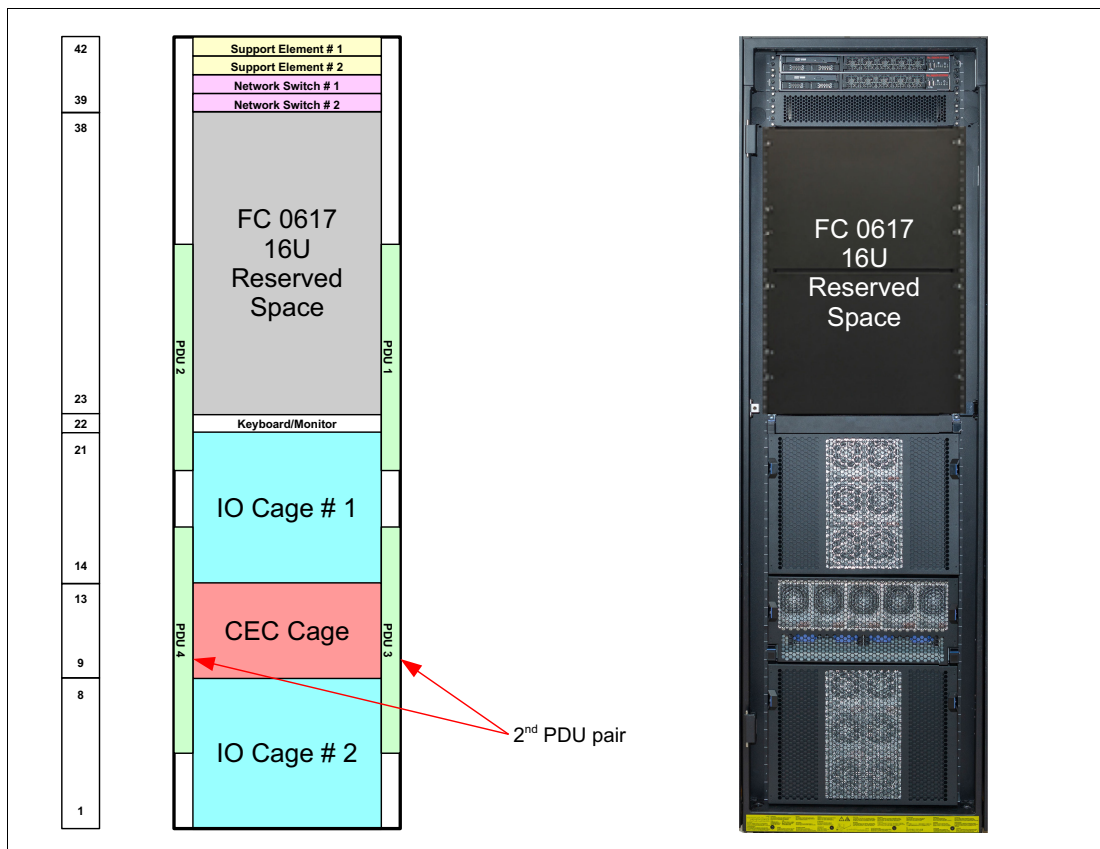
Figure 3-5   IBM z14 model ZR1/LinuxONE II model LR1: Feature Code 0617 16U reserved space

Figure 3-6 shows the IBM z14 rack enclosure FC cable management system. This configuration organizes and routes host FC cables from the IBM z14 model ZR1 or LinuxONE II model LR1 to the DS8910F.
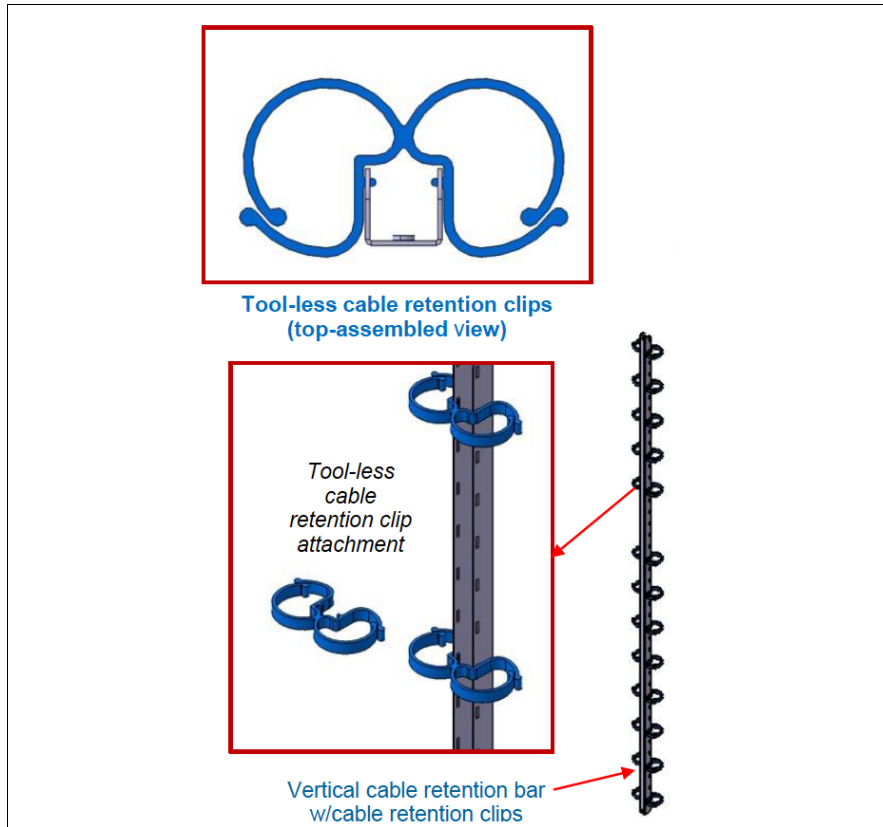

Figure 3-6   Feature Code 0617 provides the IBM z14 Fibre Channel cable management system

3.2.4 Integrating the DS8910F into the IBM z14 ZR1 or LinuxONE II LR1

The DS8910F modular system can be integrated into 16U contiguous space of an IBM z14 model ZR1 or LinuxONE II model LR1 with Feature Code 0617, 16U reserved space feature.

When ordering the DS8910F to be integrated into an existing IBM z14 model ZR1 or LinuxONE II model LR1, the correct DS8910F field merge feature must be ordered:

► An existing IBM z14 model ZR1: Feature Code 0937
► An existing IBM LinuxONE II model LR1: Feature Code 0938

Feature Codes 0937 or 0938 are used as indicator feature codes, and more feature codes are required to provide the parts that are needed for the integration. The following billable feature codes are required for field integration of a DS8910F Model 993 order:

► Feature Code 0610: IBM z14 model ZR1 field integration
► Feature Code 0620: IBM LinuxONE II model LR1 field integration

Feature Code 0610 or 0620 adds two KVM converter cables to the system components. These cables provide connectivity from each of the DS8910F HMC screens and USB cables to the IBM Z system KVM switch. These connections allow the DS8910F to share the IBM Z system keyboard and monitor.

These feature codes also prevent ordering Feature Code 1765 (optional 1U keyboard and display). Because IBM Z system provides a keyboard and monitor, no room is available to install Feature Code 1765.

All internal and inter-module cables that are required for the DS8910F are included with the DS8910F. The cables are organized and routed within the defined 16U of reserved space of the IBM Z system.

Two IBM service representatives are required to install the DS8910F into the IBM z14 system. The optional safety equipment that is described in 3.1.5, "Planning for safety and service" on page 36 is not required.

The first IBM z14 model ZR1 or LinuxONE II model LR1 (machine type 3907) that is installed at your site should be provided with a universal lift tool that can be used for the field integration.

Note: Using the service lift tool is allowed only for IBM service personnel.
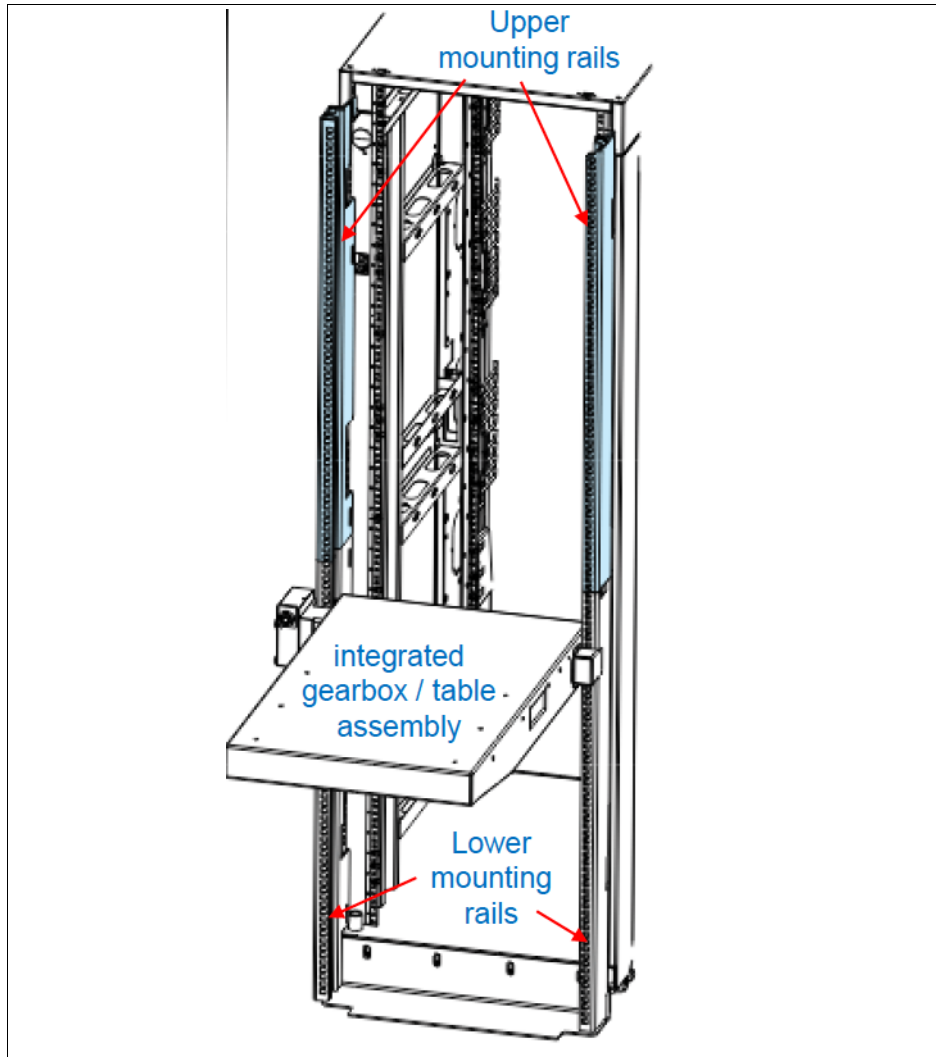

Figure 3-7   IBM 3907 service lift tool

The IBM z14 model ZR1 and LinuxONE II model LR1 systems have their power provided by the top two PDUs. These PDUs (A1 and A2) are independently powered from your facility power.

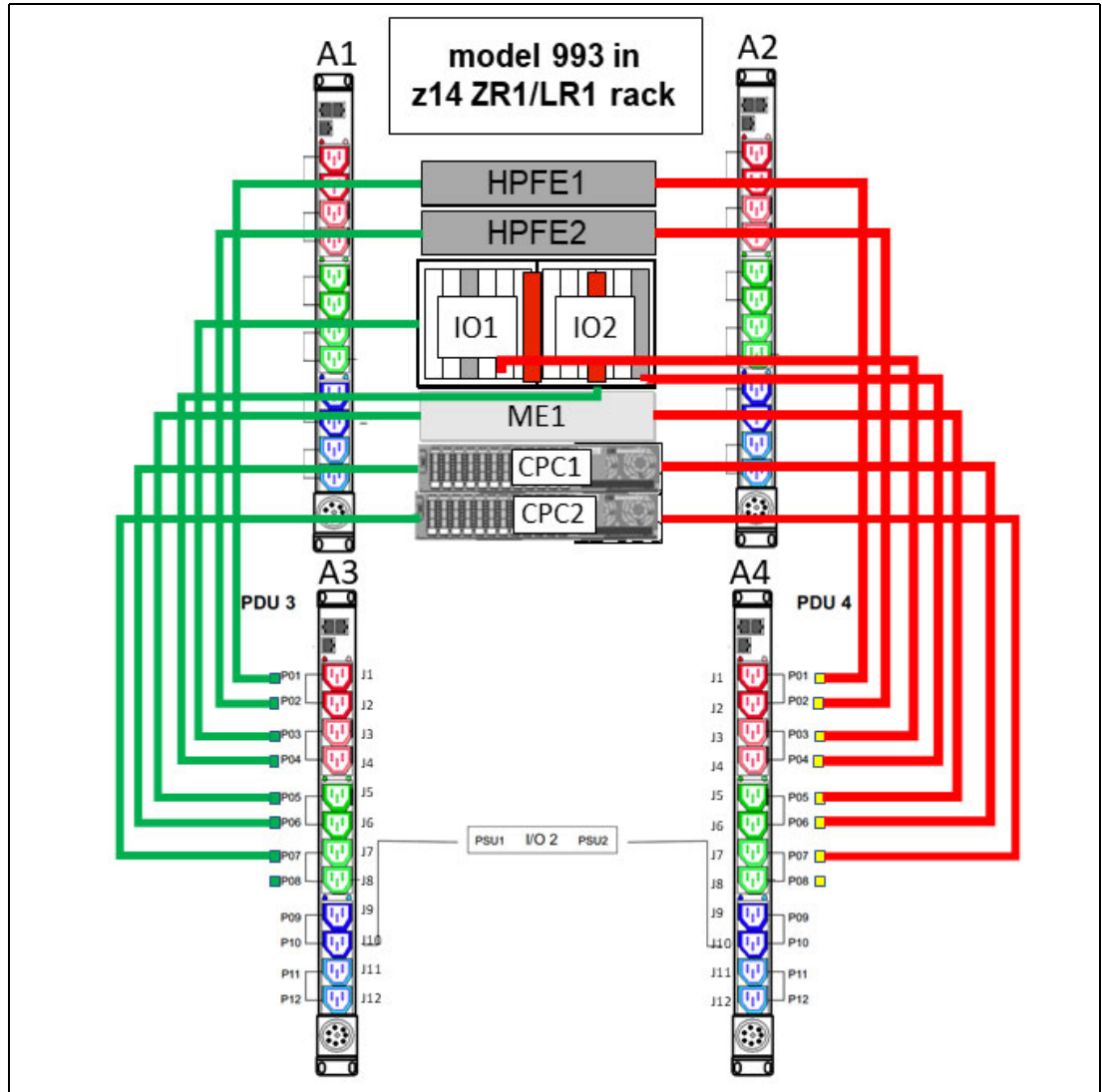DS8910F is powered by using the lower set of IBM Z iPDUs (A3 and A4), as shown in Figure 3-8.

Figure 3-8   DS8910F power connections to IBM Z iPDUs

Figure 3-9 shows a block diagram of the IBM z14 model ZR1 or LinuxONE II model LR1 with the 16U reserved space (Feature Code 0617). The DS8910F modules fit into this space, and the six modules must be installed in the order that is shown.
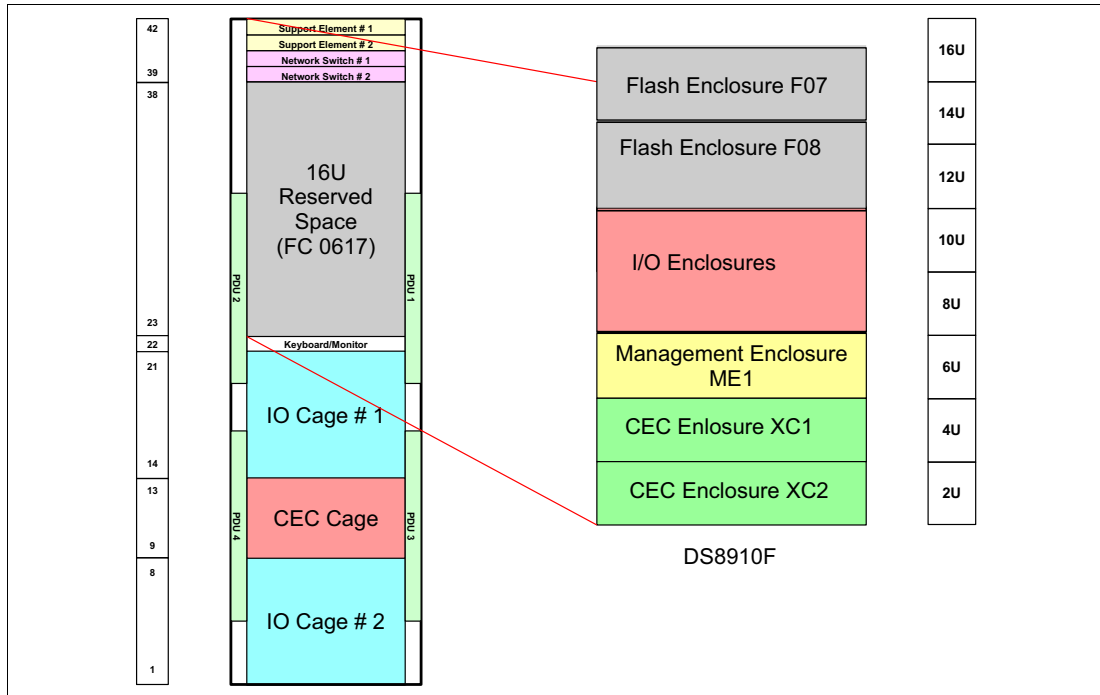

Figure 3-9   Block diagram of IBM z14 ZR1 or LinuxONE II LR1 16U reserved space and DS8910F modules

3.3 Integrating the DS8910F into a standard 19-inch rack

The DS8910F can be integrated into 15U contiguous space of a customer-supplied, standard 19-inch wide rack that conforms to EIA 310D specification.

When ordering the DS8910F to be integrated into a conforming standard 19-inch wide rack, the DS8910F field merge Feature Code 0939 must be ordered.

The standard 19-inch wide rack must conform to the following EIA 310D specifications:

► 19-inch EIA rails
► Minimum rail depth of 720 mm
► Maximum rail depth of 780 mm

The following configurations are available when integrating into the standard 19-inch wide rack:

► All six DS8910F modules are integrated into 15U contiguous space of the intended rack in the specified order. Figure 3-10 shows a block diagram that presents the DS8910F in a standard 19-inch rack. This configuration is the minimum configuration with one pair of HPFE. An optional 1U Display can be installed at 16U.
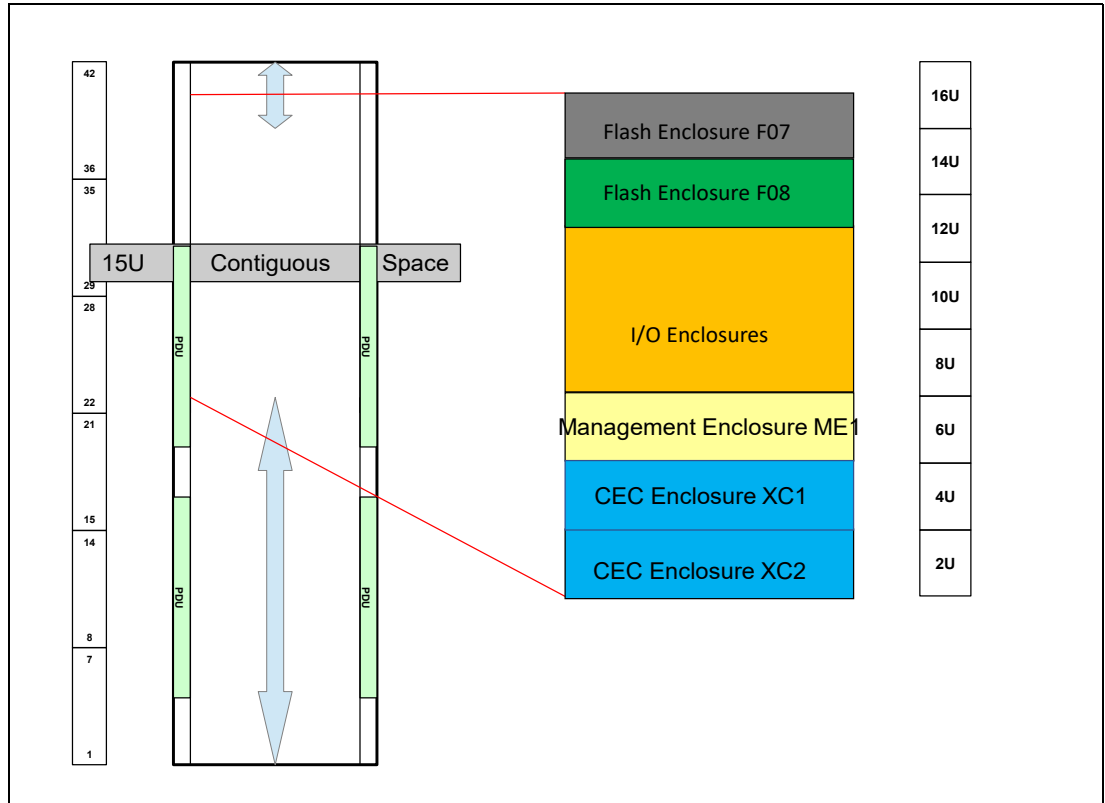

Figure 3-10   DS8910F in a standard 19-inch 15U space

► All eight DS8910F modules are integrated into 19U contiguous space of the intended rack in the specified order. This configuration is the maximum supported configuration with two pairs of HPFEs. The optional display Feature Code 1765 adds 1U to contiguous space. Figure 3-11 shows the maximum configuration when integrating DS8910F into the 19-inch wide standard rack.
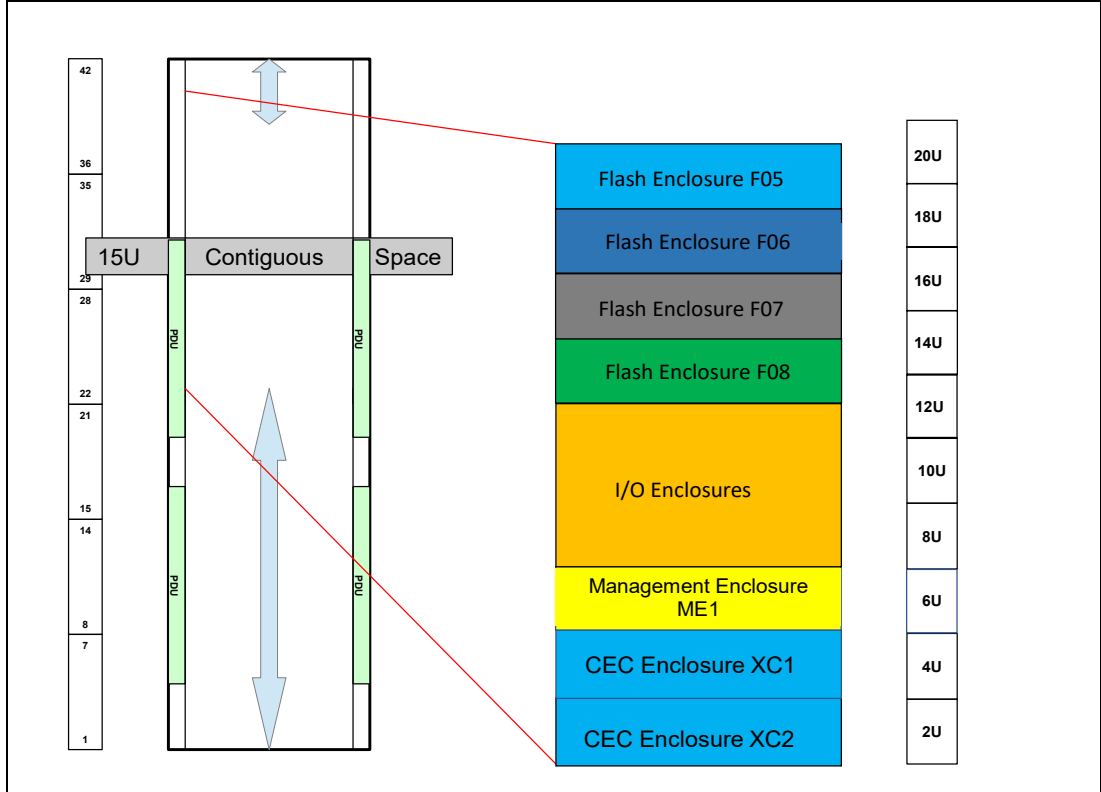

Figure 3-11   DS8910F in a standard 19-inch 19U space

3.3.1 Planning the installation into a conforming standard 19-inch rack

Note: A keyboard/mouse and monitor *must* be available to install and service the DS8910F.

The standard 19-inch wide rack installation (Feature Code 0939) supports an optional 1U keyboard and display (Feature Code 1765). The 15U contiguous space requirement does not include space for the optional keyboard and display, but they are not required to reside contiguously with the DS8910F.

For accessibility, the keyboard and display must be mounted at a height of 38 - 117 cm. (15 - 46 inches). If a keyboard and display is added, ensure that adequate space is provided to accommodate them. For Feature Code 1765, if no iPDU feature was ordered, customer PDUs will be used and one IEC C13 power connection is required. The model 993 power supplies do not include any power output connectors. You must make one available on the C13 power connection in the rack.

Note: Optional Feature Code 1765 (1U keyboard and display) cannot be added between modules of the DS8910F in the 15U of contiguous space.

Alternatively, the customer can provide their own keyboard and display solution. The video connection should be an SVGA connector. The USB connection should support keyboard and mouse functions. For more information, see 3.1.4, "Planning external connectivity" on page 36.

When the DS8910F is integrated into a conforming standard 19-inch wide rack, host connectivity can be to following components:

► Any supported distributed systems that are inside or outside the same rack
► IBM Z hosts
► Other DS8000 systems through Copy Services

For more information about supported host connectivity, see the *DS8910F Introduction and Planning Guide*, SC27-9560.

The DS8910F requires two service representatives to install into the designated rack. Although the DS8910F can be installed in 15U or 19U of contiguous space at any height in the rack, consider the position in the rack where it is installed because of the weight of the components and accessibility for service.

Ensure that an approved safety appliance is available for installation and service. Table 3-7 on page 36 lists the safety equipment that can be ordered with the DS8910F.
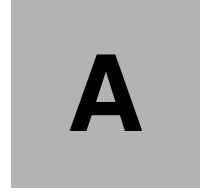
Remote Code Load

For the DS8910F and other DS8900 models, IBM is adopting Remote Code Load (RCL) as the default delivery and installation of microcode upgrades.

This appendix describes the process.

Overview

With RCL, IBM provides an efficient and secure method to update the DS8000 systems microcode in a concurrent way without interrupting business operations.

> **Important:** IBM is adopting RCL as the default delivery for DS8000 code upgrades.

RCL is the trusted process of having IBM support personnel securely connect to a DS8000 system, enable the remote acquisition, perform the distribution and activation of Licensed Internal Code (LIC) bundles, and Install Corrective Service (ICS) images.

The RCL process is concurrent; that is, it can be run without interruptions in the business operations. This process consists of the following steps, as shown in Figure A-1:

1. IBM Remote Support work with IBM Technical Advisors for the planning of the microcode update. This process ensures that the client's environment is considered in the planning phase.

2. When an RCL is agreed upon and scheduled, an IBM trained resource in the support center starts a session with the target Hardware Management Console (HMC).

3. During the agreed upon window, IBM directs the HMC to acquire the code images from the FixCentral repository and prepare for code activation.

4. During the customer maintenance window, IBM starts the activation request, which moves the HMCs and DS8000 to the new target microcode level.
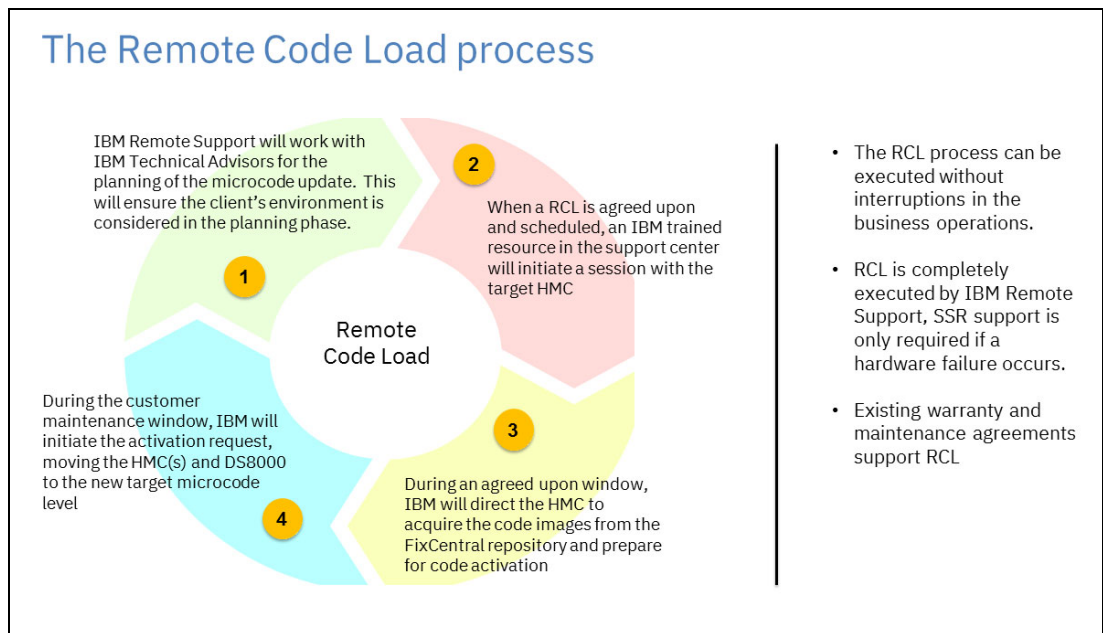

Figure A-1   Remote Code Load process

Related publications

The publications that are listed in this section are considered suitable for a more detailed description of the topics that are covered in this paper.

IBM Redbooks

The following IBM Redbooks publications provide more information about the topic in this document. Some publications that are referenced in this list might be available in softcopy only:

► *IBM DS8000 High-Performance Flash Enclosure Gen2 (DS8000 R9.0)*, REDP-5422
► *IBM DS8900F Architecture and Implementation*, SG24-8456
► *IBM DS8900F Product Guide*, REDP-5554
► *IBM Power Systems S922, S914, and S924 Technical Overview and Introduction*, REDP-5497

You can search for, view, download, or order these documents and other Redbooks, Redpapers, web docs, drafts, and other materials, at the following website:

ibm.com/redbooks

Other publications

The following publications are also relevant as further information sources:

► *Command-Line Interface User's Guide,* SC27-8526
► *DS8882F Introduction and Planning Guide*, GC27-9529
► *IBM 3907 Installation Manual for Physical Planning (IMPP)*, GC28-6974
► *IBM 8562 Installation Manual for Physical Planning (IMPP)*, GC28-7011
► *IBM DS8000 Host Systems Attachment Guide*, SC27-9563
► *IBM DS8900F Introduction and Planning Guide*, SC27-9560

Online resources

The DS8900F IBM Knowledge Center website also is relevant as a further information source:

https://www.ibm.com/support/knowledgecenter/SSHGBU_9.1.0/

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