

Technical Overview

FLEX-ES

Release 6.2.x

FLEX-ES,® the FLEXible Enterprise Solution from Fundamental Software, Inc., provides innovative solutions to the problems of bringing the stability of mainframe operating systems and applications into the flexibility of new Intel-based technology.

This document provides a general technical introduction to FLEX-ES, highlighting its concepts, features, and capabilities.

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1. The FLEX-ES Concept:

A Mainframe in Software

FLEX-ES implements z/Architecture® in software.

In 1964, IBM pioneered the separation of a computer's architecture from its implementation with the introduction of System/360. By defining the machine's logical architecture as independent of the technology of its implementation, IBM enabled the same machine to be implemented using a variety of different technologies. Since then, this architecture has evolved from System/360 through System/370,™ 370-XA, ESA/370,™ ESA/390™ (System/390®), to today's 64-bit z/Architecture.® This well-proven family of computer architectures remains a significant force in the business world in part because its implementations have always kept pace with the latest technologies. FLEX-ES from Fundamental Software, Inc. employs one of the latest of these technologies: software implementation.

Traditional mainframe manufacturers such as IBM implement this architecture using hardware technologies. Fundamental Software has taken a different route. Instead of implementing z/Architecture in hardware, the FLEX-ES mainframe implements it in software². The FLEX-ES software mainframe runs as an application program on modern Intel® Pentium® processor series servers running the UNIX® or Linux® operating system. It provides full-featured uniprocessor and multiprocessor 31-bit and 64-bit mainframe CPU complexes, along with a wide range of emulated devices and the capability to attach to physical peripherals.

A mainframe operating system such as VSE/ESA,[®] z/OS,[™] z/VM,[™] or Linux[®]/390 runs "on top" of FLEX-ES. Mainframe applications in turn run on top of the mainframe operating system. Because FLEX-ES is an implementation of the machine architecture itself, these mainframe operating systems and applications run with no modification. From the point of view of the mainframe software, FLEX-ES is logically indistinguishable from a traditional hardware mainframe.

2. FLEX-ES Capabilities

FLEX-ES is a Plug-Compatible Mainframe.

FLEX-ES is a true Plug-Compatible Mainframe (PCM) which may be configured as a drop-in replacement for many existing mainframe installations. However, FLEX-ES goes beyond conventional plug compatibility. This product provides a level of configurability and a diversity of device support which make it the Flexible Enterprise Solution. The capabilities FLEX-ES provides include:

- Uniprocessor or multiprocessor 64-bit¹ or 31-bit z/Architecture, ESA/390, System/370, or ECPS:VSE mainframe CPU complexes
- A wide range of peripheral devices implemented in software, including:
 - Emulated CKD and ECKD DASD (3390, 3380, and many earlier DASD)
 - Emulated FBA DASD (3370, 3310, 9332, 9335, ...)
 - Emulated tape (FSI "FakeTape,"[™] IBM "AWSTAPE," IBM OMA/2 "tape")
 - Emulated printers
 - Emulated 3270 terminals over TCP/IP (TN3270) networks
 - Emulated ASCII (TWX) terminals
 - Emulated 3172 (Ethernet, Token Ring) controllers for TCP/IP
 - Emulated XCA and OSA (Ethernet[™], Token Ring) controllers for TCP/IP and SNA
 - Emulated Ceti (Ethernet, Token Ring) controllers for TCP/IP and SNA
 - Emulated CTCA
- The FLEX-ES Parallel Channel Adapter (PCA) which supports the channel-attachment of traditional mainframe peripherals, including tape drives, printers and high-speed printers, communications controllers, and CTCAs.
- The FLEX-ES Integrated Communications Adapter (ICA) which supports binary synchronous communication (BSC) lines and synchronous data link communication (SDLC) lines without the use of channel-attached communications controllers.
- SCSI-attached 9-track open reel and 3480/90/90-E compatible cartridge tape drives
- DAT or DLT cartridge tape on the host server as mainframe tape drives

At the present time, FLEX-ES does not include support for certain capabilities, including the following:

- ESCON
- DASD on FSI PCA channels
- Parallel Sysplex

Mainframe Multiprocessing

When run on a multiprocessor host server, FLEX-ES can provide a multiprocessor (MP) emulated mainframe CPU complexes up to the limits defined by the z/Architecture.¹ Because

the emulated mainframe is a processor-intensive application, there is a required one-to-one correspondence between CPUs in an emulated CPU complex and server processors. To enhance performance, it is possible to configure an emulated CPU complex (an "Instance") to bind individual mainframe processors to individual Intel processors on the host server so that they have the exclusive use of that host processor.

Mainframe and Open System Coexistence

In addition, because *FLEX-ES* runs as a user-level application program on the host server, all of the resources on the host server are available simultaneously with the *FLEX-ES* mainframe; UNIX/Linux and mainframe applications can coexist on the same server. Communication between mainframe applications and UNIX/Linux applications is possible using either emulated card decks (written to server disk files) or *FLEX-ES* FakeTape™ emulated tape. Using the FakeTape™ Programming Library, UNIX/Linux applications can be developed which can create, read, and write emulated mainframe tape.

Multiple Mainframes on a Single Server

Multiple "Instances" of *FLEX-ES* may run simultaneously on the same server³, just as multiple instances of any UNIX/Linux application program can run on a single server. Each Instance of *FLEX-ES* is, logically, a completely separate mainframe computer. A separate mainframe operating system runs on top of each Instance. (Note that multiple simultaneous Instances may require multiple mainframe operating system and application licenses, as required by the customer's licensing agreements with IBM and other vendors.)

This capability is different from the Logical Partitions (LPARs) provided by IBM PR/SM. *FLEX-ES* does not implement PR/SM or provide LPARs. However, the ability to run multiple Instances simultaneously (and thus multiple mainframe OSs) addresses many of the same needs addressed by LPARs.

This capability is also different from the capabilities provided by VM, although in practice it may be used to the same end. VM, IBM's "Virtual Machine" operating system, takes the resources of a mainframe CPU complex and "virtualizes" them so that they appear to be several machines. One instance of VM, running on a machine of a particular architecture, provides multiple virtual copies of that same machine architecture. By contrast, *FLEX-ES* provides a machine of one architecture (z/Architecture, etc.) on top of a machine of a different architecture (an IA-32 server). Running multiple instances of *FLEX-ES* provides multiple separate mainframes which happen to reside on the same physical server. *FLEX-ES* does not "virtualize" the System/390 machine in the same way that VM does. Nevertheless, *FLEX-ES* can provide multiple mainframes on the same server, each running its own mainframe operating system. When the primary purpose of VM is to provide multiple mainframes, multiple instances of *FLEX-ES* can provide equivalent functionality through different means.

3. Architectural and OS Support

Architectural Support

FLEX-ES supports IBM's z/Architecture® in both 31-bit and 64-bit¹ modes. 64-bit z/Architecture support became available in release 6.2.

Separate operating modes are provided for support of legacy and other systems which must operate in ESA/390 ("System/390"; including ESA/370 and 370-XA), System/370, or ECPS:VSE modes.

FLEX-ES supports all current and most older IBM operating systems in 64-bit or 31-bit mode, as appropriate for the operating system release. Supported OSs include:

VSE	All releases of the VSE family of operating systems, from DOS through DOS/VSE to VSE/ESA® 2.7.
OS	All releases of the OS family of operating systems, from OS/360, through MVS and OS/390,® to z/OS™ 1.4 in 64-bit mode.
VM	All releases of the VM operating system to z/VM™ 4.4 in 64-bit mode.
Linux/390	IBM's port of the Linux® kernel to System/390.
DPPX/370	

In addition, **FLEX-ES** supports mainframe operating systems from other vendors, including:

UTS All releases of the Amdahl® UTS® mainframe UNIX® operating system.

MTS

FLEX-ES supports all system services and applications which run under these mainframe operating systems, except those which require specific features or facilities not implemented by **FLEX-ES** (such as hardware cryptographic facilities, for example).

It is important to remember that **FLEX-ES** supports operating system and application software by providing a mainframe computer on which these systems and applications run. **FLEX-ES** itself does not implement any part of these mainframe programs. They run without modification on the **FLEX-ES** mainframe system itself.

It is the customer's responsibility to obtain all IBM and third party operating system and application licenses at the appropriate performance or other rating for the **FLEX-ES** system(s) they have installed.

4. Device Support

FLEX-ES supports a wide range of physical and virtual peripheral devices in several ways:

- As emulated devices
- As channel-attached peripherals through the **FLEX-ES** Parallel Channel Adapter (PCA)
- As SCSI-attached physical devices
- Through the **FLEX-ES** Integrated Communications Adapter (ICA)

Emulated Devices

FLEX-ES provides a wide range of emulated devices, including emulated tape drives, printers, card equipment, communications controllers for TCP/IP and SNA, 3270 and ASCII (TWX) terminals, and virtually all CKD, ECKD, and FBA DASD. These emulated devices are implemented in software. When necessary, they take advantage of hardware and system services provided by the host server and its network. For example, emulated DASD use the disk resources of the host server. Emulated terminals use the network services provided by the host.

Emulated devices may provide significant economic and operational advantages over physical peripherals. Because they are built out of software, they can be created and reconfigured as necessary to build or match any configuration⁴. Emulated 3270 terminal networks may take advantage of new or existing TCP/IP intranets to replace dedicated 3270 networks. Emulated CKD, ECKD, and FBA DASD using disks on the server are faster and less expensive than traditional mainframe DASD.

The FLEX-ES Parallel Channel Adapter (FSI PCA)

The FLEX-ES Parallel Channel Adapter provides parallel channel ("bus and tag") peripheral connectivity. It is available in versions which provide either one channel or three channels per card. It supports most peripherals, including all tape drives, many printers (including Xerox, Siemens, and IBM 38XX laser printers), and many communications controllers. It does not support DASD. It supports operation in both DC Interlocked mode and in Data Streaming mode. In Data Streaming mode it supports transfer rates of both 3.0 and 4.5 Megabytes/second. Each PCA card comes with a custom cable which adapts the card connector appropriately to one or three pairs of bus and tag cable ends.

SCSI-Attached Physical Devices

FLEX-ES supports certain Fundamental Software certified SCSI-attached physical 9-track tape drives as if they were 3420 series tape drives, and certain SCSI-attached 3480, 3490, and 3490-E compatible cartridge tape drives as if they were 3480, 3490, or 3490-E tape drives. Tapes written with SCSI-attached 3420 9-track tape drives are physically compatible with traditional mainframe 9-track tape drives (open reel round tape). Tapes written with SCSI-attached 3480/90/90-E compatible tape drives are physically compatible with traditional mainframe 3480/90/90-E and compatible tape drives (mainframe cartridge "square" tape).

FLEX-ES also supports modern cartridge tape drives on its host server (e.g., DAT or DLT) as if they were any model tape drive supported by FLEX-ES (3420, 3422, 3430, 3480, 3490, 3490-E) The tapes for these drives are not, of course, physically interchangeable with conventional mainframe tapes, but in situations where such interchangeability is not required they can provide significant cost and space advantages.

The FLEX-ES Integrated Communications Adapter (FSI ICA)

The FLEX-ES Integrated Communications Adapter (ICA) is an optional card which provides six communications lines which may be configured as either binary synchronous communication (BSC) lines or synchronous data link communications (SDLC) lines, in any combination.

Taken together, these four methods provide an extremely wide range of supported peripheral devices.

There is some overlap between the support provided by these methods. For example, 9-track tape is supported by emulated devices (FakeTape[™]), SCSI-attached 9-track devices, SCSI-attached cartridge devices (DAT, DLT), and channel-attached peripherals.

Because of the extensive, overlapping device support provided by these methods, is it easiest to consider devices by category and to examine the options for providing devices within each category.

DASD

FLEX-ES supports virtually all mainframe CKD, ECKD, and FBA DASD as emulated devices:

CKD and ECKD DASD:

- 2305 Model 2
- 2314
- 3330 Model I
- 3330 Model II
- 3340-35
- 3340-70
- 3350
- 3375
- 3380 Models A, D, J, E, K
- 3390 Models 1, 2, 3, 9
- 6280
- 9345 Model 1
- 9345 Model 2

FBA DASD:

- 3310
- 3370 Model 1
- 3370 Model 2
- 9332 Model 200
- 9332 Model 400
- 9332 Model 600
- 9335
- 9336 Model 1
- 9336 Model 2

Emulated DASD are implemented in software on a host server and employ the physical disks attached to the server. In a typical installation, these disks might be provided in a RAID array. FLEX-ES is not tied to any particular server disk technology.

Emulated DASD are both fast and very economical by comparison to traditional physical DASD. All emulated DASD, whatever the model being emulated, operate as fast as possible given the installation. Thus, an emulated 2305 and an emulated 3390 both operate at the same speed. Typically, these speeds greatly exceed the speeds of traditional physical mainframe DASD. All emulated DASD implement a cache. For CKD emulated DASD, this cache may be specified in the configuration as either write-back or write-through.

Emulated DASD implement all of the blocks, tracks, or cylinders of the equivalent physical DASD, including those not generally visible to users, such as alternate, Customer Engineering (CE) and Selective Availability (SA) blocks, tracks, or cylinders.

Emulated DASD support shared disk access. This allows any emulated DASD to be connected to up to 32 FLEX-ES emulated channel paths (with a maximum of one channel path per channel subsystem per DASD).

FLEX-ES looks at emulated DASD from the logical point of view rather than a physical one. For example, a physical 3380-A DASD contained two Head/Disk Assemblies (HDAs), each of which contained two access mechanisms. However, from a logical point of view each of these access mechanisms was accessible as a distinct device. Therefore, a FLEX-ES "3380A" emulated DASD corresponds in size to a single access mechanism on a physical 3380-A, because this is the logically addressable unit.

Fundamental Software defines a "Megabyte" as 1,024 kilobytes, or 1,048,576 bytes. Other manufacturers, including IBM, sometimes define a Megabyte as one million bytes. This, combined with the fact that the size of a FLEX-ES emulated DASD is calculated to include all alternate, CE, and SA blocks, tracks, and cylinders, and the fact that certain roundings occur during FLEX-ES emulated DASD size calculation, may cause the calculated size of a FLEX-ES emulated DASD to appear to be different than the size of the equivalent physical DASD.

As noted, emulated DASD use the physical disks provided by the host server. Space permitting, multiple emulated DASD may reside on a single real (or virtualized RAID) disk on the host. For example, one could configure a system so that a single 4 gigabyte disk on the host provided storage for 6 emulated 3380-A DASD. These DASD occupy 608 Megabytes each, for a total of 3648 Megabytes; this leaves 448 Megabytes on this disk left for other purposes, including smaller emulated DASD or space in the server filesystem.

Individual CKD emulated DASD may also be split over up to five server physical or logical disks. While this capability is less important with today's large RAID subsystems, in certain situations it can be advantageous.

Tape

FLEX-ES provides support for tape in several different ways:

- Channel-attached peripherals
- FakeTape™ emulated tape
- SCSI-attached compatible drives (9-track and 3480/90/90-E)
- SCSI-attached cartridge tape (DAT/DDS, DLT)
- Emulated IBM AWSTAPE and OMA/2 "tape"

Channel-Attached Mainframe Tape Drives

The FLEX-ES Parallel Channel Adapter supports the channel attachment of IBM 3420-4, -6, and -8 (200 ips) and compatible tape drives, and of IBM 3480/3490/3490-E and compatible tape drives.

FakeTape™ Emulated Tape

FakeTape, FSI's emulated tape support, provides the ability to read and write emulated tapes to and from server disk files. To the mainframe operating system or application, a FLEX-ES FakeTape emulated tape drive is indistinguishable from a 3420 (-4, -6, -8), 3422, 3430 or 3480/3490/3490-E tape drive. From the server's point of view, a FakeTape tape is just a file on disk.

FakeTapes may be mounted and unmounted by an operator using FLEX-ES Command Line Interface (CLI) commands. Once unmounted, a FakeTape "tape" may be handled like any other file on the server; it may be copied, moved, written to another medium, or exchanged with another system.

The FLEX-ES **FakeTape Programming Library**, standard on supported server operating systems, provides the ability to manipulate FakeTape tapes (files) from server-side application programs. It is possible therefore to build applications on the server which can read, write, and create FakeTapes. Several standalone server-side FakeTape utility programs are also supplied. This makes FakeTape a powerful medium for data exchange between server-side and mainframe-side applications.

FLEX-ES FakeTapes written from any FakeTape emulated tape "drive" may be read on any other FakeTape drive. They are completely interchangeable with each other. For example, a FakeTape written from an emulated 3420 drive may be read on an emulated 3490-E drive.

SCSI-Attached Cartridge Tape (DAT/DDS, DLT)

FLEX-ES supports cartridge tape drives on the host server as if they were any tape drive type supported by FLEX-ES (3420, 3422, 3430, 3480, 3490, 3490-E). Server cartridge tapes, such as DAT (DDS) and DLT, are economical, high-capacity, and easy to handle. While a FLEX-ES tape written to a DAT or DLT cartridge is not physically interchangeable with a conventional 9-track or 3480 family cartridge tape, in situations where interchangeability is not necessary they can provide significant cost and operational advantages.

Technical Note: Physical 9-track tape is an open-reel medium where tapes may be of arbitrary length. These tapes therefore have an end of tape mark to signal the advent of the end of the physical tape. Cartridge tapes such as DAT or DLT have no such mark. However, cartridge tapes are always of known length. It is therefore possible for the tape driver to assure that the end of the tape is never passed; these cartridge tapes have no need for an end of tape marker.

SCSI-Attached Tape Drives

Certain models of SCSI-attached 9-track tape drives are certified by Fundamental Software for use with FLEX-ES. These drives may be configured to appear to FLEX-ES as if they were channel-attached 3420-4, -6, or -8 drives. The actual speed of the drive is, of course, determined by the tape drive hardware itself.

Certain SCSI-attached 3480/3490/3490-E compatible tape drives are certified by Fundamental Software for use with FLEX-ES. These drives may be configured to appear to FLEX-ES as if they were channel-attached 3480, 3490, or 3490-E drives.

AWSTAPE and OMA/2 Emulated Tape

The FLEX-ES FakeTape emulated tape drives support emulated tapes written in the IBM P/390 AWSTAPE format for both reading and writing. AWSTAPE format tapes are automatically detected. (A standalone program is provided to create a blank

AWSTAPE format tape so that new AWSTAPE format tapes can be created, written, and read.)

In a similar manner, emulated "tapes" written in the IBM Optical Media Attach/2 (OMA/2) format are supported. (The OMA/2 format is sometimes referred to as the "TDF" format after the Tape Descriptor File which organizes such a tape.) Only read support is provided.

Communications

FLEX-ES provides support for communications, terminal, and console devices in many ways:

- The FSI Integrated Communications Adapter (FSI ICA)
- The FSI Parallel Channel Adapter (FSI PCA) and traditional peripherals
- The emulation of 3172 Ethernet and Token Ring controllers
- The emulation of XCA and OSA Ethernet and Token Ring controllers
- The emulation of CETI Ethernet and Token Ring controllers
- The emulation of k200 Ethernet controllers
- The emulation of 3270 class terminal devices over TN3270
- The emulation of TWX (ASCII) devices
- The emulation of the 3215 console

ICA: Binary Synchronous Communication (BSC) Lines

ICA: Synchronous Data Link Communication (SDLC) Lines

The FLEX-ES Integrated Communications Adapter (ICA) provides binary synchronous communication (BSC) lines and synchronous data link communication (SDLC) lines with a combination of hardware and software support. This allows the attachment, usually through modems, of remote equipment such as 3174 remote terminal controllers and 2780/3780 class BSC-attached terminals.

The FSI ICA can support up to 6 BSC lines at up to 19.2 kpbs, and, depending upon application conditions, 3 or 4 SDLC lines at 56 kpbs.

The use of the FLEX-ES Integrated Communications Adapter (ICA) or of peripheral controllers attached via the FLEX-ES Parallel Channel Adapter (PCA) may be advantageous because it allows a FLEX-ES system to take advantage of existing terminal networks. This can eliminate conversion time, conversion cost, and the retraining of users.

Great variety exists in the devices attachable to BSC and SDLC lines. Please contact your FSI-authorized FLEX-ES reseller to discuss your situation.

PCA: 3705, 3725, 3745 Control Units

PCA: 3174 Control Units

PCA: 3274 Control Units

The FLEX-ES PCA supports 3705, 3725, and 3745 communications controllers running Network Control Program (NCP), EP (2701 Emulation Program), or PEP (2701 Partitioned Emulation Program).

It also supports all 3174 and 3274 communications controllers.

Please contact your FSI-authorized FLEX-ES reseller if you have other communications peripheral needs.

Emulated: 3172 Ethernet and Token Ring

FLEX-ES provides emulated control units and devices with functionality equivalent to the Ethernet® and Token Ring capabilities of an IBM 3172 Communications Controller. These emulated devices use the networking hardware of the host server (certain restrictions may apply in specific server environments).

Certain mainframe operating systems provide support for TCP/IP over 3172 Ethernet and Token Ring.

Emulated: XCA and OSA Ethernet and Token Ring Controller (Emulated)

FLEX-ES provides emulated control units and devices with functionality equivalent to a subset of the IBM OSA (Open System Adapter) functionality, including Token Ring, 10 Base-T Ethernet, and 100 Base-T Ethernet. Other OSA functionality, such as FDDI and ATM networking, is not supported.

FLEX-ES also provides emulated control units and devices with functionality equivalent to a subset of IBM XCA functionality (IBM External Communications Adapter; VTAM major node "TYPE=XCA").

These emulated devices use the networking hardware of the host server (certain restrictions may apply in specific server environments).

Certain mainframe operating systems provide support for TCP/IP and SNA over XCA and OSA Ethernet and Token Ring.

Emulated: CETI Ethernet and Token Ring

FLEX-ES provides emulated control units and devices with functionality equivalent to the CETI (Continuously Executing Transfer Interface) Ethernet and Token Ring (4 and 16 Megabit/second) control units integrated into certain traditional IBM mainframes. These emulated devices use the networking hardware of the host server (certain restrictions may apply in specific server environments).

Certain mainframe operating systems provide support for TCP/IP over CETI Ethernet and Token Ring. Certain mainframe operating systems provide support for SNA over CETI Token Ring.

Emulated: k200 Ethernet

FLEX-ES provides an emulated communications controller and device with functionality equivalent to a Spartacus Inc. / Fibronics Inc. K200 mainframe Ethernet controller. This emulated device uses the networking hardware of the host server (certain restrictions may apply in specific server environments).

Certain mainframe operating systems provide support for TCP/IP over K200 Ethernet.

Emulated: 3270 Terminals Over TN3270

FLEX-ES provides support for a number of 3270 series terminals, including the 3277, 3278, 3279, 3179, 3180, and 3287, by supporting the TN3270 and TN3270E protocols. TN3270 is a protocol in the TCP/IP suite of protocols which allows the transmission of 3270 data streams over TCP/IP networks (such as TCP/IP corporate

intranets or the Internet). The actual terminal emulation is provided by a "front end" 3270 terminal emulation program running on the user's machine in the TCP/IP network. FLEX-ES provides a 3270 terminal emulation program suitable for use with supported UNIX/Linux systems. Other compatible 3270 terminal emulation programs running in other environments (e.g., Windows®) may also be used.

The use of emulated terminals over TCP/IP networks may be advantageous because it allows easy configuration, reconfiguration, and expansion of terminal networks using TCP/IP networks. As TCP/IP inter- and intra-networks are increasingly common, this option allows hardwired 3270 terminal networks to be phased out in favor of virtual 3270 networks built on top of a modern network infrastructure.

Emulated: TWX (ASCII) Terminals

One way in which FLEX-ES can provide ASCII terminals is through the use of emulated TWX terminals. FLEX-ES implements as an emulated device the ASCII Telegraph Adapter Type II ("TWX") transmission adapter feature of the IBM 2701 Data Adapter Unit for use with Common-Carrier Teletypewriter Exchange ("TWX") Model 33 and Model 35 terminal equipment. This emulated device is provided in both TTY-style and X Window System environments.

Serial-Attached: TWX (ASCII) Terminals

In addition to emulated TWX terminals as described above, physical ASCII terminals may be attached using serial ports on the host server.

Modem-Attached: TWX (ASCII) Terminals

In addition to emulated TWX terminals as described above, physical ASCII terminals may be attached via modem to the host server.

Emulated: 3215 Console

FLEX-ES provides an emulated 3215 console. This console appears as a window on the screen of the host server.

Unit Record Equipment

FLEX-ES supports many emulated and physical printers, card readers, and card punches, as described below.

Card Equipment

The 2501 Card Reader and the 2540 Card Reader/Punch are fully supported both as emulated devices and as physical peripherals attached the FSI Parallel Channel Adapter (FSI PCA).

Printers

FLEX-ES provides the following printers as emulated devices:

- 1403
- 1403 N1
- 3203-1

- 3203-2
- 3203-4
- 3203-5
- 3211
- 3262-1
- 3262-11
- 3286
- 4245-1
- 4245-12
- 4245-20
- 4248-1
- 4248-2

Physical printers supported on the FSI PCA include the following:

- 1403
- 1403 N1
- 3203-1
- 3203-2
- 3203-4
- 3203-5
- 3211
- 3262-1
- 3262-11
- 3286
- 4245-1
- 4245-12
- 4245-20
- 4248-1
- 4248-2
- 38XX laser printers
- Xerox laser printers
- Siemens laser printers

Channel to Channel Adapter

FLEX-ES supports Channel to Channel Adapters (CTCAs) both as emulated and as physical devices.

The FLEX-ES emulated CTCA device allows the channel to channel connection of two FLEX-ES emulated channel paths.

The FSI PCA supports physical IBM 3088 Channel to Channel Adapters as channel-attached devices.

5. Platforms

FLEX-ES runs on the following platforms, if the specific server and server OS combination has been certified by Fundamental Software, Inc. (FSI). Not all devices are available on all platforms, and certain other limitations may apply to specific platforms.

Please contact your FSI-authorized FLEX-ES reseller to determine an installation appropriate for your needs.

UnixWare

FLEX-ES runs in production and development environments on FSI certified Intel® Pentium® processor family (IA-32) based uniprocessor and multiprocessor servers running FSI certified releases of the UnixWare® or OpenUNIX® operating system.

Linux

FLEX-ES runs in development, not production, environments on FSI certified Intel® Pentium® processor family (IA-32) based uniprocessor laptop computers running FSI certified releases of the Redhat® Linux® operating system.

6. Environmental Considerations

Because the FLEX-ES host servers run in office environments, FLEX-ES itself does not require a traditional mainframe machine room (raised floor, special power, special cooling, noise isolation). The low power consumption of the FLEX-ES host servers and disk arrays allows the use of small, economical Uninterruptible Power Supplies (UPSs).

Customers who wish to retain or obtain traditional mainframe peripherals (mainframe tape drives, printers, etc.) may find that these peripherals require a machine room environment.

7. Installation

FSI Authorized Resellers

FLEX-ES is sold through FSI authorized resellers. For further information, please [contact FSI](#).

Physical Installation

The physical and software installation of FLEX-ES normally will be handled by your FSI-authorized FLEX-ES reseller.

As noted earlier, FLEX-ES may run in either an office environment or a machine room environment, depending upon the requirements of any mainframe peripherals used.

When using the optional FSI Parallel Channel Adapter (FSI PCA), appropriate cabling from the adapter card is supplied. Further conventional peripheral cabling will normally be

necessary. The cabling restrictions on the FSI PCA are identical to those of traditional mainframe channels; no special restrictions apply. Depending upon machine room configurations, it may also be necessary to re-route cables to peripherals. When replacing existing mainframe peripherals, such as DASD, with FLEX-ES emulated devices, considerable savings of floorspace may be realized.

If the server is to be connected to the Internet or to any other non-secure network, then an appropriate corporate network security policy, including the provision of a secure firewall, **must** be in place before any such connection is made.

Mainframe Software Installation (From Distribution Media)

FLEX-ES is a Plug-Compatible Mainframe. The installation of mainframe operating systems and applications from their distribution media is the same as it would be with any mainframe installation.

Mainframe Software Installation (PWD)

FLEX-ES is an ideal platform for developers in IBM's PWD program. For direction to FSI authorized resellers serving developers in this program, please [contact FSI](#). The installation of the preconfigured systems in the PWD Application Developer's CDs is straightforward.

Mainframe Software Installation (Retirement of Old System)

Because a FLEX-ES system may be configured to match most existing system configurations, it is also possible to transfer an existing mainframe software installation from a system which is being retired to a replacement FLEX-ES system of the same Group or other rating.

NOTE: It is expected in such a situation that the old system is to be retired. All license terms for all operating systems and applications must be adhered to strictly.

The general procedure for such a replacement is first to quiesce the existing system and then to use standalone utilities to take a dump of it to tape. The FLEX-ES system is then configured identically, often using some of the existing system's peripherals. Then standalone utilities are used to restore the dump of the old system to the identically configured new system. When the FLEX-ES boots, the complete existing installation runs on it just as it had previously run on the old system. The old system is then decommissioned and the machine room floorspace it occupied is reclaimed.

8. FLEX-ES Strengths

From a technical point of view, FLEX-ES excels in four general areas:

- Compatibility
- Flexibility
- Interoperability
- Performance

Compatibility

FLEX-ES is a real z/Architecture mainframe. It has no compatibility issues.

Flexibility

Flexibility may be the single greatest strength of FLEX-ES. It is available in single or multiprocessor configurations. It supports physical channel-attached peripherals, emulated devices, SCSI-attached devices, and an Integrated Communications Adapter. Its devices may be configured (and reconfigured) in software. Within the device limits specified in the FLEX-ES License Agreement, emulated devices may be instantiated at will. This may be especially valuable in testing and product evaluation environments, where systems must be configured to match diverse production environments.

Interoperability

As a single solution running unmodified mainframe operating systems and applications on open server platforms, FLEX-ES provides considerable opportunity for interoperability between these two environments. In particular, emulated 3172/XCA/OSA and the FLEX-ES FakeTape Programming Library & utilities provide opportunities for communication between the mainframe and the server.

Performance

As an emulated machine, FLEX-ES takes advantage of the best in new platform technologies. These include:

- Faster processors from Intel
- Multiprocessor host servers
- Larger, faster SCSI disks and RAID arrays
- Economical TCP/IP networking

These commodity technologies are being driven by the marketplace, and will continue to provide the best combination of performance and economy.

Notes

¹ Licensing restrictions may apply.

² It is also correct to speak of FLEX-ES as an "emulator," because it uses one type of technology (software) to provide services logically identical to those conventionally provided by another type of technology (hardware). An emulated mainframe CPU or peripheral is just another kind of mainframe CPU or peripheral. It is not correct to speak of FLEX-ES as a "simulator," because a simulator merely models a system without necessarily providing its functionality (a flight simulator, for example, doesn't actually fly).

³ The number of instances of FLEX-ES which may be run simultaneously on a single server may be limited by your FLEX-ES License Agreement.

⁴ The maximum number of devices which may be configured on any FLEX-ES system may be limited by the FLEX-ES License Agreement. Emulated DASD require sufficient real storage on the host server's disks.

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