Fundamental Software's FLEX-*ES* Control Unit Behavior: FLEXCUB

Flexible I/O for *any* mainframe from the innovators of mainframe emulation technology

Executive Summary

Mainframe peripheral controllers—tape controllers, disk controllers, print controllers, communications controllers—are traditionally hard-wired special-purpose devices. Lately, IBM® and other vendors have offered virtualized versions of these controllers, versions that perform the same functions as the traditional devices but offer additional benefits in performance, environmentals, maintenance, and flexibility of deployment and operation.

Fundamental Software has taken this "virtualization" to the next, more useful level. Now a Linux-based xSeries® (System x) server box can attach via ESCON® channel to the mainframe and present itself as one or more control units and associated devices. Using this technology, a single xSeries server can displace the need for an entire data center of peripherals.

Each data center can configure this technology to meet its specific needs. One may deploy a server to displace its tape silos, while another may use the same unit as a cost-effective source of plentiful and easily moved DASD. One data center may deploy a server as a low-cost ESCON TN3270 control unit alternative, while another may configure a whole range of peripherals for attachment to its test LPAR.

What Is FLEX-*ES* Control Unit Behavior?

FLEX-*ES*® Control Unit Behavior (FLEXCUB) allows the conventional mainframe to access emulated mainframe devices over a channel. FLEXCUB resides on an xSeries server that is ESCON-attached to the mainframe using a Fundamental Software Serial Communications Adapter (SCA). For every FLEXCUB running on the xSeries server, emulated devices are addressable by the mainframe as if they were traditional mainframe devices.

The figure at right shows an example configuration of a single xSeries server attached to two mainframes. The xSeries server is presenting itself as a number of control units and associated devices. DASD devices are emulated on commodity server disks, giving access to terabytes of inexpensive and readily transportable mainframe DASD. Emulated mainframe tape devices are themselves virtualized tape, written to local or remote commodity disks, providing for cost-effective and very speedy tape silos. Alternatively, mainframe-addressable tape devices can be real SCSI-attached devices such as DLT drives. Print devices are local or network-attached commodity printers, and communication devices are TN3270 sessions or other TCP/IP connections running through the network card on the server.

What Devices Does FLEXCUB Present?

CKD DASD

- 3390-1/2/3/9, 3380-A/D/E/J/K
- 3375, 3350, 3340-35/70, 3330-1/11
- 9345-1/2
- Custom sizes supported

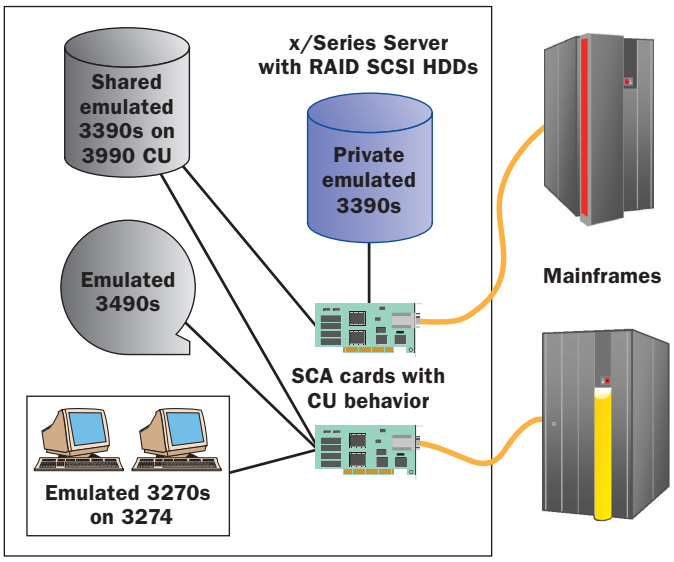
FBA DASD

- 9336-10/20, 9335, 9332-200/400
- 3370-1/2, 3310
- Custom sizes supported

Tape with Compression and Encryption

- 3480, 3490, 3490-E

Server Using FLEX-*ES* CU Behavior (FLEXCUB)



- 3590
- 3420-4/6/8, 3422, 3423, 3430
- All tape models work as emulated devices using files on disk. Supported formats are FSI FakeTape,™ AWSTAPE, and OMA/2. FLEXCUB also supports emulation of these drive types using SCSI cartridge tape drives, including some that are mainframe-media compatible; the exception is the 3590, which is emulated only on disk

Consoles

- Local non-SNA 3270s via TN3270 clients

Communications

- 3172/XCA Ethernet or Token Ring

Printers

- 1403, 1403-N1
- 3203-1/2/4/5, 3211, 3262-1/11
- 4245-1/12/20, 4248-1/2

Card Reader/Punch

- 2501, 2540

While the real versions of some of these control units were never produced with ESCON interfaces, FLEXCUB allows access from a mainframe ESCON channel, subject to the flexibility of the mainframe operating system's ability to define and use it.

The FSI SCA-1

An FSI Serial Channel Adapter (SCA-1) can present itself as one or more heterogeneous control unit interfaces to a mainframe channel. Each SCA-1 can support up to 16 separate control units per adapter. In the spirit of rigorous mainframe design, FSI has manufactured the SCA-1 to protect data with parity at all points in the adapter components between which the data is moved.

Linux-Based Control Units and Open-System Elements

FLEXCUB runs on a Linux base. Traditional control-unit recoverability and security are provided by a read-only version of Linux bootable directly off a CD-ROM, which also offers protection from tampering and viruses. User-customized configuration data is stored on diskette, flash memory drive, or both. Using Linux as the base system for the controller allows a data center to uniquely marry control-unit functions with open-system elements. Data residing on devices behind the controller can be backed up using the controller CPU cycles rather than mainframe cycles. FLEXCUB can also be used to exploit FSI's secure remote tape storage service for storing tape volumes off site. See the flyer "Fundamental Software's Data Backup and Disaster Recovery Services" for more information.

Making the Most of FLEXCUB DASD

IBM xSeries servers can be equipped with high-capacity, high-speed SCSI hard disk drives (HDDs) in a RAID configuration. FLEXCUB provides mainframe DASD volumes using space on those HDDs. RAID technology assures that data is striped across the HDDs in the array, and RAID-1 or RAID-5 technology protects the data against an HDD failure. Failure of an HDD in a typical configuration allows for the failed drive to be replaced and the data rebuilt without disruption of service or loss of access to data.

Because the HDDs are treated as open-system DASD space, new possibilities exist for data backup, for instance in disaster recovery or for compliance with HIPAA and the 2002 Sarbanes-Oxley Act. Custom-sized volume capacity makes it possible to logically segregate data along lines not previously available without wasting a lot of disk space. For example, if a 500-cylinder 3390 volume is all that is needed for retention of 2004 records, then FLEXCUB can create it; alternatively, a 3390-9 volume as large as 65,520 cylinders can be created for more extensive data.

FSI's emulation of mainframe DASD delivers excellent performance for I/O. Customers replacing 9345 and 9395 DASD will enjoy improved response times in most workloads. With FLEXCUB, a mainframe always gets the benefit of very fast emulation delivered by far less expensive hardware in a much smaller footprint.

An optional feature of FLEXCUB allows for secure encrypted synchronization on a track-basis with another backup copy of each emulated DASD volume across a TCP/IP network. The copy on the remote system is synchronized with the original copy in batch mode, and only those tracks on a volume that have changed since the previous synchronization are sent between the two servers. The tracks are compressed to minimize transmission time.

Additionally, because the DASD volumes are objects on open-system HDDs, they can be backed up to SCSI tape drives and securely copied to other servers using open-system software tools without consuming valuable mainframe computing cycles. Existing mainframe backup tools can still be used as well.

Benefits of FLEXCUB DASD

- Emulation of mainframe DASD volumes on inexpensive SCSI RAID HDDs
- Configurable control unit and DASD device caches
- Concurrent sharing between multiple S/390® and z/Architecture™ operating systems with the same capabilities as sharing real 3990 control units
- New options for backing up data to open-system tape such as DLT
- Exploitation of open-system capabilities to prepare for disaster recovery
- Addition of DASD volumes by a simple change to the configuration file
- Custom-sized volume capability, allowing for data segregation in ways not previously possible

Making the Most of FLEXCUB Virtual Tape

Many data professionals are interested in emulation of tape on disk (also known as virtual tape). Because the speed of emulated tape greatly exceeds that of traditional tape storage, customers find it easy to minimize or even eliminate day-to-day use of traditional tape media in their mainframe batch processing.

FSI's FLEXCUB allows for emulating more than just the 3480 and 3490(E) devices that some vendors allow. In addition, 3590 tape devices may be emulated, along with older 3420, 3422, and 3430 reel-to-reel tape drives. The capabilities of all these types are functionally the same, and the tape volumes created on one type (for example 3490) can be mounted and used on another type (for example 3422), allowing for easy interchange and better management of tape devices and classifications (esoterics) used by some operating systems.

FLEXCUB offers automatic compression and decompression support to reduce the size of the tape volume on disk. This compression support is available even for those devices whose real versions had no built-in compression capability. All FLEXCUB tape drives support encryption of tape volumes for added data security.

New Tools for Managing a Virtual Tape Library

FLEXCUB makes managing an inventory of virtual tape files faster and easier than ever. FSI offers a virtual tape library management package that provides automatic mounting of virtual tape files for z/OS® batch jobs or TSO users and that requires no changes in job control language.

Using the AFLIB package, a z/OS system can access multiple tape libraries installed on one or more FLEXCUB servers. In turn, each tape library can be accessed by multiple z/OS systems. Utilities and operator commands are provided to list and manage library inventories and to enter, eject, scratch, or erase volumes as needed.

The AFLIB package assists with SMS-managed libraries as well. AFLIB creates and synchronizes the contents of its libraries with the SMS inventory, and it routes applicable updates from the storage administrator's ISPF panels or the z/OS operator's LIBRARY command to the appropriate virtual library. In testing, AFLIB has mounted more than 6,000 tapes per hour. Both AWSTAPE and FakeTape encoded files are supported for tape volumes in the libraries.

Exploiting SCSI Tape

Select SCSI tape drive types such as DLT can be mounted directly on an emulated tape device instead of a file on disk. For example, a DLT volume can be mounted on an emulated 3490 tape drive. The program writing to that 3490 from the mainframe will believe it is writing to a 3490 when it is actually writing to a high-capacity DLT. Higher-capacity and newer-technology media can be exploited without the need for new device support on the mainframe.

Benefits of FLEXCUB Tape

- Because it is faster than real tape and has higher capacity than actual tape cartridges, FLEXCUB allows for improved speed in tape jobs, with fewer tape mounts due to higher capacity. Mechanical concerns such as "back-hitching" and "time to rewind and unload" are eliminated when the tape is emulated on disk.
- Fewer mounts and fewer volumes are needed because of higher capacity.
- Emulated tape volumes eliminate storage of real magnetic tapes and can be stored off site immediately with FSI's remote tape service.
- Newer tape technologies such as DLT can be exploited directly and transparently from the mainframe.
- Adding more emulated tape drives is as easy as a change in the configuration file.

Making the Most of Emulated Consoles

IBM mainframe operating systems have long required a local non-SNA 3270 control unit and device(s) for installation and operation. Though the requirement is beginning to lessen in

the newest versions of these operating systems, it is not eliminated for local 3270s. For example, for "dark room operations," how does one log in remotely to fix a problem with the mainframe TCP/IP stack if normal access is through that broken mainframe TCP/IP stack?

FLEXCUB can emulate local non-SNA 3274 controllers with 3270 display and 3287 printer devices attached. These emulated devices can be used by TN3270 or TN3287E clients to appear as a local non-SNA 3270 or 3287 device on the channel of the mainframe allowing it to do all of the things that such a device can do. For example, the TN3270 client can act as the IPL console for the mainframe operating system or provide log-in access to fix a broken mainframe TCP/IP or SNA communication stack. This also provides new productivity possibilities for test LPARs by giving systems programmers access to an IPL console from a remote office. Support is available for SSL TN3270 display sessions and SSL TN3287 printer sessions, subject to export laws. Applications that exploit older 3287 printer capabilities can be rejuvenated.

Because a single FLEXCUB server can provide multiple, different 3274s, it can meet the 3270 console needs of multiple systems or LPARs. Some vendors sell specialty devices that can provide this same capability. But FSI's FLEXCUB server can offer this function in combination with concurrent DASD, tape, and other devices.

For additional security, access to particular 3270 console device addresses by TN3270 clients may be restricted to clients originating at specific TCP/IP addresses if desired.

Benefits of the FLEXCUB 3270 Console

- No need for real channel-attached 3274 or 3174 to support 3270 devices for IPL
- Remote access for TN3270 and TN3287E clients to appear as local non-SNA devices

Making the Most of Legacy Printers

FLEXCUB makes it possible to move legacy printed output from older, channel-attached impact or matrix printers and send the data to more modern TCP/IP printers without changes to the mainframe job stream or JCL. By emulating these legacy printers, FLEXCUB can translate printed data to ASCII and write it to a file or named pipe for automated viewing, printing, or archiving. This can be especially helpful when use of a network printer is unnecessary or impossible. Additionally, when the mainframe TCP/IP is unavailable, a printer in the FLEXCUB can fill the needs of occasionally-used mainframe stand-alone utilities that have support for channel-attached printers.

The printer capability of FLEXCUB can be invaluable when it is necessary to gather diagnostic information concerning an IPL problem in a mainframe operating system. Even in its most recent operating systems publications, IBM makes this recommendation: *"Although a printer is not required to install [the operating system], IBM recommends having one available so you can obtain important diagnostic information if you encounter a problem during IPL."* (IBM publication GC24-6095-00, section 3.1.2)

Summary

Fundamental Software Inc.'s FLEXCUB distills the heart of FLEX▪*ES*—the IT industry's only proven mainframe implemented in software—into a powerful standalone product featuring flexible peripheral device emulation. By providing a large suite of control unit types in one server, FLEXCUB is uniquely able to reduce the costs of equipment, space, environmentals, and support, while simultaneously offering new capabilities unique to the open-systems environment.

Fundamental Software, Inc.
5865 Sills Road
Arbuckle, CA 95912 USA

For sales questions please contact:

Sales Department
+1 (530) 476-2459
Fax +1 (530) 476-2431
inquiry@funsoft.com

www.funsoft.com

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