

WHITE PAPER

BS2000/OSD Business Servers - Using Emulated Tape Devices

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The functions described in this document are available on business servers of the SX-series (SX servers for short), the S-series (S servers for short), and the SQ-series (SQ servers for short).

On SQ and SX servers, the carrier system X2000 provides emulated tape devices for BS2000/OSD, in addition to any existing real tape drives with their media. A tape device visible in BS2000/OSD can be mapped to either a file in the Solaris or Linux file system ("file emulation") or to a file on a CD or DVD ("CDROM emulation") in the CD or DVD drive of the System Management Console (SMC) or of the server (for SQ servers and SX100).

On S servers, a tape device visible in BS2000/OSD can be mapped onto a file in the SINIX-2000 file system of the Service Console Processor SCP 3970-3 or in the Linux file system of the SCP as of 3970-4, or onto a CD in the drive of the SCP 3970. On the SCP as of 3970-4 a DVD may also be used for this purpose. The SCP as of 3970-4 also offers the option to transfer files of emulated tape devices between its Linux file system and the file system on the administrator PC in both directions.

Access to files in the Solaris, Linux or SINIX-2000 file system is possible both in read and write mode. Access to a CD or DVD in this way is possible in read mode; the respective media can be created using a CD or DVD writer on an external server. SQ servers and SCP as of 3970-5 additionally support the feature to write the content of an emulated tape onto a CD or DVD at the end of the tape processing.

Due to the fact that the same file format is used on all systems and for both types of emulation the following complex usage scenarios among others can be realized:

- The CDROM/DVD emulation function is used, for example, to install BS2000/OSD software delivered by FUJITSU S, SQ or SX servers.
- The file emulation function enables the following usage scenarios (as well as others):
 - saving/restoring of BS2000/OSD data via files in the Solaris, Linux or SINIX-2000 file system,
 - exchanging BS2000/OSD files between different S, SQ or SX servers (or BS2000 partitions of SX servers),
 - creating user specific CDs/DVDs in the format of the tape emulation.

For all usage scenarios to be discussed it should be noted that the software programs used to export the data from BS2000/OSD (e.g. HSMS/ARCHIVE) have to be compatible to the software which is used to import the data into BS2000/OSD from the medium (CD/DVD or file) at a later time.

This paper aims to illustrate the above usage scenarios for emulated tape devices, to draw attention to a number of special points and to describe the use of this features with SCP 3970-30 and SX servers.

For SCP as of model 3970-50 and for SQ servers the use of emulated tapes is described in the user manual and is not contained in this white paper.

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1 CDROM emulation

The CDROM emulation permits reading of tape volumes in BS2000/OSD with BS2000 utilities (e.g. IMON, HSMS, Archive) directly from a "tape" on the medium CD/DVD.

The CDROM emulation supports the CDROM drive of the SMC of a partitionable SX server, of an SX100 server, an SQ server or an SCP 3970.

On every CD/DVD there is exactly one file that represents a BS2000/OSD volume. In general, the CDROM emulation accepts both `emfile` and `emfile.` as a valid filename. This is of particular relevance for users creating their own CDs or DVDs, as in this case the filename `emfile` without terminating period is used.

A file named `emfile.` on the CD is therefore visible as `EMFILE` in Windows systems, and as `emfile.` in Solaris, Linux and SINIX-2000 systems (note the period after the name `emfile`).

The files of the CDROM emulation have the same format as those of the file emulation

The CDROM emulation uses the following directories:

System	Directory
Solaris file system of an SX server up to and including X2000 V3.x	/var/opt/SMAW/X2000/emtape/cdrom
Solaris file system of an SX server from X2000 V4.0	/var/opt/SMAW/data/cdrom
Linux file system of an SCP 3970-4	/media/cdrecorder
SINIX-2000 file system of an SCP 3970-3	/usr/apc/lib/cdrom

The CDROM file system is mounted automatically when the command `/ATTACH-DEVICE` is issued for the emulated tape drive in BS2000/OSD.

The CDs supplied by FUJITSU are created in ISO9660 format with Rockridge extensions (but without Joliet extensions); for `emfile` files with a size greater 2 GB the UDF format is used.

Software packages of BS2000/OSD are delivered by FUJITSU on CDs in the appropriate format and are installed by means of the CDROM emulation in BS2000/OSD.

1.1 Configuring tape devices with CDROM emulation on SX servers

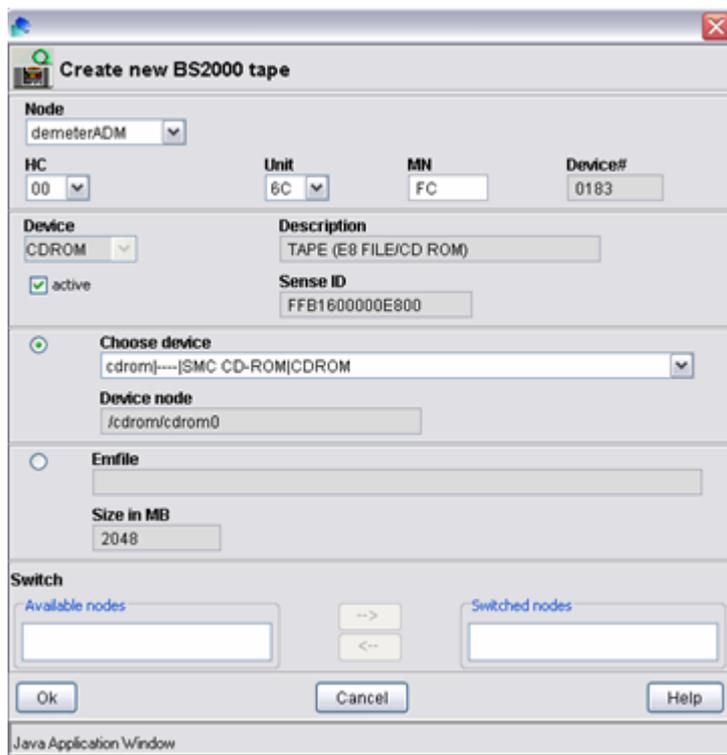
Like all devices managed by X2000, emulated tape devices are configured on SX servers using PRIMEPOWER ServerView (PWSV)¹. The device is then dynamically added to the device configuration in BS2000/OSD and is available for immediate use. As for all devices managed by X2000, it is not necessary to generate the emulated CDROM tape device with IOGEN. Information about the emulated tapes, which are configured on an SX server, can be obtained by selecting `tab BS2 Tapes` and sub-tab `Configured Tapes` of the PWSV application `Bs2Devices`. The configured emulated tapes are listed in the object table.

To configure an additional emulated tape device, `tab BS2 Tapes` and sub-tab `Configured Tapes` has to be selected in the PWSV application `Bs2Devices`, and item `Create` has to be selected from the `BS2 Tapes` menu. The server node as well as the host connector and unit (emulated channel/device) can then be selected from the input mask which appears, and the BS2000 MN has to be specified (see the screenshot below).

The type of the device also has to be configured. In the case of the CDROM emulation the section `Choose device` has to be selected; the item `cdrom|----|SMC CD-ROM|CDROM` (on SX100 servers the string "SMC" is not included) is then displayed.

After the `Ok` button has been pressed and the user has confirmed that the device is to be created, the configuration in X2000 is complete.

¹ A description of how to start PWSV and of the general control functions for configuring BS2000 devices can be found in the manual "SX Series Business Servers – Operation and Administration" □.



To delete an emulated tape device, tab **BS2 Tapes** and sub-tab **Configured Tapes** has to be selected in the PWSV application **Bs2Devices**, the tape device to be deleted has to be marked in the object table and the operation **Delete** has to be chosen from the **BS2 Tapes** menu.

1.2 Configuring tape devices with CDROM emulation on the SCP 3970-3

Emulated tape devices on S servers with an SCP 3970-3 are configured using SINIX-2000.

On S servers with an SCP 3970-3, the device is dynamically added to the device configuration in BS2000/OSD after it has been configured. It is, however, necessary to generate the emulated CDROM tape device by means of IOGEN beforehand (see manual □).

Any modification of the generation data takes effect only after a restart of BS2000/OSD. After having logged into the SINIX-2000 system under the user ID `sysadm` and having typed in the password (or after having entered the `sysadm` command) the SINIX System Administration menu appears on the screen. The user has to ensure that the `TERM` variable is set to the correct value (for example to the value `xterm` when an X-terminal is used).

In the SINIX System Administration menu the item `sinix_2000` and then `bs2000_devices` have to be selected. The window **BS2000 Device Configuration** appears.

For the SCP 3970-3:

```

3 BS2000 Device Configuration
>Cluster - Select by Cluster
Device - Select by Device Type
Licence - Overview of Currently Used Licences
Mnemonics - Show device mnemonics

```

An overview of the generated emulated devices is given by the function `Mnemonics` in the menu **BS2000 Device Configuration**.

On the SCP 3970-3 the BS2000 device configuration can be selected via a Cluster.

Explanation of the term Cluster

This term is used on the SCP 3970-3. Here, one and the same device can be reached over several paths (multi-pathing), either from different hosts or from one host over different channels. There is, however, the requirement that the paths lead to the same cluster, i.e. are defined in the same cluster. The cluster number ranges from 0 to 3; for every cluster unit numbers range from 00 to FF are possible. Devices have to be generated by means of IOGEN (see □).

To configure an additional emulated tape device, now select the menu item `Cluster` in the window **BS2000 Device Configuration**. The menu `Select by Cluster` appears:

```

4 Select by Cluster
>Cluster 0
Cluster 1
Cluster 2
Cluster 3

```

The menu `Unit Cluster x` appears. Now select the desired Unit Number. Then the window `Cluster x Unit yy` with the available functions appears:

```

6 Cluster 0 Unit 04
>New - Make new device
Change - Change device
Delete - Delete device
Show - Show device

```

You can configure a new BS2000-device with the menu item `New - Make new device`. Select the device type `Tape`. Then the following window appears:

```

7 Tape Cluster:0 Unit:60
Device: TAPE (E8 FILE/CDROM) CDROM
Mnemonic: EQ
Device Number: 01B0
Event ID: EQ
Sense ID: FFB1600000E800

SINIX Device: /usr/apc/lib/cdrom/emfile
CDROM: /dev/dsk/cdr8t5s0

active: YES

```

Using the function key `F2 CHOICES` you can select the device type `CDROM`; then you have to specify the `MN`. After pressing the function key `F3 SAVE` the configuration is completed.

You can delete an existing `CDROM` emulation by means of the window `Cluster x Unit yy` and the function `Delete - Delete device`.

1.3 Configuring tape devices with `CDROM` emulation on the `SCP 3970-4`

On `S` servers with an `SCP 3970-4` the configuration of emulated tape devices with `CDROM` emulation is performed using a web-based GUI. (The GUI is invoked by entering the name or the IP-address of the `SKP 3970-4` in the address field of the browser. The welcome screen is then displayed. Then the main window has to be opened for the administrator role. For details see [7].) Select tab `BS2000 DEVICES` in the header bar of the main window.

A list of all emulated BS2000 devices configured on the `SCP 3970-4` appears. Select sub-tab `TAPE DEVICES`. A list of all emulated tape devices, which are configured on this `SCP`, is then shown. Emulated tape devices with `CDROM` emulation are designated by the string `CDROM` in the type column, those with file emulation by the string `EMFILE`. The functionality, which is connected with the `Download` und `Upload` pushbuttons, is described in section 2.

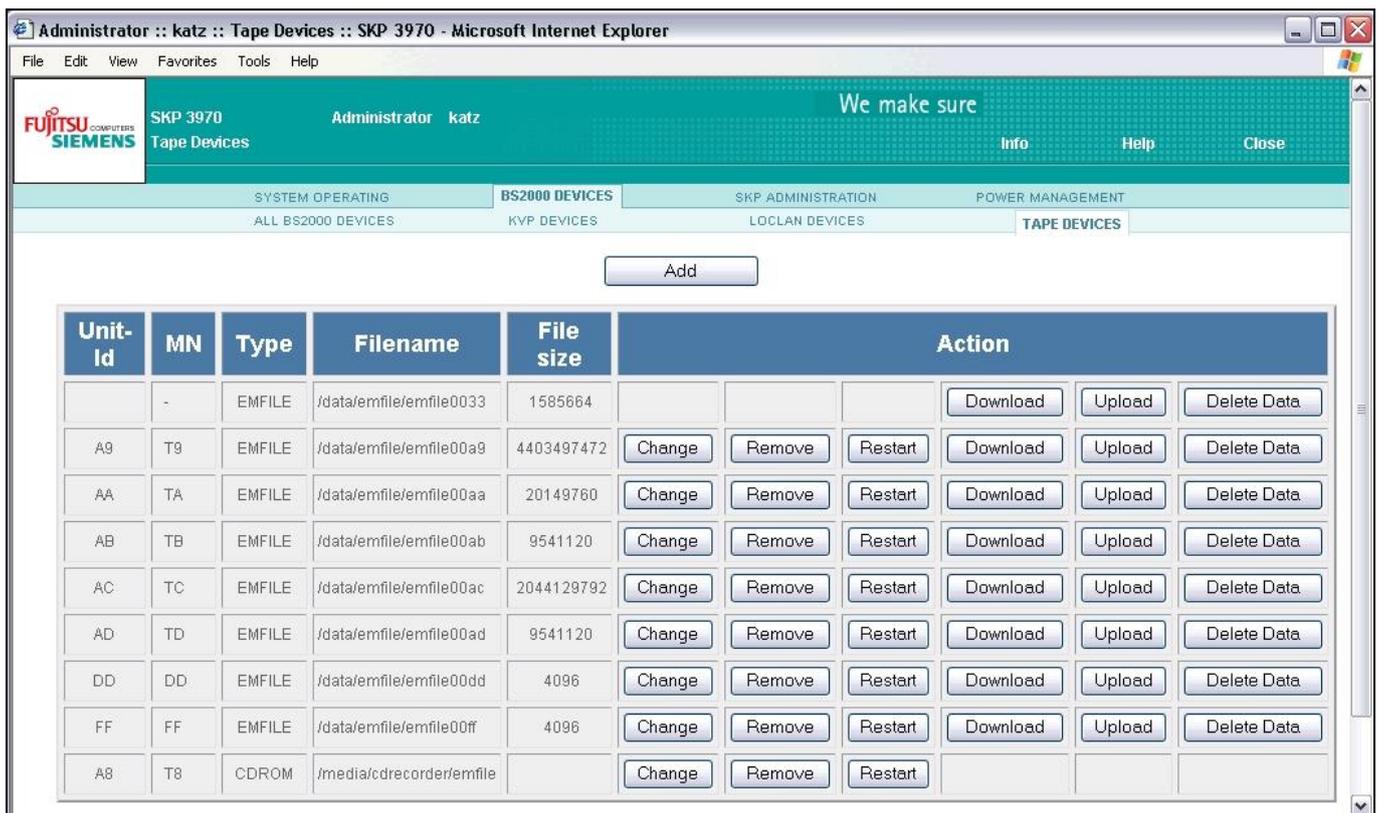
If no tape device with `CDROM` emulation has been created so far, you can create one by clicking the `Add` pushbutton. Then the following window appears:



Select CDROM as type.

In addition, if desired, you can choose a unit number in the Device field different from the preset unit number. After clicking the OK pushbutton the configuration on the SCP 3970-4 is completed.

The created device immediately appears in the table of tape devices.



On S servers with an SCP 3970-4, the device is dynamically added to the device configuration in BS2000/OSD after it has been configured

The device address (unit id) of a tape device has to be generated in BS2000/OSD. This can be done statically through the IOCF file (see manual "System Installation" [5]); modifications do not take effect until after a reboot of BS2000/OSD.

For a running system and for the current BS2000 session a device can be generated by means of the command /ADD-IO-UNIT (see manual "BS2000/OSD-BC Commands Vols 1-5" [8]).

You can delete an existing tape device with CDROM emulation in the list of the emulated tape devices by clicking the Remove pushbutton.

1.4 Using tape devices with CDROM emulation in BS2000/OSD

Emulated tape devices can be addressed as devices of type T9G in BS2000/OSD ;they are displayed as type BM1662FS by the command /SHOW-DEVICE-STATUS .

Before the CD/DVD can be accessed by BS2000/OSD, the emulated tape device has to be attached using the BS2000 command /ATTACH-DEVICE. The emfile file on the CDROM is then automatically mounted by the device emulation. Similarly, the file is unmounted when the BS2000 command /DETACH-DEVICE is issued.

After the emulated tape device has been attached in BS2000/OSD, the system reports successful reading of the label by displaying the message NKVT010.

The medium of the emulated tape device can then be read in the usual way e.g. by ARCHIVE/HSMS or IMON.

Example:

BS2000/OSD console message issued during configuration of the device with the mnemonic F0 by the PWSV-application Bs2Devices:

```
%IOR1-000.162822 % NKR0164 DEVICE F0 OF TYPE E800 ADDED
```

Messages issued by the commands /ATTACH-DEVICE and SHOW-DEVICE-STATUS for the emulated tape device:

```
/ATTACH-DEVICE F0<
% MSG-000.162954 % NKR0042 'DEVICE =F0': ATTACH ACCEPTED
%XAAG-000.162954 % NKR0116 ASSIGN FOR 'DEVICE=F0' IN PROCESS
% MSG-000.162955 % NKR0110 'DEVICE =F0' ATTACHED AND ASSIGNED
% TM-000.162959 % NKVT010 TAPE 'QE6941' MOUNTED ON DEVICE 'F0'
! UCO-000.162959 % NBR0740 COMMAND COMPLETED 'ATT'; (RESULT: SC2=000, SC1=000, MC=CMD0001);
DATE: 2004-04-28
```

```
/SHOW-DEVICE-STATUS F0<
% MNEM DEV-TYPE CONF-STATE POOL VSN DEV-A PHASE ACTION
% F0 BM1662FS ATTACHED SW QE6941 FREE ONLINE NO ACTION
```

Reading the meta-data from the CDROM using HSMS:

```
/START-HSMS<
//LIST-VOLUMES INPUT-VOLUME=QE6941,DEVICE-TYPE=T9G<
//END<
```

The LIST-VOLUMES statement lists the contents of a volume, which has been written by HSMS, in a report (with output to SYSLST or into a file).

Reading the meta-data from the CDROM using Archive:

```
/START-ARCHIVE<
*FILES<
*LIST FROM=(QE6941),DEVICE=T9G,LIST=SYSOUT
```

The LIST statement lists the contents of a volume, which has been written by Archive, in a report (with output to SYSLST and/or SYSOUT).

Console messages:

```
%0BGG-000.163246 % ARC0000 ARCHIVE SUBTASK STARTED BY TSN '0BGF'
%0BGG-000.163246 % DMS0DE3 TAPE WITH VSN 'QE6941' FOR FILE
':HOM2:$TSOS.ARCHIVE.SAVE.FILE(040428-163242-000-I)' IS MOUNTED ON DEVICE 'F0'
%0BGG-000.163953 % ARC0018 ARCHIVE SUBTASK TERMINATED
```

Error messages:

- On SX servers with X2000 V3.0A9 or later versions and on SCP 3970-4 systems the BS2000 command /ATTACH-DEVICE is always executed, for instance even if there is no medium (CD or DVD) in the drive.
- On older systems an error to the effect, that the BS2000 command ATTACH-DEVICE is aborted with the message EXC0858 IVRQ (Intervention Required), may occur.

Possible causes are:

- No medium (CD/DVD) has been inserted into the drive
- The data on the CD/DVD do not conform to the CDROM emulation format (i.e. no emfile on the medium)
- The CD/DVD drive is not in working order.

1.5 Notes on the CDROM emulation

Due to the fact that for all the servers discussed in this paper there is just one CD/DVD drive the number of emulated tape drives of type CDROM is strictly limited to one per BS2000 system or for partitionable SX servers to one per BS2000 partition.

As the CDROM emulation is not a real tape device, a number of points has to be observed during operation.

- **File system on CD/DVD**
On the CD/DVD there must be exactly one file system, which contains a file with the fixed name `emfile.` or `emfile .`. This file represents a BS2000/OSD volume.
This condition is always fulfilled by CDs/DVDs delivered by FUJITSU.
For CDs/DVDs created by a user, the filename `emfile` must be chosen.
- Only read access is supported; all write operations are rejected.
- **Supported file size**
 - The file size supported for `emfile` files is determined by the capacity of the underlying medium, i.e. the blank CD that was used. Depending on the CD type it can be 650 MB, 700 MB or 800 MB.
 - SX servers and the SCP 3970-4 support `emfile` files on DVD. The maximum file size for `emfile` files on DVD is 2 GB for SX servers and 4.4 GB for the SCP 3970-4.
- "Continuation tape processing" is not possible.
The CD/DVD must always contain a complete BS2000/OSD volume.
- **Check of the medium at /ATTACH-DEVICE**
The following function is available on SX servers with X2000 V3.0A9 and later releases and on the SCP 3970-4:
The BS2000 command /ATTACH-DEVICE is executed even when no medium is in the drive. When a medium is inserted at a later time, it can be activated with the command /CHECK-TAPE.
- **Eject – ejecting a medium from the drive**
For older systems the following holds:
A BS2000 command /UNLOAD-TAPE for the device in state ATTACHED is treated as null operation (NOOP).
A CD/DVD has to be unloaded using the Solaris Volume Manager or the command `eject [cdrom]` after the command /DETACH-DEVICE has been executed in BS2000/OSD.
The following function is available on SX servers with X2000 V3.0A9 and later releases and on the SCP 3970-4:
Ejecting the medium from the drive in state ATTACHED is supported by the BS2000 command /UNLOAD-TAPE UNIT=<mn>.
- **Restrictions:**
The medium cannot be ejected on SX100 servers, which do not have SlimLine drives with spring-operated doors
On SX servers with SMCs of type PRIMESTATION the rack door has to be open in order that ejection of the medium is ensured.
- **Changing the medium**
Changing the medium inserted in the drive by access through the Solaris-, Linux- or SINIX-2000 system, while it is in BS2000 state ATTACHED, is not permitted.
The following function is available on SX servers with X2000 V3.0A9 and later releases and on the SCP 3970-4 release S-V1.0A06 or later:
In state ATTACHED a new medium can be activated for BS2000 by either the command sequence /DETACH-DEVICE, /ATTACH-DEVICE or by the command /CHECK-TAPE-UNIT UNIT = <mn>, ACTION=*UPDATE
- Access to a Solaris, Linux or SINIX-2000 file system, which has been mounted as a result of an ATTACH-DEVICE command, by the respective operating system is not permitted (see introduction to chapter 1).

2 File emulation

The file emulation permits reading and writing of files in BS2000/OSD with BS2000 utilities (e.g. HSMS or ARCHIVE) from or to a single file in Solaris, Linux or SINIX-2000, which acts as a carrier of a tape volume on an SQ server, an SX server or an SCP 3970.

With the file emulation, for every emulated BS2000 tape device exactly one Solaris, Linux or SINIX-2000 file is available, whose name and location within the file system are predefined.

The following directories are used by the file emulation

Operating System	Directory
Solaris file system of an SX server up to and including X2000 V3.x	/var/opt/SMAW/X2000/emtape/
Solaris file system of an SX server from X2000 V4.0	/var/opt/SMAW/data/emtape/
Linux file system of an SCP 3970-4	/data/emfile/
SINIX-2000 file system of an SCP 3970-3	/usr/apc/emfile/

Example: Files in Solaris File System of X2000 V3.x:

```
Diese # ls -la /var/opt/SMAW/X2000/emtape
total 854
drwxr-xr-x  3 root    sys      512 Apr 28 17:17 .
drwxr-xr-x 11 root    root     512 Apr  7 13:48 ..
drwxr-xr-x  2 root    sys      512 Aug 26  2003 cdrom
-rw-r--r--  1 root    root    423936 Apr 28 17:26 emfile00b
```

Example: Files in Linux File System:

```
# ls -la /data/emfile
total 428
drwxrwxrwx  2 root    root     176 Apr 21 13:04 .
drwxr-xr-x  9 root    root     200 Apr 12 12:32 ..
-rw-r--r--  1 root    root        2 Apr 21 13:03 emfile0003
-rw-r--r--  1 wwwrun  www     668 Apr 19 12:20 emfile0006
```

Example: Files in SINIX-2000 File System:

```
# ls -la /usr/apc/emfile
total 10
drwxr-xr-x  2 root    other    96 Nov  9 14:52 .
drwxr-xr-x 14 root    other   1024 Sep 20 10:10 ..
-rw-r--r--  1 root    root   4096 Nov  9 14:52 emfile00b
```

The emfile file is created automatically when the command /ATTACH-DEVICE is issued, if a corresponding file does not already exist. If a file with the same name already exists, it is used by the emulation.

The files of the file emulation have the same format as those of the CDROM emulation. The file names of the CDROM emulation are different from those of the file emulation.

For the file emulation, the number of the host connector (on SX servers; on the SCP 3970-4 it is always equal to 00) or the cluster (on the SCP 3970-3) and the unit address of the emulated device are part of the filename.

Thus, for example, for host connector 0 and unit 60 the file /var/opt/SMAW/X2000/emtape/emfile060 is created in Solaris, the file /data/emfile/emfile0060 in Linux and /usr/apc/emfile/emfile060 in SINIX-2000.

The full pathname of the files are displayed by the operator interfaces of the systems of type SX server and SCP 3970-4.

2.1 Configuring tape devices with file emulation on SX servers

Emulated tape devices using the file emulation are configured in the same way as those based on the CDROM emulation, i.e. on SX servers PWSV is used. Here too, the device is dynamically added to the device configuration in BS2000/OSD and can be used immediately. As for all devices managed by X2000, it is not necessary to generate the emulated tape device with IOGEN.

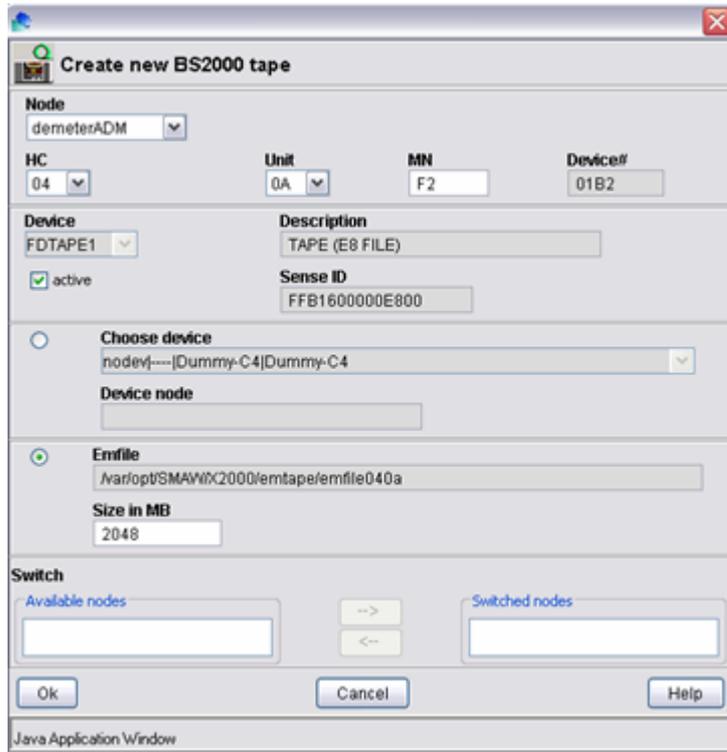
Information about the emulated tapes, which are configured on an SX server, is obtained from tab BS2 Tapes and sub-tab Configured Tapes of the PWSV application Bs2Devices. The configured emulated tapes are listed in the object table.

For the configuration of an additional emulated tape device, select the PWSV application Bs2Devices, click on tab BS2 Tapes and on sub-tab Configured Tapes, and then select the entry Create in the BS2 Tapes menu. From the input window, which then appears, the server node and the host connector and unit (emulated channel/device) can be selected, and the BS2000 MN has to be specified.

In the next section of the input window, select Emfile; a fixed file name for the location of the data is then generated.

Notes on the allowed number and size, and on the management of `emfile` files can be found in section 2.6 “Supported data volume; management of `emfile` files”

Example: Configuring a tape device using file emulation:



2.2 Configuring tape devices with file emulation on the SCP 3970-3

The configuration of emulated tape devices on S servers with an SCP 3970-3 is performed using SINIX-2000. On S servers with an SCP 3970-3, the device is dynamically added to the device configuration in BS2000/OSD after its configuration has been completed. However, it is necessary to generate the emulated tape device by means of IOGEN (see manual □). Any modification of the generation data is effective only after a restart of BS2000/OSD.

After having logged in the SINIX-2000 system under the user-ID `sysadm` and having typed in the password (or after input of the `sysadm` command) the SINIX System Administration menu appears on the screen. The user must ensure that the `TERM` variable is set to the correct value (viz. `xterm` when using an X-terminal).

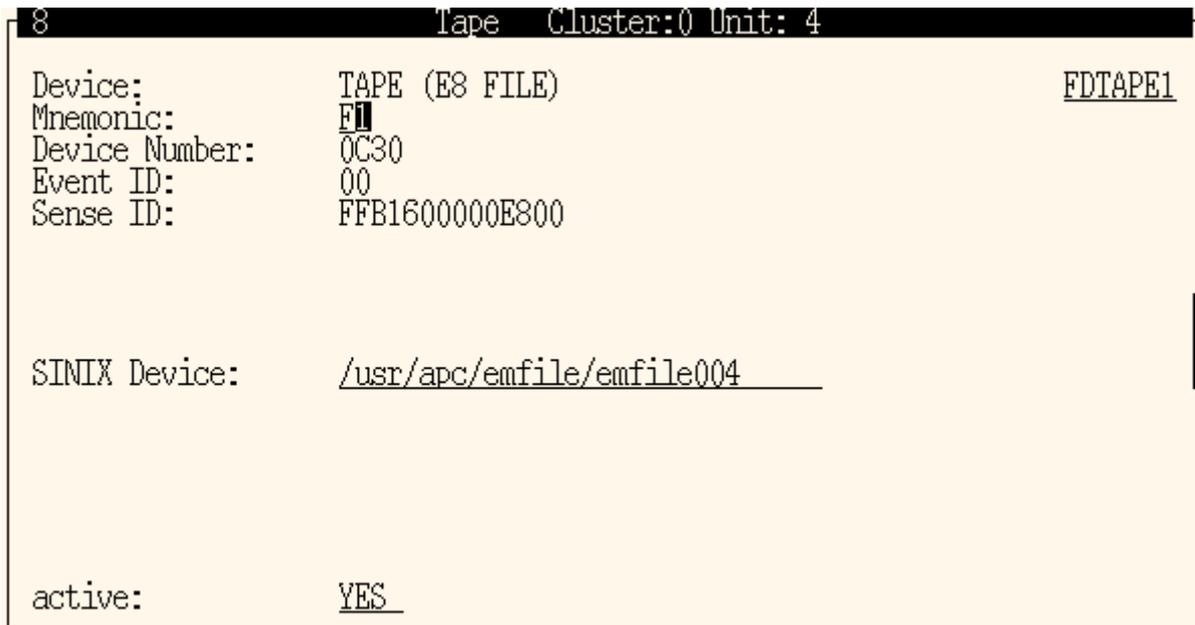
In the SINIX System Administration menu the item `sinix_2000` and then `bs2000_devices` have to be selected. The window BS2000 Device Configuration appears (see section 1.2).

An overview of the generated emulated devices is given by the function `Mnemonics` in the menu BS2000 Device Configuration.

To configure an additional emulated tape device now select the menu item `Cluster` in the window BS2000 Device Configuration. The menu `Select by Cluster` appears (see section 1.2). Now select the desired `Cluster`.

The menu `Unit Cluster x` appears. Now select the desired Unit Number. Then the window `Cluster x Unit yy` with the available functions appears (see section 1.2).

You can configure an additional BS2000 device with the menu item `New - Make new device`. Select the device type `Tape`. Then the following window appears:



Using the function key F2 CHOICES you can select the device type FDTAPE1 and then you have to specify the MN. After pressing the function key F3 SAVE the configuration is completed.

You can delete an existing file emulation by means of the window Cluster x Unit yy and the function Delete - Delete device.

2.3 Configuring tape devices with file emulation on the SCP 3970-4

On S servers with an SCP 3970-4 the configuration of emulated tape devices with file emulation is performed using a web-based GUI. (The GUI is invoked by entering the name or the IP-address of the SKP 3970-4 in the address field of the browser. The welcome screen is then displayed. Then the main window has to be opened for the administrator role. For details see [7].) Select the tab bs2000_devices in the header bar of the main window.

Now select sub-tab TAPE DEVICES

An overview of all emulated BS2000 devices which are configured on the SCP 3970-4 appears. Emulated tape devices with file emulation are designated by the string EMFILE in the type column, those with CDROM emulation by the string CDROM.

You can create an additional tape device with file emulation by clicking the Add pushbutton. Then the following window appears:



The type EMFILE is preset. If desired, you can choose a unit number different from the one preset in the Device field. The device mnemonic used in BS2000 can be documented in the file Unit ID. After clicking the Ok pushbutton the configuration on the SCP 3970-4 is completed. The newly created device immediately appears in the list of the tape devices.

The device address (unit id) of a tape device has to be generated in BS2000/OSD. This can be done statically via the IOCF file (see manual "System Installation" [1]); any modification of the generation data does not take effect until after a restart of BS2000/OSD. For a current BS2000 session in a running system the device can be generated by means of the command /ADD-IO-UNIT (see manual "BS2000/OSD-BC Commands Vols. 1-5" [8]).


```
*export tapes=emtp01,device=t9g,list=sysout<
*   EXPORT COMMAND LISTING ***
...
FILES NAME=SYS.SSD.CAT.X
EXPORT TAPES=EMTP01,DEVICE=T9G,LIST=SYSOUT
% ARC0002 STATEMENT ACCEPTED. ARCHIVE SEQUENCE NUMBER 'A.040501.232602', VERSIO
N '07.0A00'
% ARC0033 ARCHIVE SUBTASK TSN '0DHC' GENERATED
% ARC0815 SUBTASK '0' HAS TRANSFERRED '198' PAM PAGES FOR '1' FILES AND '0' JVS
IN '0' SECONDS
..
% ARC0003 ARCHIVE STATEMENT COMPLETED
```

2.5 Notes on the file emulation

As the file emulation is not a real tape device, certain restrictions have to be observed during operation.

■ Modifications

If an existing emulation is to be modified (e.g. modification of the maximum size) it must be ensured that the tape device in BS2000 has the status "detached".

Otherwise the reservation information of the emulated tape is lost, and further access would only be possible after a detach/attach sequence.

■ /UNLOAD-TAPE

Unlike real tape drives, the "medium" of the file emulation is fixed. Load and unload functions via BS2000 are therefore not possible. Accordingly, the BS2000 UNLOAD-DEVICE function is executed as "No Operation" (NOOP).

■ File size

The size of the Solaris, Linux or SINIX-2000 files created by the emulation is never reduced – even if the amount of data is written by BS2000/OSD is smaller on subsequent usage.

■ Deleting files

The files created by the emulation are not deleted. However, a corresponding option exists on the SCP 3970-4 (see section 2.3).

The system administrator is responsible for deleting emfiles that are no longer used in order to reduce the size of the used disk space.

■ Access to file system

Access to a file system, which has been mounted as a result of an ATTACH-DEVICE command to the directory `/var/opt/SMAW/X2000/emtape` in Solaris, `/data/emfile` in Linux or `/usr/apc/emfile` in SINIX-2000, is not permitted.

■ Required main storage

Every tape emulation needs up to 6 MB of main storage for administration information.

■ SX servers

If more than two tape drives, as recommended by FUJITSU, are to be used the configuration of the main storage may need to be changed. Main storage is modified via the PWSV menu "bs2_devices -> X2000". Any modifications take effect only after a reboot. See [1] for a description of the function and possible constraints.

Note:

It is urgently recommended to consult the service centre before any changes to the configuration of the main storage are made.

■ SCP 3970-3 systems

If the performance deteriorates when using emulated tape devices, the SINIX-2000 storage can be increased for SCP 3970-3 systems (see section 9.17 "hal" of the manual "SINIX-2000 V8.0/V8.1/V8.5 Installation, Operation and Administration" □).

■ This problem does not arise for SCP 3970-4 systems.

2.6 Maximum Volume Size; Management of emfile files

Maximum volume size

The following limits apply for the maximum size of volumes managed by the file emulation:

■ 2 GB maximum size

for SX servers with X2000 V3.0A08 and earlier releases
for SCP systems of type 3970-3

■ 4.4 GB maximum size

for SX servers with X2000 V3.0A09 and later releases
for SCP systems of type 3970-4

These limits have to be observed when `emfile` files are to be transferred between different systems. If an `emfile` file is to be written onto a CD the capacity of the blank CD to be used has to be observed. The capacity can be 650, 700 or 800 MB depending on the type of the CD.

When a DVD is to be written the maximum size supported by the system on which it is to be used has to be taken into account: 2 GB for SX servers and 4.4 GB for the SCP 3970-4.

Management of emfile files

When several emulated tape drives are in use, large volumes of data are generated. Depending on the type and state of the system this may cause a shortage of system resources.

Unused emfile files

By removing a tape device only the corresponding tape emulation is deleted, but not the associated data. If `emfile` files are no longer needed (or are not needed for the time being, cf. the scenarios in chapter 3) they should be deleted or, at least, their size should be reduced. It is the system administrator's responsibility to take the appropriate action.

Recommended Procedure

On all systems the size of an `emfile` file can be reduced with actions from BS2000 in the following way

By issuing the INIT statement
INIT T9G, VSN = <vsn>, ERASE

The data on the emulated tape are erased. This includes deleting the emulation file with the option "data security erase"; re-initialisation of the header label and reduction of the file size to 4 KB.

Alternative Procedure

If necessary, the `emfile` files can be deleted by the system administrator (see introduction to chapter 2). The web interface of the SCP 3970-4 offers the possibility of deleting `emfile` files independent of a tape emulation at any time (pushbutton Delete Data)

Maximum number of emfile files

Space is occupied by emulated disk drives not immediately after creation, but only after a "tape" has been written to. The maximum number of `emfile` files is determined by the system type and the maximum size of an `emfile` file.

- SX servers:
 - As only a limited amount of free space is available in the Solaris file system, it is recommended that at most two emulated tape drives with file emulation be written to the maximum size of 2 GB.
 - For X2000 V3.0 and later releases these data are located in the ROOT slice of the system disc (for X2000 up to V2.5 they are located in the VAR slice). The amount of space available in the respective slices can be found in section 9.3.1 of the manual "SX Series Business Servers Operation and Administration" [1]. The current amount of free space can be queried with the UNIX command `df -k`.
 - On SX servers, the user has the option of limiting the file size:
When X2000 is configured the maximum file size for `emfile` files can be specified in the field `Size in MB`; in this way the space occupied by the file emulation in the Solaris file system is also limited. The value preset to 2048 MB can be modified in steps of 1 MB.
- A maximum of 8 `emfile` files at a maximum file size of 4.4 GB is supported on systems of type SCP 3970-4.

2.7 End-of-tape handling; Nonavailability of disk space

With file emulations, the capacity available for a backup does not depend on the type of medium as with real drives, but it is determined by the following factors:

- By the maximum size of the emulation file
The maximum size of the file emulation can be configured by the user on SX servers for each tape (see preceding section). It is fixed in all other systems.
- By the available disk space of the UNIX file system
(see the output of the Unix command `df -k` or section 9.3.1 "Default partitioning of the boot disk" in the manual "SX Series Business Servers, Operation and Administration" □) or of the SINIX-2000 storage (see section 9.17 in the manual "SINIX-2000 V8.0/V8.1/V8.5 Installation, Operation and Administration" □).

On write access, each configured file emulation checks the available disk space of the file system, as well as its current upper limit, which may have been modified by the user.

If less than 3 MB of free disk space are available in the file system or if the configured upper limit is reached, the emulation reports LEOT (Logical End of Tape) to BS2000. As with real drives, the system can now terminate the backup with the EOF / EOY blocks.

Important note

If several instances of the file emulation are used, it should be noted that, when file system saturation is reached (3 MB free disk space) by one instance of the emulation, no further disk space can be made available, neither to any other instance of the emulation nor to any other processes. In this way correct operation of the BS2000 operating system can be impaired, in particular on SX servers.

2.8 Continuation tape processing

Continuation tape processing on a single emulated tape device is not possible because the medium would have to be changed for this purpose when end-of-tape is reached. This is not possible because of the fixed assignment of the file to one "drive".

Continuation tape processing is, however, possible if the initialized media are located on separate emulated tape devices.

The following points have to be taken into account in this context:

- It is the user's responsibility to see to that the capacity limits are not exceeded in order to avoid an abort of the backup run.
- As mentioned above, the BS2000 Unload function is not executed.

If this function were executed by B2000, it could lead to inconsistencies between the BS2000/OSD view in terms of the load status of the drive and the current status because the medium is still loaded in the file emulation.

3 Usage scenarios

3.1 Data exchange between systems – General information

The usage scenarios for the CDROM and file emulation are described in the following section. As a rule these scenarios involve data exchange based on transfer of `emfile` files.

Note on file names

As explained in the introductions to chapter 1 and chapter 2 the names of the `emfile` files obey the following convention

- CDROM emulation: `emfile[.]`
- File emulation: `emfile<host connector><host unit>`

Whereas the file names can be changed during transfer, the above convention for the file names has to be enforced, at the latest, when the file is placed in the target directory of a system that supports emfiles.

If the convention is not enforced, the system will not recognize these files as `emfile` files, and they will thus be unusable.

Note on file size

When an `emfile` file is transferred the maximum file size of the target system has to be taken into account. While current systems (SX servers with X2000 V4.0, SCP as of 3970-4) permit a file size of 4.4 GB, the maximum file size of earlier systems (SX servers with X2000 up to V3.x, SCP 3970-3) is limited to 2 GB.

File transfer

Depending on the security settings either the command `ftp` or `sftp` is recommended for transferring the `emfile` files. For transfers from or to Windows PCs (a PC might be used as an intermediate system for a transfer of `emfile` files) the freeware program WinSCP (<http://winscp.net>) is recommended for its simple and reliable user interface.

The product openFT with a similar range of functions, which must be purchased, is also recommended. It offers the additional benefit of being aware of a number of features of the BS2000 operating system – for example, it is able to handle the LMS format – and can be used for transfers to BS2000.

Alternative procedures can be employed for performing a transfer:

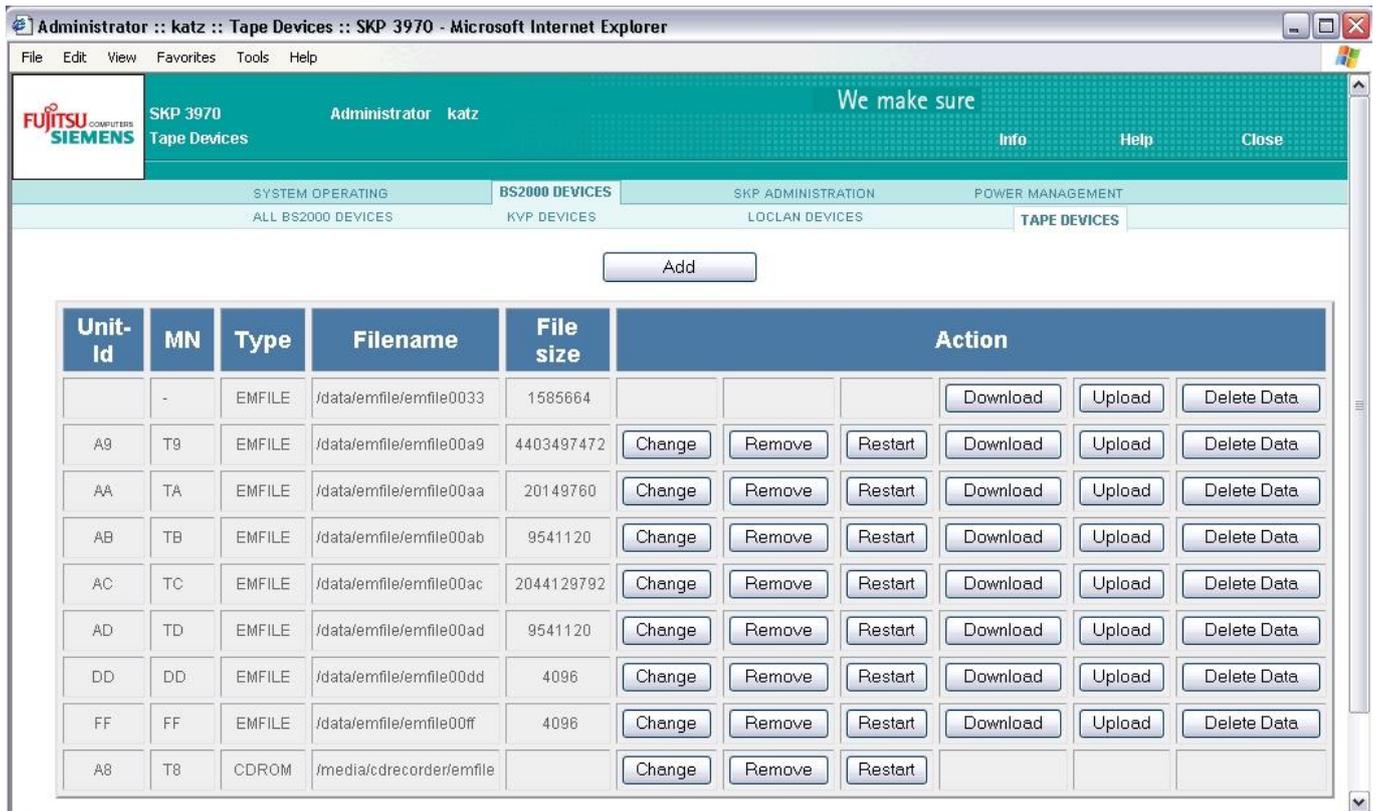
- `ftp` to a laptop computer, transport the laptop computer to the target computer (if it is not accessible via a LAN),
`ftp` to the target computer
- transfer by means of `tar/cpio` and a tape drive (DAT)

Notes on file transfer

As a rule the `emfile` files created by the file emulation have read permission for all users and write permission for the user id `root`. Therefore transfer of the transfer file to the `emfile` on the target server has to be performed under the user id `root` (or with root privileges). The file `/etc/ftpusers` should be checked in this connection. If necessary, the entry for the user id `root` is to be – temporarily – de-activated by inserting a comment character at the beginning of the line.

3.2 Data Exchange between Systems - Download- and Upload Functions on the SCP 3970-4

The SCP 3970-4 offers the option to transfer files of emulated tape devices between its Linux file system and the file system on the administrator's PC work place. In this context the term “download” implies a transfer direction from the SCP 3970-4 to the administrator, whereas the term “upload” implies a transfer direction from the administrator to the SCP 3970-4. For using this option, the emulated tape device must already have been configured. The transfer function is activated by clicking the `Download` or the `Upload` pushbutton, respectively, in the list of all emulated tape devices configured on the SCP 3970-4.



Download Function

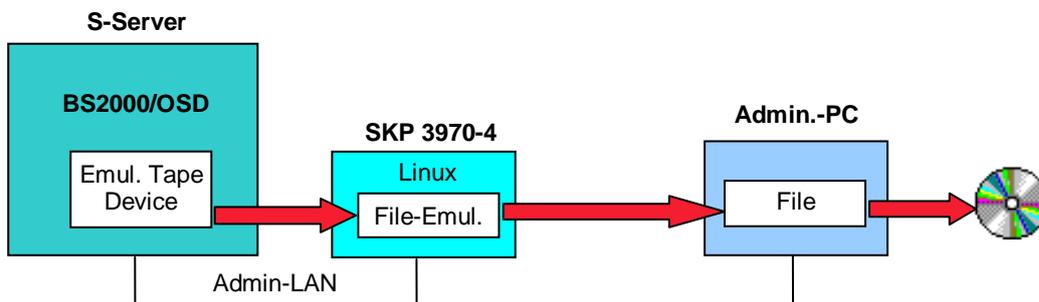
After clicking the Download pushbutton, a security warning may appear, depending on the security settings on the administrator PC. Click the Save pushbutton, if necessary. Then a select box of the file manager of the PC work place appears. Select the target directory and enter the desired file name. After clicking the Save pushbutton the file transfer is performed.

Upload Function

After clicking the Upload pushbutton, a file select box appears; select the source directory and the source file name by using the Browse pushbutton. After clicking the Ok pushbutton the file transfer is performed.

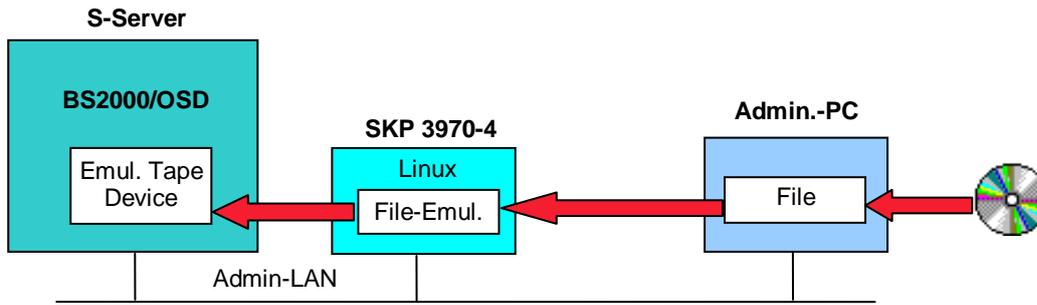
Application of the Download Function

You can use this function, for instance, to write the contents of an emulated tape device with file emulation to a CD or DVD. For this purpose you have to transfer the contents of the corresponding file in the carrier system to your administrator PC by using the Download function. If a CD/DVD writer is connected to your PC, you can create a medium with a file named emfile immediately. Otherwise the file has to be transferred to a server with a connected CD/DVD writer beforehand (see section 5).



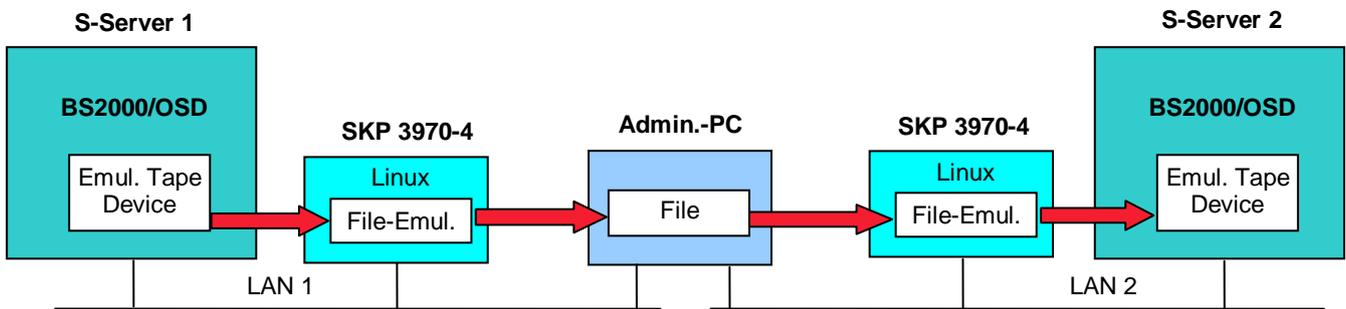
Application of the Upload Function

You can use this function to install BS2000/OSD software delivered by FUJITSU on an S server with an SCP 3970-4 from the administrator PC. For this purpose, insert the CD/DVD in the CD/DVD drive of the administrator PC. Configure an emulated tape device with file emulation on the SCP 3970-4. Transfer the contents of the installation CD/DVD by means of the Upload function to the file in the Linux carrier system, to which this emulated tape device belongs. You will then be able to attach the emulated tape device in BS2000/OSD and install the software in BS2000/OSD from this tape device with IMON.



Data Transfer between BS2000/OSD systems

The Download and Upload function together can be used in order to transfer data between BS2000/OSD servers, which do not have a common network. For this purpose, emulated tape devices with file emulation must be configured on both BS2000/OSD servers. The data transfer between these emulated tape devices can then take place via the administrator PC if, for instance, the procedure described in section 3.4 is not applicable because of disjoint networks. The administrator PC must, however, be connected to both servers.

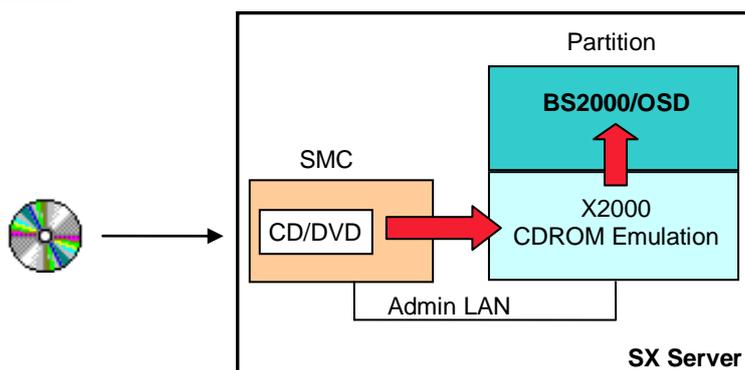


Note

If the two SCP systems are connected directly via a LAN any data transfer between the systems can be performed from the local console as an upload or download depending on the system and the transfer direction. In this case an administrator PC is not required. Care has to be taken that the file name is not corrupted by an upload or download because of a conversion from small to capital letters.

3.3 Installing Software for BS2000/OSD shipped on a CD or DVD

Example of an SX server:



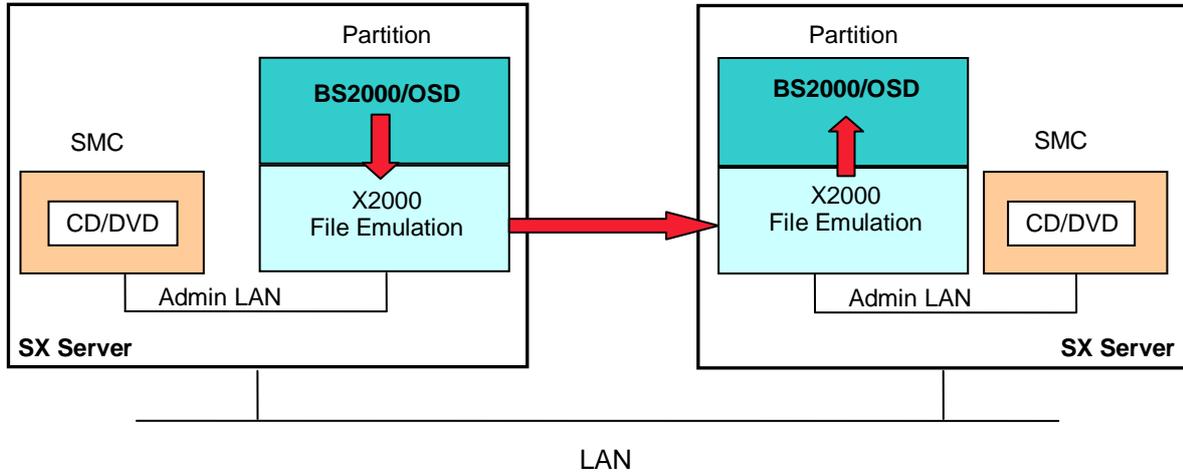
Procedure:

- If not yet present, configure the emulated tape device for CDROM emulation
- Insert the CD/DVD into the drive of the SMC (or of the SX100 server or the SCP 3970)
- Attach the emulated tape device in BS2000/OSD
- Install the BS2000/OSD software using the IMON installation monitor (see the manual □)
- The installation with IMON may be performed directly from the CD/DVD or at a later time after having temporarily parked the installation data with IMON in a user ID of BS2000/OSD created for this purpose.
- For older systems
 - Detach the emulated tape device in BS2000/OSD
 - Eject the CD/DVD by issuing the `eject` command.
- For SX servers with X2000 V3.0A09 or later and for the SCP 3970-4
 - Eject the medium by issuing the command `/UNLOAD-TAPE UNIT = <mn>`
 - Detach the emulated tape device in BS2000/OSD.

3.4 Exchanging/migrating BS2000/OSD data between different servers

The data exchange can be performed homogeneously between S-, SX- and/or SQ-servers.

Example of two SX servers:

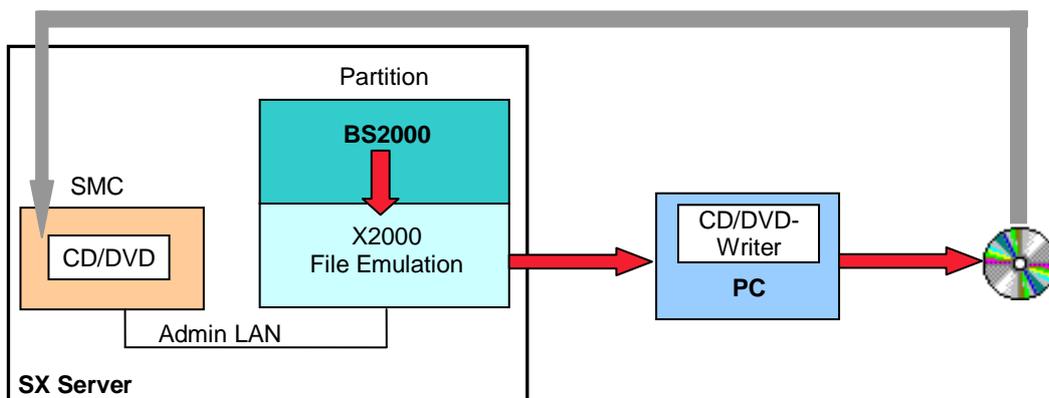


Procedure:

- Export the data from BS2000/OSD on the first system
 - If not yet present, configure the emulated tape device for file emulation on the first server (a size appropriate to the amount of data to be transferred should be chosen here)
 - Attach the emulated tape device in BS2000/OSD
 - Initialize the emulated medium using the BS2000/OSD utility INIT (see the manual □)
 - Export the BS2000/OSD data to the emulated tape device using the ARCHIVE/HSMS export functions
 - Detach the emulated tape device in BS2000/OSD
- If not yet present and/or not yet initialized, configure and initialize the emulated tape device on the second server
 - Configure the emulated tape device for file emulation on the second server (host connector- or cluster-, and unit number and mnemonic do not have to be the same as on the first system)
- Transfer the data to the second system
- Import the data into BS2000/OSD on the second system
 - Attach the emulated tape device in BS2000/OSD
 - Import the BS2000/OSD data using the ARCHIVE/HSMS import functions
 - Detach the emulated tape device in BS2000/OSD

3.5 Creating CDs or DVDs in the format of the tape emulation (archiving or data exchange)

Example of an SX server:



Procedure:

- Export the data on the server from BS2000/OSD
 - If not yet present, configure the emulated tape device for file emulation on the server (a size appropriate to the CD/DVD to be created should be chosen here)
 - Attach the emulated tape device in BS2000/OSD
 - Initialize the emulated medium using the BS2000/OSD utility INIT (see the manual □)
 - Export the BS2000/OSD data e.g. via Archive/HSMS/IMON export functions
 - Detach the emulated tape device in BS2000/OSD

- Transfer the data to the PC
- Write the CD/DVD
 - The CD/DVD may contain exactly one file system contained in a file with the fixed name `emfile`. The CD/DVD must be created in the ISO9660 format.

The CD/DVD can then be read using the CDROM emulations of the different systems.

4 References

The manuals are available online at <http://manuals.ts.fujitsu.com/index.php?id=1&l=en> or can be ordered in printed form for a separate charge from <http://manualshop.ts.fujitsu.com>:

- SQ Business Server, Operation and Administration
- SX Business Server, Operation and Administration
- SKP 3970 Service and Console Processor
- SINIX-2000 V8.0/V8.1/V8.5, Installation, Operation and Administration
- IMON (BS2000/OSD), Installation Monitor
- HSMS (BS2000/OSD), Hierarchical Storage Management System, Volume 2: Statements
- BS2000/OSD-BC System Installation, User Guide
- BS2000/OSD-BC Utility Routines, User Guide
- BS2000/OSD-BC Commands Volumes

5 Glossary

CDROM	Compact Disk Read Only Memory
DVD	Digital Versatile Disc
ISO9660	Format description of the CDROM file system; see also ECMA-119 at http://www.ecma-international.org/publications/standards/Ecma-119.htm
Joliet	Extension of the ISO9660 format by Microsoft© for Windows systems
NFS	Network File System
OSD/XC	OSD Extended Configuration for SX servers
PWSV	PRIMEPOWER ServerView (formerly called WSA)
Rockridge	Extension of the ISO9660 format for Unix systems
SCP 3970	Service Console Processor family 3970
SMC	System Management Console
SX100	Entry-level server of the SX series (not partitionable)
SX150/SX160	Business servers of the SX series with server partitioning option
SX server	Business servers of the SX series
S server	Business servers of the S series
WSA	Web-based System Administration, WebSysAdmin (previous name of PRIMEPOWER ServerView)
X2000	Carrier system for BS2000 OSD/XC on Business servers of the SX series