Chapter 11

Managing Logical Device Configurations

11.1 Introduction

You can create, modify, and delete logical devices by editing **`sda.install`**, the SDA configuration file. When you create a new logical device, you must also ensure that it is defined in **`/dev`**. Moreover, whenever **`sda.install`** is modified, the SDA must be rebooted and the revised **`sda.install`** must be downloaded to all IOCPs and PMs on which the file systems are mounted.

This chapter explains how to edit **`sda.install`** to create or alter logical device configurations. It covers the following topics:

- summary of the logical device configuration guidelines; see Section 11.2
- procedure for creating and modifying logical devices; see Section 11.3
- logical drive substitutions (drive sparing); see Section 11.4

See Chapter 10 for a basic description of **`sda.install`**. The procedures for coldbooting the SDA and downloading **`sda.install`** are described in Chapter 2, Section 2.7.

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11.2 Configuration Requirements and Guidelines

Section 11.2.1 describes the restrictions governing the creation of logical devices on the SDA. Section 11.2.2 offers recommendations that are likely to promote better performance and/or simpler system management.

11.2.1 Restrictions

The following requirements must be observed when creating logical devices on the SDA:

- **Logical device sizes** — Logical devices can be scaled to have any number of data disks up to 128, plus one parity disk. Larger logical devices must contain an even number of data disks, with an upper limit of 254 data disks and one parity disk.

Data	Parity
1	1
2	1
:	:
127	1
128	1
130	1
132	1
:	:
252	1
254	1

  NOTE: The parity disk is optional. It is strongly recommended, however, for file systems with critical data. If a disk fails in a logical device that lacks a parity disk, the data stored on that system cannot be recovered.

- **Splitting caddies** — Disk caddies must not be split between two file systems. Both drives in a disk caddy share a single SCSI channel connecting them to their SCN. Consequently, two independent file systems cannot contend for use of that common channel.

- **Parity disk assignments** — When a parity disk is used, it must share an SCN with at least one of the data disks from its logical device. This rule requires special attention when configuring a logical device in which the number of data disks is a multiple of 8. In such cases, the stride of

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8 used for the data disk sequence must be broken so that one disk within an SCN set can be used as the parity disk.

The 16 +1, 32 +1, and 64 +1 configurations shown below illustrate this.

```
Parity_group =0 8 1 9 2 10 3 11 4 12
              5 13 6 14 7 16 (15)

Parity_group =0 8 16 24 1 9 17 25 2 10 18 26 3 11
              19 27 4 12 20 28 5 13 21 29 6 14 22
              30 7 15 23 32 (31)

Parity_group =0 8 16 24 32 40 48 56 1 9 17 25 33 41
              49 57 2 10 18 26 34 42 50 58 3 11 19
              27 35 43 51 59 4 12 20 28 36 44 52 60
              5 13 21 29 37 45 53 61 6 14 22 30 38
              46 54 62 7 15 23 31 39 47 55 64 (63)
```

- **Parity disk position** — A logical device's parity disk must be enclosed in parentheses and be the last disk listed in the logical device descriptor.

11.2.2 Recommendations

The following are guidelines, not requirements:

- **Disk ordering** — Disk ordering in the logical device determines the mapping of data packets across a logical device. Data packets are distributed sequentially, beginning with the first disk listed in the the logical device descriptor and proceeding left-to-right and downward.

  The recommended disk ordering is shown below for three sample logical devices. In a logical device that is contained on a single SCN, no special ordering is called for. The sequence simply follows the disk ID. In larger logical devices that occupy multiple SCNs, disk ordering should provide a stride of 8 wherever possible. This stripes the data packets across the SCNs to maximize bandwidth.

```
Parity_group =0 1 2 3 4 5 (6)

Parity_group =0 8 1 9 2 10 3 11 4 12 5 13 6 7 (14)

Parity_group =0 8 16 24 32 40 1 9 17 25 33 41 2 10
              18 26 34 42 3 11 19 27 35 43 4 12 20
              28 36 44 5 13 21 29 37 45 6 14 22 30
              38 7 15 23 31 39 (47)
```


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- **SCN sharing** — SCNs should not be shared by multiple file systems. Although such sharing of SCNs is supported, it is likely to degrade performance as file systems compete for access to a single network interface.

- **Master SCNs** — If an SCN is shared by multiple file systems, is should not be the master SCN for either file system. In such cases, begin the device descriptor of each logical device with disks connected to unrelated SCNs.

  NOTE: A logical device's master SCN is the SCN that controls the first disk listed in the logical device descriptor.

- **Cold booting multiple file systems** — Cold boot all file systems from the same IOCP.

- **Scaling logical devices** — Performance can be influenced by the following scaling considerations:

  - Scale logical devices as large as possible without reducing the size of the typical parallel I/O operation to less than 1 Mbyte per data drive.

  - Performance is enhanced when the number of data disks in a logical device is a power-of-two.

11.3 Creating and Modifying Logical Devices

To organize a set of disks into one or more logical devices, enter the desired logical device descriptors into the **`LOGICAL_DEVICES`** section of **`sda.install`**. Device descriptors take the following form:

```
LOGICAL_DEVICES {
    {
    Parity_group =  id0 id1 . . . idn  (idpar)
    }
    {
    Parity_group =  id0 id1 . . . idn
    }
}
```


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Each inner pair of curly braces encloses a logical device descriptor. A descriptor must include a **`Parity_group =`** entry, which lists the physical disks belonging to that logical device. If the logical device includes parity protection, its parity disk terminates the list and is enclosed in parentheses. Use the ID values given in the **`DISKS`** section of **`sda.install`** to specify each disk member of the logical device.

Figure 37 shows an example of **`sda.install`** with two logical devices defined. The first has 14 data disks and 1 parity disk. The second has 8 disks and no parity.

NOTE: While a logical device is not required to include parity, it is strongly recommended. File systems that are not protected by parity cannot be recovered should a single disk fail.

Figure 38 shows how the physical disks are allocated to the logical device in this example.

The order in which disks are listed in a logical device descriptor determines the order in which data is distributed among them. Section 11.2.2, "Summary of Configuration Guidelines," explains the recommended disk order for any supported configuration.

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```
DISKS {
  { Id = 0    CBS = (0 5 0)    NI = 160   Interface = 0 Target = 0 }
  { Id = 1    CBS = (0 5 0)    NI = 160   Interface = 1 Target = 0 }
  { Id = 2    CBS = (0 5 0)    NI = 160   Interface = 2 Target = 0 }
  { Id = 3    CBS = (0 5 0)    NI = 160   Interface = 3 Target = 0 }
  { Id = 4    CBS = (0 5 0)    NI = 160   Interface = 0 Target = 1 }
  { Id = 5    CBS = (0 5 0)    NI = 160   Interface = 1 Target = 1 }
  { Id = 6    CBS = (0 5 0)    NI = 160   Interface = 2 Target = 1 }
  { Id = 7    CBS = (0 5 0)    NI = 160   Interface = 3 Target = 1 }
  { Id = 8    CBS = (0 5 1)    NI = 161   Interface = 0 Target = 0 }
  { Id = 9    CBS = (0 5 1)    NI = 161   Interface = 1 Target = 0 }
  { Id = 10   CBS = (0 5 1)    NI = 161   Interface = 2 Target = 0 }
  { Id = 11   CBS = (0 5 1)    NI = 161   Interface = 3 Target = 0 }
  { Id = 12   CBS = (0 5 1)    NI = 161   Interface = 0 Target = 1 }
  { Id = 13   CBS = (0 5 1)    NI = 161   Interface = 1 Target = 1 }
  { Id = 14   CBS = (0 5 1)    NI = 161   Interface = 2 Target = 1 }
  { Id = 15   CBS = (0 5 1)    NI = 161   Interface = 3 Target = 1 }
  { Id = 16   CBS = (0 5 2)    NI = 162   Interface = 0 Target = 0 }
  { Id = 17   CBS = (0 5 2)    NI = 162   Interface = 1 Target = 0 }
  { Id = 18   CBS = (0 5 2)    NI = 162   Interface = 2 Target = 0 }
  { Id = 19   CBS = (0 5 2)    NI = 162   Interface = 3 Target = 0 }
  { Id = 20   CBS = (0 5 2)    NI = 162   Interface = 0 Target = 1 }
  { Id = 21   CBS = (0 5 2)    NI = 162   Interface = 1 Target = 1 }
  { Id = 22   CBS = (0 5 2)    NI = 162   Interface = 2 Target = 1 }
  { Id = 23   CBS = (0 5 2)    NI = 162   Interface = 3 Target = 1 }
}

SPARES {
}

LOGICAL_DEVICES {

   /* (r)sda1a 14+1 */
   { Parity_group = 0 8 1 9 2 10 3 11 4 12 5 13 6 7 (14) }

   /* (r)sda2a 8 */
   { Parity_group = 16 17 18 19 20 21 22 23 }
}
```

Figure 37. `sda.install` example — with `LOGICAL_DEVICES`.

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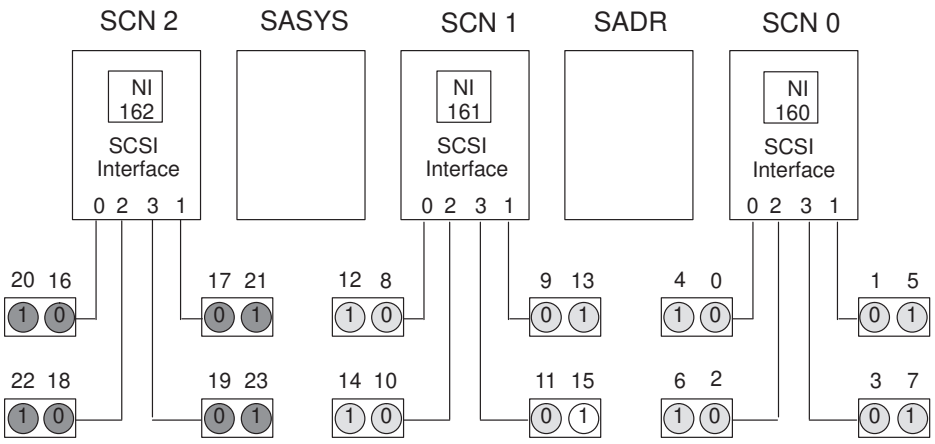


```
LOGICAL_DEVICES {

   /* (r)sda1a 14+1 */
   { Parity_group = 0 8 1 9 2 10 3 11 4 12 5 13 6 7 (14) }

   /* (r)sda2a 8 */
   { Parity_group = 16 17 18 19 20 21 22 23 }
}
```

NOTES:

1. The number shown above each disk corresponds to the disk's ID, as it is listed in the DISKS section of **`sda.install`**. Use this number for the **`-u`** argument to **`sda_disk_util`** (for heal operations).
2. The lightly shaded logical device is **`/dev/sda1a`**. The darker shading represents logical device **`/dev/sda2a`**. Disk 15 is not allocated to any logical device. It is available for use as a spare for **`/dev/sda1a`** (see note 4, below).
3. If a parity disk is used, it must share an SCN with at least one data disk in its logical device.
4. The two disks in a caddy must not be split between two logical devices. Hence, disk 15 can be spared in for **`/dev/sda1a`**, but it cannot be spared in for **`/dev/sda2a`**.

Figure 38. `sda.install` `LOGICAL_DEVICES` section vs physical disk layout.

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11.4 Logical Drive Substitutions (Sparing)

The SPARES section of **sda.install** is provided to allow you to make logical disk substitutions. A drive substitution is accomplished by entering a pair of disk drive IDs in the following manner:

```
SPARES {
    { old = original_drive_id new = substitute_drive_id }
}
```

This entry in the file has the effect of mapping **new** into the logical device in place of **old**. The disk associated with **new** will then be used wherever the disk associated with **old** is referenced. For *original_drive_id* and *substitute_drive_id*, use the IDs listed in **DISKS**.

In Figure 39, spare disk 15 is used in place of disk 4.

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```
DISKS {
  { Id = 0    CBS = (0 5 0)    NI = 160   Interface = 0 Target = 0 }
  { Id = 1    CBS = (0 5 0)    NI = 160   Interface = 1 Target = 0 }
  { Id = 2    CBS = (0 5 0)    NI = 160   Interface = 2 Target = 0 }
  { Id = 3    CBS = (0 5 0)    NI = 160   Interface = 3 Target = 0 }
  { Id = 4    CBS = (0 5 0)    NI = 160   Interface = 0 Target = 1 }
  { Id = 5    CBS = (0 5 0)    NI = 160   Interface = 1 Target = 1 }
  { Id = 6    CBS = (0 5 0)    NI = 160   Interface = 2 Target = 1 }
  { Id = 7    CBS = (0 5 0)    NI = 160   Interface = 3 Target = 1 }
  { Id = 8    CBS = (0 5 1)    NI = 161   Interface = 0 Target = 0 }
  { Id = 9    CBS = (0 5 1)    NI = 161   Interface = 1 Target = 0 }
  { Id = 10   CBS = (0 5 1)    NI = 161   Interface = 2 Target = 0 }
  { Id = 11   CBS = (0 5 1)    NI = 161   Interface = 3 Target = 0 }
  { Id = 12   CBS = (0 5 1)    NI = 161   Interface = 0 Target = 1 }
  { Id = 13   CBS = (0 5 1)    NI = 161   Interface = 1 Target = 1 }
  { Id = 14   CBS = (0 5 1)    NI = 161   Interface = 2 Target = 1 }
  { Id = 15   CBS = (0 5 1)    NI = 161   Interface = 3 Target = 1 }
  { Id = 16   CBS = (0 5 2)    NI = 162   Interface = 0 Target = 0 }
  { Id = 17   CBS = (0 5 2)    NI = 162   Interface = 1 Target = 0 }
  { Id = 18   CBS = (0 5 2)    NI = 162   Interface = 2 Target = 0 }
  { Id = 19   CBS = (0 5 2)    NI = 162   Interface = 3 Target = 0 }
  { Id = 20   CBS = (0 5 2)    NI = 162   Interface = 0 Target = 1 }
  { Id = 21   CBS = (0 5 2)    NI = 162   Interface = 1 Target = 1 }
  { Id = 22   CBS = (0 5 2)    NI = 162   Interface = 2 Target = 1 }
  { Id = 23   CBS = (0 5 2)    NI = 162   Interface = 3 Target = 1 }
}

SPARES {

 { old = 4 new = 15 }
}

LOGICAL_DEVICES {

   /* (r)sda1a 14+1 */
   { Parity_group = 0 8 1 9 2 10 3 11 4 12 5 13 6 7 (14) }

   /* (r)sda2a 8 */
   { Parity_group = 16 17 18 19 20 21 22 23 }
}
```

Figure 39. Disk sparing example in `sda.install`.

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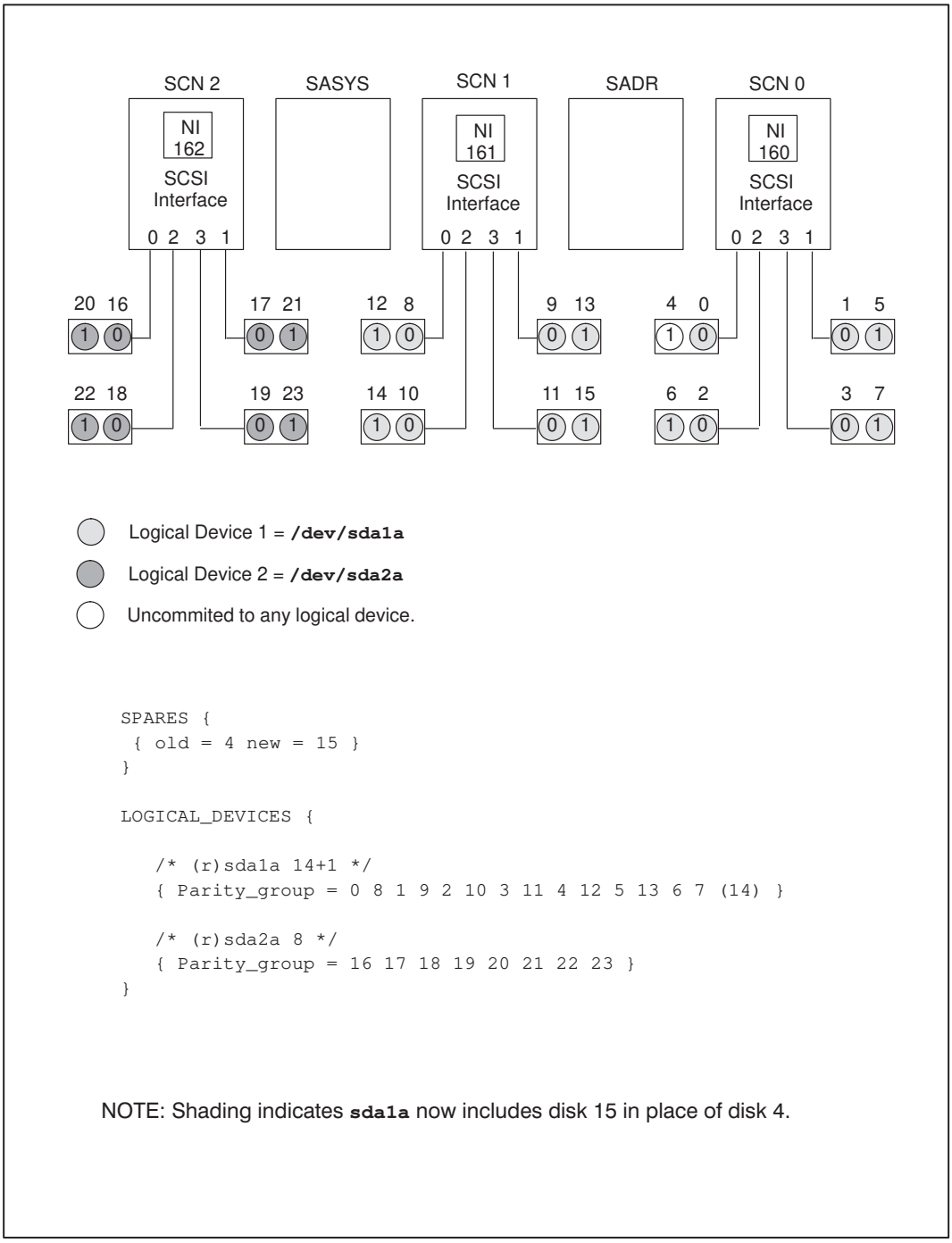


```
SPARES {
 { old = 4 new = 15 }
}

LOGICAL_DEVICES {

   /* (r)sda1a 14+1 */
   { Parity_group = 0 8 1 9 2 10 3 11 4 12 5 13 6 7 (14) }

   /* (r)sda2a 8 */
   { Parity_group = 16 17 18 19 20 21 22 23 }
}
```

NOTE: Shading indicates **sda1a** now includes disk 15 in place of disk 4.

Figure 40. Disk sparing example — physical disk implementation.

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