Boot Options

In This Chapter

This chapter provides information about configuring boot option parameters.

Topics in this chapter include:

System Initialization

The primary copy of SR OS software is located on a compact flash card. The removable media is shipped with each 7750 SR-Seriesrouter and contains a copy of the OS image.

Notes:

- The modules contain three slots for removable compact flash cards. The drives are named Compact Flash Slot #1 (cf1), Compact Flash Slot #2 (cf2), and Compact Flash Slot #3 (cf3). Configurations and executable images can be stored on flash cards or an FTP file location. There are six Compact Flash slots on the 7750 SR-c12, three for CFM-A and three for CFM-B.

- The flash card containing the bootstrap and boot option files *must* be installed in Compact Flash Slot #3 (*cf3*) on the .
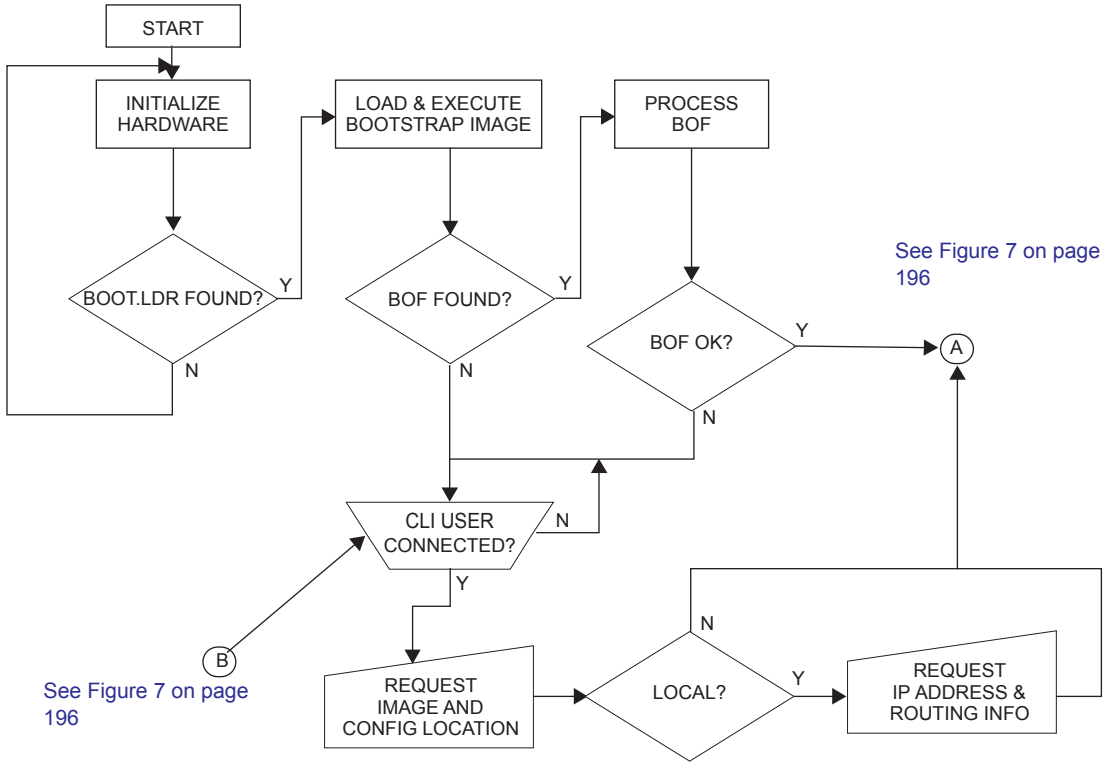
- You must have a console connection.

Starting a 7750 SR-Seriesrouter begins with hardware initialization (a reset or power cycle). By default, the system searches Compact Flash Slot #3 (*cf3*) for the `boot.ldr` file (also known as the bootstrap file). The `boot.ldr` file is the image that reads and executes the system initialization commands configured in the boot option file (BOF). The default value to initially search for the `boot.ldr` file on *cf3* cannot be modified.

The following is an example of console display output when the `boot.ldr` file cannot be located on *cf3*.

```
...
(memory test messages)
(serial number information)
Searching for boot.ldr on local drives:
No disk in cf3
No disk in cf3
No disk in cf3
Error - file boot.ldr not found on any drive
Please insert CF containing boot.ldr. Rebooting in 5 seconds.
```

When the bootstrap image is loaded, the BOF is read to obtain the location of the image and configuration files. The BOF must be located on the same compact flash drive as the `boot.ldr` file.

displays the system initialization sequence.

```
                      START

                  INITIALIZE          LOAD & EXECUTE          PROCESS
                  HARDWARE            BOOTSTRAP IMAGE         BOF

                                                                        See Figure 7 on page
                                                                        196

              BOOT.LDR FOUND?   Y       BOF FOUND?   Y       BOF OK?   Y        A

                           N                    N                    N

                                      CLI USER       N
                                      CONNECTED?

                                            Y                  N
                     B
                                      REQUEST              LOCAL?   Y    REQUEST
     See Figure 7 on page             IMAGE AND                         IP ADDRESS &
     196                              CONFIG LOCATION                   ROUTING INFO
```

Figure 6: System Initialization - Part 1

Figure 7 displays the compact flash directory structure and file names for the redundant chassis models.

```
                        ┌──────────────────┐
                        │       ROOT       │
                        └──────────────────┘
                                 │
         ┌──────────────┬────────┴────────┬──────────────┐
         ↓              ↓                 ↓              ↓
      bof.cfg        boot.ldr         config.cfg      TIMOS-n.m.Yz
                                                    ↓       ↓       ↓
                                             cpm.tim iom.tim support.tim
                                             hmac-sha1.txt
```
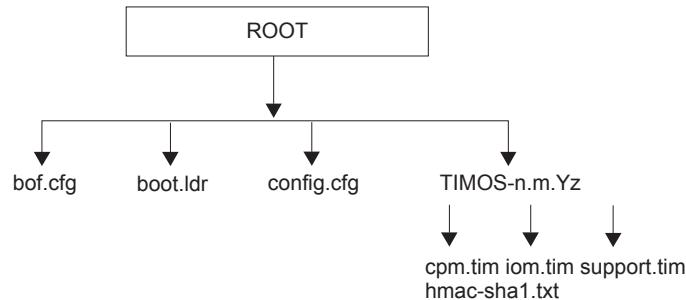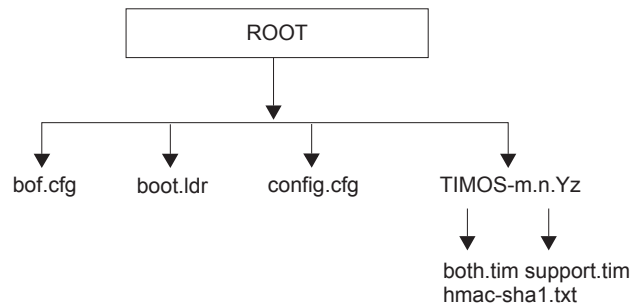
Figure 7: Files on the Compact Flash

Files on the compact flash are:

- bof.cfg — Boot option file
- boot.ldr — Bootstrap image
- config.cfg — Default configuration file
- TIMOS-m.n.Yz:

    m — Major release number

    n — minor release number

    Y: A — Alpha release

        B — Beta release

        M — Maintenance release

        R — Released software

    z — Version number

    → cpm.tim — CPM image file

    → iom.tim — IOM image file

    → support.tim — required data for SR OS .tim files

    → hmac-sha1.txt (in FIPS-140-2 mode only)

Figure 8 displays the compact flash directory structure and file names for the 1-slot models (non-redundant).

```
                          ┌──────────────────────┐
                          │         ROOT         │
                          └──────────┬───────────┘
                                     │
          ┌──────────────┬───────────┼───────────────┐
          ▼              ▼           ▼                ▼
        bof.cfg       boot.ldr    config.cfg    TIMOS-m.n.Yz
                                                    │
                                              ┌─────┴─────┐
                                              ▼           ▼
                                         both.tim support.tim
                                         hmac-sha1.txt
```

Figure 8: Files on the Compact Flash

Files on the compact flash are:

- bof.cfg — Boot option file
- boot.ldr — Bootstrap image
- config.cfg — Default configuration file
- TIMOS-m.n.Yz:

  m — Major release number

  n — Minor release number

  Y: A — Alpha release

       B — Beta release

       M — Maintenance release

       R — Released software

  z — Version number

  → both.tim — CPM and IOM image file

  → support.tim — required data for SR OS .tim files

  → hmac-sha1.txt (in FIPS-140-2 mode only)

The 7750 SR-Series router includes a boot option for running the node in a FIPS-140-2 mode. This mode limits the use of cryptographic algorithms on the CPM to only those that are in accordance with the FIPS-140-2 certifications associated with the 7750 SR-Series router.

Configuration and Image Loading

When the system executes the `boot.ldr` file, the initialization parameters from the BOF are processed. Three locations can be configured for the system to search for the files that contains the runtime image. The locations can be local or remote. The first location searched is the primary image location. If not found, the secondary image location is searched, and lastly, the tertiary image location is searched.

If the `BOF` cannot be found or loaded, then the system enters a console message dialog session prompting the user to enter alternate file locations and file names.

The **boot.ldr** can be interrupted during the boot sequence by pressing any key on the CPM console port. The operator must then type **sros** and press **ENTER** within 30 seconds or the **boot.ldr** will continue trying to boot the system. This key sequence ensures that noise or misconfiguration does not inadvertently interrupt the boot sequence. If the operator types **sros** and presses **ENTER** within 30 seconds, they are brought to a console message dialog session prompting the user to enter file locations and other boot information.

When the runtime image is successfully loaded, control is passed from the bootstrap loader to the image. The runtime image attempts to locate the configuration file as configured in the BOF. Like the runtime image, three locations can be configured for the system to search for the configuration file. The locations can be local or remote. The first location searched is the primary configuration location. If not found, the secondary configuration location is searched, and lastly, the tertiary configuration location is searched. The configuration file include chassis, IOM, MDA, and port configurations, as well as system, routing, and service configurations.
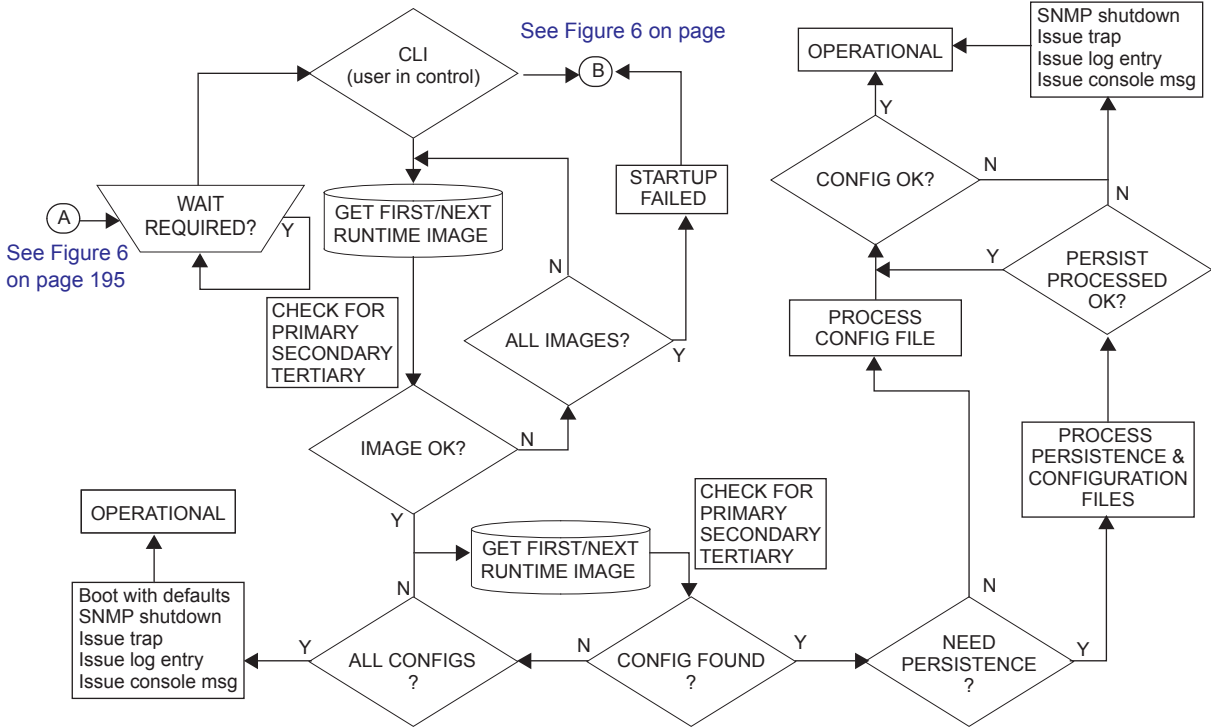
Figure 9 displays the boot sequence.

Figure 9: System Initialization - Part 2

The following displays an example of BOF output.

```
A:ALA-1>bof# show bof
=======================================================================
Memory BOF
=======================================================================
no autonegotiate
duplex          full
speed           100
address         10.10.xx.xx/20 active
wait            3
primary-image   cf3:\both.tim
primary-config  cf3:\test123.cfg
primary-dns     192.168.xx.xx
persist         on
dns-domain      test.alcatel.com
=======================================================================
A:ALA-1>bof#
```

Persistence

Optionally, the BOF `persist` parameter can specify whether the system should preserve system indexes when a **save** command is executed. During a subsequent boot, the index file is read along with the configuration file. As a result, a number of system indexes are preserved between reboots, including the interface index, LSP IDs, path IDs, etc If persistence is not required and the configuration file is successfully processed, then the system becomes operational. If persist is required, then a matching `x.ndx` file must be located and successfully processed before the system can become operational. Matching files (configuration and index files) must have the same filename prefix such as `test123.cfg` and `test123.ndx` and are created at the same time when a **save** command is executed. Note that the persistence option must be enabled to deploy the Network Management System (NMS). The default is off.

Traps, logs, and console messages are generated if problems occur and SNMP shuts down for all SNMP gets and sets, however, traps are issued.

Lawful Intercept

Lawful Intercept (LI) describes a process to intercept telecommunications by which law enforcement authorities can un-obtrusively monitor voice and data communications to combat crime and terrorism with higher security standards of lawful intercept capabilities in accordance with local law and after following due process and receiving proper authorization from competent authorities. The interception capabilities are sought by various telecommunications providers.

As lawful interception is subject to national regulation, requirements vary from one country to another. Alcatel-Lucent's implementation satisfies most national standard's requirements. LI is configurable for all service types.

FIPS-140-2 Mode

The 7750 SR-Series router includes a configurable parameter in the bof.cfg file to make the node run in FIPS-140-2 mode. When the node boots in FIPS-140-2 mode, the following behaviors are enabled on the node:

- The node performs an HMAC-SHA1 integrity test on the software images .tim files.
- The node limits the use of encryption and authentication algorithms to only those allowed for the associated FIPS-140-2 certification of the 7750-SR Series routers.
- Cryptographic module startup tests are executed on the CPM when the node boots to ensure the associated approved FIPS-140-2 algorithms are operating correctly.
- Cryptographic module conditional tests are executed when required during normal operation of associated when using FIPS-140-2 approved algorithms.
- When configuring user-defined encryption or authentication keys, CLI will prompt for the key to be re-entered. If the re-entered key does not match the original, the CLI command will be canceled. This affects several protocols and applications.

To support FIPS-140-2, an HMAC-SHA-1 integrity check is performed to verify the integrity of the software images. The following file is included in the TIMOS-m.n.Yz software bundle containing the hmac-sha-1 signature:

- hmac-sha1.txt

During the loading of the cpm.tim or both.tim, a HMAC-SHA-1 check is performed to ensure that the calculated HMAC-SHA-1 of the loaded image matches that stored in the hmac-sha1.txt file.

The HMAC-SHA-1 check is performed on the data loaded from the .tim file. Note that when configuring the primary-image, secondary-image and tertiary-image, the hmac-sha1.txt file must exist in the same directory as the .tim files. If the load has been verified correctly from the HMAC-SHA-1 integrity check, the load continues to bootup as normal. If the load is not verified by the HMAC-SHA-1 integrity check, the image load will fail.

After the HMAC-SHA-1 integrity check passes, the nodes continues its normal bootup sequence including reading the config.cfg file and loading the configuration. The config.cfg file used to boot the node in FIPS-140-2 mode must not contain any configuration that is not supported in FIPS-140-2 mode. If such configuration is present in the config.cfg file when the node boots, the node will load the config.cfg file until the location of the offending configuration and then halt the configuration at that point. Upon a failure to load the config.cfg file, a failure message is printed on the console.

Initial System Startup Process Flow

Figure 10 displays the process start your system. Note that this example assumes that the boot loader and BOF image and configuration files are successfully located.
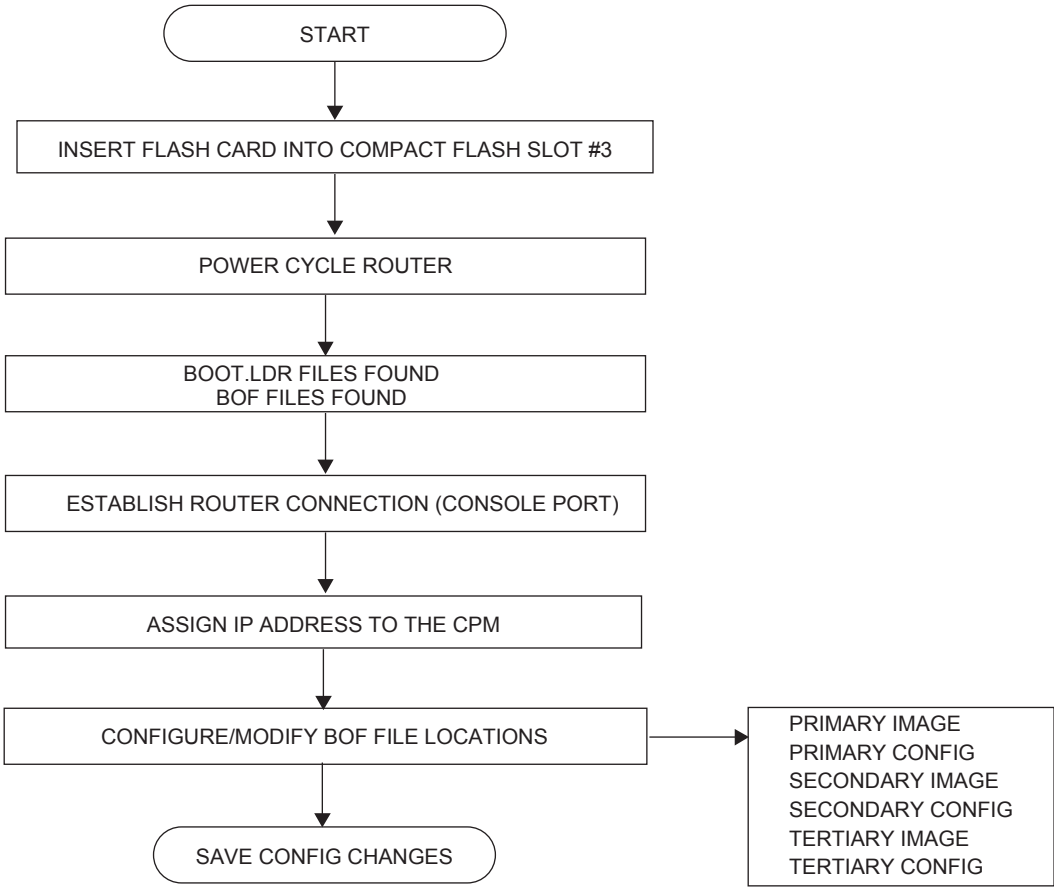
```
                        ┌─────────────────────┐
                        │        START        │
                        └─────────────────────┘
                                  │
                                  ▼
              ┌───────────────────────────────────────────┐
              │  INSERT FLASH CARD INTO COMPACT FLASH SLOT #3  │
              └───────────────────────────────────────────┘
                                  │
                                  ▼
              ┌───────────────────────────────────────────┐
              │             POWER CYCLE ROUTER             │
              └───────────────────────────────────────────┘
                                  │
                                  ▼
              ┌───────────────────────────────────────────┐
              │            BOOT.LDR FILES FOUND            │
              │             BOF FILES FOUND                │
              └───────────────────────────────────────────┘
                                  │
                                  ▼
              ┌───────────────────────────────────────────┐
              │  ESTABLISH ROUTER CONNECTION (CONSOLE PORT)  │
              └───────────────────────────────────────────┘
                                  │
                                  ▼
              ┌───────────────────────────────────────────┐
              │         ASSIGN IP ADDRESS TO THE CPM        │
              └───────────────────────────────────────────┘
                                  │
                                  ▼                              ┌──────────────────────┐
              ┌───────────────────────────────────────────┐     │   PRIMARY IMAGE      │
              │     CONFIGURE/MODIFY BOF FILE LOCATIONS     │────▶│   PRIMARY CONFIG     │
              └───────────────────────────────────────────┘     │   SECONDARY IMAGE    │
                                  │                              │   SECONDARY CONFIG   │
                                  ▼                              │   TERTIARY IMAGE     │
                        ┌─────────────────────┐                 │   TERTIARY CONFIG    │
                        │  SAVE CONFIG CHANGES │                 └──────────────────────┘
                        └─────────────────────┘
```

Figure 10: System Startup Flow

Configuration Notes

This section describes BOF configuration caveats.

- For router initialization, the compact flash card must be installed in the Compact Flash #3 slot.
- The loading sequence is based on the order in which it is placed in the configuration file. It is loaded as it is read in at boot time.