Linux From Scratch

Версия 7.3

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Пролог

Предисловие

Мои приключения в изучении Linux начались больше десяти лет назад, в 1998. Я просто установил свой первый дистрибутив Linux и быстро стал поклонником концепции и философии Linux.

Всегда существуют несколько путей решения задачи. То же самое можно сказать о дистрибутивах Linux. Самые серьезные существуют годами. Некоторые все еще существуют, некоторые превратились во что-то другое, еще одни остались только в нашей памяти. Они все разные, все отражают потребности целевой аудитории. Поскольку существует такое огромное количество путей достижения одного результата, я начал понимать, что я более не обязан ограничиваться какой-либо одной реализацией. До исследования Linux, нам просто приходилось мириться с проблемами других операционных систем, поскольку у нас не было выбора. Это было так, нравилось Вам или нет. С Linux концепция выбора дошла до своего апогея. Если Вам что-то не нравится, Вы абсолютно свободно можете поменять это, настолько свободно, насколько вообще возможно.

Я попробовал несколько дистрибутивов и не смог остановиться ни на одном. Они все хороши, каждый по-своему. Более не существует понятий "правильно" и "неправильно". Теперь всем управляет Ваш личный вкус. При огромной свободе выбора я осознал, что невозможно подобрать себе одну идеальную во всем систему. Поэтому я решил создать мою собственную систему Linux, которая полностью бы соответствовала моим персональным предпчтениям.

Чтобы действительно получить свою собственную систему, я решил собирать абсолютно все из исходных кодов вместо того, чтобы использовать прекомпилированные бинарные пакеты. Эта «идеальная» Linux-система должна иметь сильные стороны всех других систем и исключать их слабости. Поначалу идея казалась весьма обескураживающей. Не верилось, что такая система может быть создана.

После долгого преодоления препятствий, таких как взаимные зависимости и ошибки компиляции, я наконец собрал свою собственную Linux-систему. Она была полностью готова для использования, как и любой другой дистрибутив Linux. Но это было мое творение. Это было необыкновенное чувство. Лучше этого было бы только самостоятельное написание каждого компонента системы.

Как только я поделился своими идеями с другими членами Linux-сообщества, стало ясно, что существует стойкий интерес к подобным проектам. Сразу стало ясно, что такие самосборные Linux-системы могут не только служить для удовлетворения специфических требований пользователя, но и быть идеальным обучающим материалом для программистов и системных администраторов, на котором они могли бы оттачивать свое мастерство. Именно из этих идей и родился проект *Linux From Scratch*.

Эта книга - ядро проекта Linux From Scratch. Она предоставляет фундамент и инструкции, необходимые Вам для построения и компиляции собственной системы. Эта книга дает шаблон, следуя которому Вы получите корректно работающую систему; Вы свободно можете изменять инструкции, чтобы результат соответствовал

Вашим желаниям, и на самом деле именно это и есть важнейшая часть проекта. Вы контролируете все; мы просто протягиваем руку помощи, чтобы помочь Вам в начале Вашего собственного приключения.

Я искренне надеюсь, что Вы замечательно проведете время, работая над своей собственной сборкой Linux From Scratch и наслаждаясь огромным числом преимуществ Своей Собственной Системы.

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Кому адресована эта книга?

Существует множество причин, по которым Вы могли захотеть прочесть эту книгу. Один из вопросов, который задают многие люди, «почему так необходимо полностью проходить весь процесс ручной сборки Linux-системы с нуля, когда можно просто скачать и установить уже готовый дистрибутив?»

Одна из важных целей существования этого проекта - помочь Вам изучить, как Linux-система работает изнутри. Сборка LFS помогает показать, что составляет Linux и как его компоненты взаимодействуют друг с другом. Одна из лучших вещей - это то, что приобретенный опыт самообучения поможет Вам в дальнейшем расширении Linux-системы в любом направлении.

Другой важный аспект LFS - это возможность полностью контролировать систему, не полагаясь при этом на чью-то-там реализацию дистрибутива Linux. С LFS, Вы находитесь в кресле водителя и диктуете каждый аспект своей системы.

LFS позволяет Вам создавать ультракомпактные Linux-системы. При установке обычного дистрибутива Вам часто приходится устанавливать огромное количество программ, которые никогда не будут использованы. Эти программы впустую занимают место на диске. Вы можете заметить, что с нынешними жесткими дисками это не так уж и страшно. Однако, иногда Вам будет важен размер системы. Вспомните о загрузочных CD, USB-дисках и встраиваемых системах. Это области, где LFS будет весьма выгоден.

Еще одна важная причина собственноручной сборки Linux - безопасность. Компилируя всю систему из исходного кода, Вы можете проверить все и применить необходимые патчи безопасности. Больше не нужно ждать, пока кто-нибудь другой откомпилирует бинарные пакеты и устранит в них дыру. Хотя Вы и можете проверить патч, нет никакой гарантии, что новый бинарный пакет был собран корректно и в нем действительно исправлена проблема.

Цель Linux From Scratch - собрать полную и готовую к использованию систему базового уровня. Если Вы не хотите собирать свою собственную Linux систему с нуля, Вам не удастся извлечь всей пользы из данной книги.

Конечно же, причин для сборки своей LFS-системы слишком много, чтобы перечислять здесь их все. Подводя итоги, знания являются самым весомым аргументом "за". Если Вы продолжите свое изучение LFS, Вы будуте поражены силой, которую дают информация и знания.

Целевые архитектуры LFS

Главными целевыми архитектурами LFS являются 32-разрядные (x86) и 64-разрядные (x86_64) процессоры AMD/Intel. Несмотря на это, инструкции в книге, с небольшими изменениями, работают и с Power PC. Чтобы собрать систему, использующую один из этих процессоров, необходимо, в дополнение к другим нижеследующим требованиям, иметь существующую систему Linux, такую как более ранняя установка LFS, Ubuntu, Red Hat/Fedora, SuSE, которая также бы поддерживала данную архитектуру процессора. Также, помните, что 32-разрядный дистрибутив может быть установлен и использован как хост-система на 64-разрядных компьютерах AMD/Intel.

Необходимо сказать еще несколько слов о 64-разрядных системах. В сравнении с 32-разрядными, размер исполняемых файлов немного больше при практически незаметной разнице в скорости выполнения. Например, при тестовой сборке LFS-6.5 на системе с процессором Core2Duo были получены следующие результаты:

Архитектура	Время сборки	Размер
32-разрядная	198.5 минут	648 MB
64-разрядная	190.6 минут	709 MB

Как Вы можете видеть, 64-разрядная сборка только на 4% быстрее и при этом на 9% больше, чем 32-разрядная. Выгода от перехода на 64-разрядную систему крайне невелика. Конечно, если у Вас более 4GB RAM или Вам необходимо часто работать с данными, размер которых превышает 4GB, преимущества 64-разрядной системы очевидны.

По умолчанию, 64-разрядная система, которая получится при сборке LFS, является так называемой "чистой" 64-разрядной системой. Такая система поддерживает только 64-разрядные исполняемые файлы. Сборка "мульти-архитектурной" системы требует двойной компиляции многих приложений, один раз для 32-разрядных файлов и один раз для 64-разрядных. Это не поддерживается проектом LFS, поскольку не соотносится с идеей предоставления инструкций, необходимых для сборки простой Linux-системы. Вас может заинтересовать проект *Cross Linux From Scratch* ключевой целью которого и является сборка мультиархитектурной системы.

И напоследок еще одно замечание о 64-разрядных системах. Некоторые пакеты на данный момент не могут быть собраны для "чистой" 64-разрядной системы или требуют специальных инструкций по сборке. Как правило, такие приложения написаны с использованием специфичных для 32-разрядных систем ассемблерных инструкций, которые не позволяют собрать программу для 64-разрядной системы. Такими проблемными пакетами являются некоторые драйвера Xorg для устаревших видеокарт из *http://xorg.freedesktop.org/releases/individual/driver/*. Большую часть таких проблем можно обойти, но это требует дополнительных специальных действий и патчей.

LFS и стандарты

Структура LFS следует стандартам Linux так строго, как только возможно. Главными стандартами являются:

- *POSIX.1-2008*.
- *Filesystem Hierarchy Standard (FHS)*

• *Linux Standard Base (LSB) Specifications*

LSB имеет пять отдельных частей: Core, C++, Desktop, Runtime Languages, и Printing. В дополнение к основным требованиям имеются архитектурно-специфичные. LFS старается следовать вышеприведенным правилам.

> **Замечание**
>
> Многие люди не согласны с требованиями LSB. Основной причиной их определения была необходимость в уверенности, что проприетарное программное обеспечение можно будет установить и нормально использовать на совместимой системе. Поскольку LFS - source-based система, пользователь имеет полный контроль над всеми пакетами и может отказаться от установки некоторых пакетов, требуемых по спецификациям LSB.

Создание LFS-системы, соответствующей всем спецификациям LSB, вполне возможно, но потребует установки множества дополнительных пакетов, которые находятся за пределами рассморения LFS. Большую часть из этих пакетов можно установить по инструкциям из BLFS.

Пакеты, предоставляемые LFS и необходимые для удовлетворения требований LSB

LSB Core:	Bash, Binutils, Coreutils, Diffutils, File, Findutils, Gawk, Grep, Gzip, M4, Man-DB, Ncurses, Procps, Psmisc, Sed, Shadow, Tar, Util-linux, Zlib
LSB C++:	Gcc
LSB Desktop:	Нет
LSB Runtime Languages:	Perl
LSB Printing:	Нет
LSB Multimeda:	Нет

Пакеты, предоставляемые BLFS и необходимые для удовлетворения требований LSB

LSB Core:	At, Batch (часть At), Bc, Cpio, Ed, Fcrontab, Initd-tools, Lsb_release, PAM, Sendmail (или Postfix, или Exim)
LSB C++:	Нет
LSB Desktop:	ATK, Cairo, Desktop-file-utils, Freetype, Fontconfig, Glib2, GTK+2, Icon-naming-utils, Libjpeg, Libpng, Libxml2, MesaLib, Pango, Qt3, Qt4, Xorg
LSB Runtime Languages:	Python
LSB Printing:	CUPS
LSB Multimeda:	Alsa Libraries, NSPR, NSS, OpenSSL, Java, Xdg-utils

Пакеты, не предоставляемые LFS или BLFS и необходимые для удовлетворения требований LSB

LSB Core:	None

LSB C++:	Нет
LSB Desktop:	Нет
LSB Runtime Languages:	Нет
LSB Printing:	Нет
LSB Multimeda:	None

Пояснения к выбранным пакетам

Как было сказано выше, цель проекта LFS - построение полной и готовой к использованию системы базового уровня. Она должна включать в себя все пакеты, необходимые для самовоспроизведения, предоставляя относительно небольшую основу, от которой пользователь может отталкиваться в построении своей, более сложной системы. Это не значит, что LFS не может быть сделана еще более маленькой. Некоторые важные пакеты, несмотря на наши рекомендации, могут быть более-менее безболезненно исключены из построения. Список, представленный ниже, поясняет роль каждого пакета в системе и причины, по которым он был включен в книгу.

- Autoconf

  Этот пакет содержит программы, создающие скрипты оболочки, способные автоматически сконфигурировать исходные коды из шаблона, предоставленного разработчиком. Он часто необходим для повторной сборки пакета после изменений в процедуре построения.

- Automake

  Пакет содержит программы для генерации Make-файлов из шаблонов. Он часто необходим для повторной сборки пакета после изменений в процедуре построения.

- Bash

  Этот пакет удовлетворяет требование LSB Core, по которому система должна предоставлять интерфейс Bourne Shell. Он был выбран из большого числа других вариантов потому, что является наиболее популярным и одним из самых мощных по возможностям.

- Binutils

  Этот пакет содержит компоновщик, ассемблер и другие утилиты для работы с объектными файлами. Программы из этого пакета необходимы для компиляции почти всех пакетов LFS и большинства остальных программ.

- Bison

  Пакет содержит GNU-версию yacc (Yet Another Compiler Compiler, Еще Один Компилятор Компиляторов), необходимого для сборки некоторых других программ LFS.

- Bzip2

  Этот пакет содержит программы для работы со сжатыми данными. Он необходим для распаковки многих пакетов LFS.

- Check

This package contains a test harness for other programs. It is only installed in the temporary toolchain.

- Coreutils

Пакет включает в себя необходимые программы для просмотра и обработки файлов и каталогов. Они требуются для управления файлами из командной строки, а также для установки абсолютно всех пакетов LFS.

- DejaGNU

Содержит компоненты для тестирования других программ. Этот пакет устанавливается только как временный инструментарий.

- Diffutils

Пакет содержит программы, которые позволяют выявить различия между файлами или каталогами. С их помощью можно создавать патчи, а также они необходимы для сборки многих пакетов.

- E2fsprogs

Пакет включает в себя утилиты для оперирования с файловыми системами ext2, ext3 и ext4. Это самые популярные и тщательно протестированные файловые системы, поддержимаемые ядром Linux.

- Expect

Этот пакет содержит программу для связывания скриптовых диалогов с другими интерактивными программами. Он зачастую используется при тестировании других пакетов. Он устанавливается только как временный инструментарий.

- File

Этот пакет включает в себя утилиту для определения типа переданного ей файла или нескольких файлов. Некоторые пакеты требуют ее для сборки.

- Findutils

Пакет содержит программы для поиска файлов в файловой системе. Очень многие пакеты используют эти утилиты при сборке.

- Flex

Этот пакет содержит утилиту для генерации программ, способных распознавать шаблоны в тексте. Это GNU-версия lex (лексического анализатора), необходимого для сборки некоторых пакетов LFS.

- Gawk

В этом пакете содержится программа для оперирования содержимым текстовых файлов. Это GNU-версия awk (Aho-Weinberg-Kernighan), который используется в скриптах сборки многих пакетов.

- Gcc

Это - Собрание Компиляторов GNU (Gnu Compiler Collection). Данный пакет содержит компиляторы C и C, а также многие другие, не устанавливаемые в процессе сборки LFS.

- GDBM

Пакет предоставляет библиотеку управления базами данных GNU (GNU Database Manager). Она используется другим пакетом, Man-DB.

- Gettext

В данном пакете находятся утилиты для интернационализации и перевода интерфейса программ на другие языки. Они необходимы некоторым пакетам.

- Glibc

Этот пакет содержит главную библиотеку языка C. Ни одна программа в Linux не запустится без нее.

- GMP

This package contains math libraries that provide useful functions for arbitrary precision arithmetic. It is required to build Gcc.

- Grep

This package contains programs for searching through files. These programs are used by most packages' build scripts.

- Groff

This package contains programs for processing and formatting text. One important function of these programs is to format man pages.

- GRUB

This package is the Grand Unified Boot Loader. It is one of several boot loaders available, but is the most flexible.

- Gzip

This package contains programs for compressing and decompressing files. It is needed to decompress many packages in LFS and beyond.

- Iana-etc

This package provides data for network services and protocols. It is needed to enable proper networking capabilities.

- Inetutils

This package contains programs for basic network administration.

- IProute2

This package contains programs for basic and advanced IPv4 and IPv6 networking. It was chosen over the other common network tools package (net-tools) for its IPv6 capabilities.

- Kbd

This package contains key-table files, keyboard utilities for non-US keyboards, and a number of console fonts.

- Kmod

This package contains programs needed to administer Linux kernel modules.

- Less

This package contains a very nice text file viewer that allows scrolling up or down when viewing a file. It is also used by Man-DB for viewing manpages.

- Libpipeline

The Libpipeline package contains a library for manipulating pipelines of subprocesses in a flexible and convenient way. It is required by the Man-DB package.

- Libtool

This package contains the GNU generic library support script. It wraps the complexity of using shared libraries in a consistent, portable interface. It is needed by the test suites in other LFS packages.

- Linux Kernel

This package is the Operating System. It is the Linux in the GNU/Linux environment.

- M4

This package contains a general text macro processor useful as a build tool for other programs.

- Make

This package contains a program for directing the building of packages. It is required by almost every package in LFS.

- Man-DB

This package contains programs for finding and viewing man pages. It was chosen instead of the man package due to superior internationalization capabilities. It supplies the man program.

- Man-pages

This package contains the actual contents of the basic Linux man pages.

- MPC

This package contains functions for the arithmetic of complex numbers. It is required by Gcc.

- MPFR

This package contains functions for multiple precision arithmetic. It is required by Gcc.

- Ncurses

This package contains libraries for terminal-independent handling of character screens. It is often used to provide cursor control for a menuing system. It is needed by a number of packages in LFS.

- Patch

This package contains a program for modifying or creating files by applying a *patch* file typically created by the diff program. It is needed by the build procedure for several LFS packages.

- Perl

This package is an interpreter for the runtime language PERL. It is needed for the installation and test suites of several LFS packages.

- Pkg-config

  This package provides a program to return meta-data about an installed library or package.

- Procps-NG

  Пакет содержит программы для слежения за работой процессов. Эти программы полезны для администрирования системы, а также используются загрузочными скриптами LFS.

- Psmisc

  Пакет предоставляет программы, выводящие различную информацию о запущенных процессах. Они полезны для системного администрирования.

- Readline

  Пакет содержит набор библиотек, предоставляющих возможность редактирования командной строки и хранения истории команд. Он используется Bash.

- Sed

  Этот пакет позволяет редактировать текст без открытия его в текстовом редакторе. Он также требуется большинством конфигурационных скриптов.

- Shadow

  Пакет содержит программы для безопасного управления паролями.

- Sysklogd

  Этот пакет содержит программы для журналирования системных сообщений, подобных тем, что ядро или демоны посылают в случае необычного события.

- Sysvinit

  В этом пакете содержится программа init, являющаяся родителем всех остальных процессов в системе Linux.

- Tar

  Этот пакет предоставляет возможность создания архивов и их распаковки. Необходим для извлечения абсолютно всех пакетов, используемых в LFS.

- Tcl

  Пакет содержит Tool Command Language, используемый при выполнении тестирования во многих пакетах LFS. Он устанавливается только как временный инструментарий.

- Texinfo

  Этот пакет содержит программы для чтения, создания и преобразования info-страниц. Он используется при установке многих пакетов LFS.

- Udev

  Пакет содержит программы для динамической генерации узлов устройств. Udev является альтернативой созданию нескольких тысяч статических устройств в директории /dev.

- Util-linux

Пакет включает в себя разнообразные утилиты. Среди них программы для управления файловыми системами, разделами, консолью и сообщениями.

- Vim

Этот пакет содержит редактор. Он был выбран из-за совместимости с класическим редактором vi и огромного числа мощных возможностей. Выбор редактора - очень субъективный момент, поэтому Вы, по желанию, пожете заменить Vim любым другим текстовым редактором.

- XZ Utils

Данный пакет включает в себя программы для сжатия и распаковки файлов. На данный момент, они предоставляют наилучшее вообще возможное сжатие, и необходимы для распаковки пакетов формата XZ или LZMA.

- Zlib

Пакет содержит библиотеку процедур компрессии/декомпрессии, используемую некоторыми программами.

Необходимые знания

Сборка системы LFS - непростая задача. Она требует некоторого умения администрировать Unix-системы, чтобы решать возникающие проблемы и правильно выполнять написанные команды. Как абсолютный минимум, Вы уже должны уметь использовать командную строку (оболочку): копировать или перемещать файлы и папки, просматривать содержимое папок и файлов, менять текущую рабочую директорию. Также Вы должны знать, как устанавливать и использовать программное обеспечение в Linux.

Поскольку книга LFS предполагает *как минимум* наличия этих базовых умений, различные форумы поддержки LFS не предоставят Вам помощь по таким вопросам. Вы будете расстроены, что Ваши просьбы помочь с основными навыками либо останутся вообще без ответа, либо ответы будут содержать лишь ссылки на эту страницу.

Перед сборкой LFS мы рекомендуем прочитать следующие HOWTO:

- Software-Building-HOWTO *http://www.tldp.org/HOWTO/Software-Building-HOWTO. html*

Это замечательное руководство по сборке и установке «основных» пакетов программного обеспечения Unix под Linux. Хотя оно и было написано достаточно давно, оно до сих пор позволит получить основные навыки, необходимые для сборки и установки программного обеспечения.

- The Linux Users' Guide *http://tldp.org/pub/Linux/docs/ldp-archived/users-guide/*

Это руководство рассказывает об использовании различного программного обеспечения Linux. Оно также очень старое, но своей актуальности не утратило.

- The Essential Pre-Reading Hint *http://www.linuxfromscratch.org/hints/downloads/ files/essential_prereading.txt*

Это LFS Hint, написанный специально для новичков в Linux. Он включает в себя список ссылок на великолепные источники информации по большому кругу различных тем. Любой, кто хочет установить LFS, должен понимать большую часть из них.

Требования к хост-системе

Данный список содержит имена и минимальные версии пакетов, которые необходимо установить на Вашей хост-системе. Это не должно быть проблемой для последних дистрибутивов Linux. Не забывайте, что многие дистрибутивы помещают заголовочные файлы в отдельные пакеты, часто в виде «<package-name>-devel» или «<package-name>-dev». Вам необходимо установить и их, если Ваш дистрибутив их предоставляет.

Более старые версии перечисленных пакетов могут работать, но корректность их работы не проверялась.

- **Bash-3.2** (/bin/sh должен быть символической ссылкой на bash)
- **Binutils-2.17** (Версии новее, чем 2.23.1 не рекомендуются, поскольку они не были протестированы)
- **Bison-2.3** (/usr/bin/yacc должен быть ссылкой на bison или маленьким скриптом, запускающим bison)
- **Bzip2-1.0.4**
- **Coreutils-6.9**
- **Diffutils-2.8.1**
- **Findutils-4.2.31**
- **Gawk-3.1.5** (/usr/bin/awk должен быть ссылкой на gawk)
- **Gcc-4.1.2** (Версии новее, чем 4.7.2 не рекомендуются, поскольку они не были протестированы)
- **Glibc-2.5.1** (Версии новее, чем 2.17 не рекомендуются, поскольку они не были протестированы)
- **Grep-2.5.1a**
- **Gzip-1.3.12**
- **Linux Kernel-2.6.25** (откомпилированное GCC-4.1.2 или более новым)

  Причина, по которой необходимо ограничение на версию ядра кроется в том, что мы указываем эту версию при сборке glibc в Главе 6, как рекомендуется разработчиками. Также это необходимо для udev.

  Если ядро хост-системы не 2.6.25, или если оно было собрано не компилятором GCC-4.1.2 (или более поздним), Вам необходимо заменить ядро на соответствующее этим требованиям. Существуют два способа сделать это. Во-первых, проверьте, не предоставляет ли Ваш Linux дистрибутив ядро 2.6.25 или более новое. Если это так, Вам следует установить его. Если же Ваш дистрибутив не предоставляет приемлемое ядро, или Вы не хотите устанавливать его, Вы можете собрать ядро самостоятельно. Инструкции по сборке ядра и конфигурированию загрузчика (предполагая, что хост-система использует GRUB), расположены здесь: Chapter 8.

- **M4-1.4.10**
- **Make-3.81**
- **Patch-2.5.4**
- **Perl-5.8.8**
- **Sed-4.1.5**
- **Tar-1.18**
- **Texinfo-4.9**
- **Xz-5.0.0**

Заметьте, что символические ссылки, упомянутые выше, необходимы для сборки LFS по инструкциям этой книги. Символические ссылки, указывающие на другие приложения (вроде dash, mawk, и т.д.) могут работать, но не были проверены и не поддерживаются командой разработки LFS, и могут потребовать отклонений от инструкций или дополнительных патчей к некоторым пакетам.

Чтобы проверить, установлено ли на Вашей системе все необходимое и можно ли в ней компилировать программы, запустите следующий скрипт:

```
cat > version-check.sh << "EOF"
#!/bin/bash
# Simple script to list version numbers of critical development tools

export LC_ALL=C
bash --version | head -n1 | cut -d" " -f2-4
echo "/bin/sh -> `readlink -f /bin/sh`"
echo -n "Binutils: "; ld --version | head -n1 | cut -d" " -f3-
bison --version | head -n1
if [ -e /usr/bin/yacc ];
  then echo "/usr/bin/yacc -> `readlink -f /usr/bin/yacc`";
  else echo "yacc not found"; fi

bzip2 --version 2>&1 < /dev/null | head -n1 | cut -d" " -f1,6-
echo -n "Coreutils: "; chown --version | head -n1 | cut -d")" -f2
diff --version | head -n1
find --version | head -n1
gawk --version | head -n1
if [ -e /usr/bin/awk ];
  then echo "/usr/bin/awk -> `readlink -f /usr/bin/awk`";
  else echo "awk not found"; fi

gcc --version | head -n1
ldd --version | head -n1 | cut -d" " -f2-  # glibc version
grep --version | head -n1
gzip --version | head -n1
cat /proc/version
m4 --version | head -n1
make --version | head -n1
patch --version | head -n1
echo Perl `perl -V:version`
sed --version | head -n1
tar --version | head -n1
echo "Texinfo: `makeinfo --version | head -n1`"
xz --version | head -n1

echo 'main(){}' > dummy.c && gcc -o dummy dummy.c
if [ -x dummy ]
  then echo "gcc compilation OK";
  else echo "gcc compilation failed"; fi
rm -f dummy.c dummy
EOF

bash version-check.sh
```

Соглашения, используемые в книге

Чтобы Вам легче было следовать инструкциям, здесь приводится разъяснение некоторых обозначений, используемых в книге Linux From Scratch.

```
./configure --prefix=/usr
```

Текст такого типа необходимо вводить так, как он напечатан, если явно не сказано иное. Также он будет использован в секциях объяснения, для подчеркивания вызываемой команды.

В некоторых случаях одна логическая строка разделена на две или более физические строки с помощью обратного слеша в конце строки.

```
CC="gcc -B/usr/bin/" ../binutils-2.18/configure \
  --prefix=/tools --disable-nls --disable-werror
```

Заметьте, что за обратным слешем сразу же идет перевод строки. Другие символы пробелов или табуляций приведут к неверным результатам.

```
install-info: unknown option '--dir-file=/mnt/lfs/usr/info/dir'
```

Текст такого типа (моноширинный текст) показывает вывод с экрана, обычно как результат выполненной команды. Этот формат также используется для выделения имен файлов, например /etc/ld.so.conf.

Курсив

Этот тип текста используется в книге для нескольких целей, в основном для выделения важных моментов и понятий.

http://www.linuxfromscratch.org/

Такой формат используется для гиперссылок, включающих ресурсы сообщества LFS, HOWTO, зеркала и другие веб-сайты.

```
cat > $LFS/etc/group << "EOF"
root:x:0:
bin:x:1:
......
EOF
```

Этот формат используется при создании конфигурационных файлов. Первая команда говорит системе создать файл $LFS/etc/group из того, что вводится в следующих строках вплоть до последовательности конца файла (End Of File, EOF). Эта секция чаще всего вводится как она есть.

<ЗАМЕНЯЕМЫЙ ТЕКСТ>

Такой формат используется для участков текста, которые не должны вводиться как есть или копироваться и вставляться.

[НЕОБЯЗАТЕЛЬНЫЙ ТЕКСТ]

Этот формат используется для участков текста, которые не являются обязательными.

passwd(5)

Такой тип текста используется для указания на определенную страницу руководства (man). Номер внутри скобок указывает секцию, в которой находится страница. Например, у **passwd** есть две страницы руководства. В соответствии с инструкциями LFS, эти две страницы будут расположены в /usr/share/man/man1/passwd.1 и /usr/share/man/man5/passwd.5. Когда книга использует passwd(5), это означает специальную отсылку к /usr/share/man/man5/passwd.5. **man passwd** напечатает первую найденную страницу руководства с именем «passwd», которой будет /usr/share/man/man1/passwd.1. В этом примере Вам необходимо выполнить **man 5 passwd** чтобы прочесть нужную страницу. Нужно отметить, что большинство страниц руководства не имеют дублирующихся имен в разных секциях. Поэтому **man <program name>**, скорее всего, подойдет в большинстве случаев.

Структура

Эта книга разделена на следующие части.

Часть I - Введение

Часть I объясняет несколько важных моментов, необходимых для установки LFS. Эта секция также содержит информацию о самой книге.

Часть II - Подготовка к сборке

Часть II описывает подготовку к процессу сборки—создание раздела, загрузка пакетов и компиляция временного инструментария.

Часть III - Сборка системы LFS

Часть III проводит читателя через процесс сборки LFS системы— компиляция и установка всех пакетов по одному, настройка загрузочных скриптов и установка ядра. Полученная Linux-система является хорошей базой, на которую можно установить дополнительное программное обеспечение, чтобы расширить систему как угодно. В конце книги приведен легкий в использовании глоссарий всех установленных программ, библиотек и важных файлов.

Предупреждения об ошибках

Программное обеспечение, используемое для создания LFS, постоянно обновляется и улучшается. Предупреждения безопасности и исправления ошибок могут появиться после выхода книги о LFS. Чтобы проверить, нужно ли обновить версию какого-либо пакета или инструкции его по сборке в связи с найденными уязвимостями и другими ошибками, пожалуйста, посетите *http://www.linuxfromscratch.org/lfs/errata/7.3/* перед началом сборки системы. Необходимо внимательно изучить все изменения и аккуратно применить их к соответствующей части книги на соответствующем этапе ее построения.

Часть I. Начало

Глава 1. Введение

1.1. Как собрать LFS-систему

Система LFS будет построена с использованием уже установленного дистрибутива Linux (такого как Debian, Mandriva, Red Hat или Suse). Эта существующая Linux-система (хост) будет использована как отправная точка, предоставляющая необходимые программы - компилятор, компоновщик и оболочку - для сборки новой системы. Выберите компонент «Разработка» при установке дистрибутива, чтобы иметь доступ к этим инструментам.

Вместо того, чтобы устанавливать отдельный дистрибутив на жесткий диск Вашего компьютера, Вы можете использовать LiveCD с дистрибутивом Linux.

Глава 2 этой книги описывает, как создать новый родной Linux-раздел и файловую систему на нем. Это место, где система LFS будет собрана и установлена. Глава 3 объясняет, какие пакеты и патчи необходимо загрузить, чтобы построить LFS-систему, и как сохранить их на новой файловой системе. Глава 4 рассказывает об установке правильного рабочего окружения. Пожалуйста, внимательно прочтите Глава 4, поскольку в ней говорится о нескольких важных моментах, кокторые Вам необходимо знать, прежде чем переходить к Chapter 5 и далее.

Chapter 5 описывает установку пакетов, формирующих базовую среду разработки (или набор инструментов), с помощью которых будет построена новая система в Глава 6. Некоторые из этих пакетов необходимы для разрешения циклических зависимостей—например, чтобы скомпилировать компилятор, Вам необходим компилятор.

Chapter 5 также расскажет Вам о том, как начерновую установить инструментарий, включая Binutils и GCC (начерновую означает, что далее эти два ключевых пакета будут переустановлены). Следующим шагом будет сборка Glibc, библиотеки языка C. Glibc будет скомпилирована с помощью программ, собранных на предыдущем шаге. Затем инструментарий будет пересобран для того, чтобы связать его динамически с только что скомпилированной Glibc. Следующие пакеты в Chapter 5 будут собраны с использованием этого инструментария. Когда это будет сделано, процесс сборки LFS больше не будет зависеть от хост-системы, исключая, конечно, запущенное ядро.

Усилия по тщательной изоляции новой системы от хост-дистрибутива могут показаться излишними. Полное техническое разъяснение причин, по которым это делается, представлены в Раздел 5.2, «Toolchain Technical Notes».

В Глава 6 система LFS будет полностью собрана. Команда **chroot** (change root, смена корня) будет использована для входа в виртуальное окружение и запуска новой оболочки, чьей корневой директорией будет установлен раздел LFS. Это очень похоже на перезагрузку и указание ядру использовать раздел LFS как корневой. Система не перезагружается, вместо этого используется **chroot**, так как создание загружаемой системы требует дополнительных усилий, которые на данном этапе не нужны. Главный плюс использования **chroot** - это то, что Вы можете спокойно продолжать пользоваться Вашей хост-системой, пока LFS собирается. Пока Вы ждете окончания компиляции пакета, Вы можете продолжать использовать Ваш компьютер как обычно.

Для завершения установки в Глава 7 будут установлены скрипты загрузки LFS-Bootscripts, а в Chapter 8 - ядро и загрузчик. Глава 9 содержит информацию по продолжению изучения LFS за пределами этой книги. После выполнения всех шагов, описанных здесь, компьютер наконец будет готов для перезагрузки в новую LFS-систему.

Это весь процесс в двух словах. Подробная информация о каждом шаге будет постепенно раскрываться в следующих главах и в описаниях пакетов. Вещи, кажущиеся сложными, буут подробно объяснены, и все будет раскладываться по полочкам по мере вашего погружения в увлекателное приключение LFS.

1.2. Нововведения в этом выпуске

Ниже приведен список пакетов и патчей, обновленных со времени прошлого выпуска книги.

Обновление до:

•
• Automake 1.13.1
• Binutils 2.23.1
• Bison 2.7
• Check 0.9.9
• Coreutils 8.21
• E2fsprogs 1.42.7
• Gawk 4.0.2
• GCC 4.7.2
• Gettext 0.18.2
• Glibc 2.17
• GMP 5.1.1
• Groff 1.22.2
• IPRoute2 3.8.0
• Kbd 1.15.5
• Kmod 12
• Less 451
• Libpipeline 1.2.2
• Linux 3.8.1
• Man-DB 2.6.3
• Man-pages 3.47
• MPC 1.0.1
• Patch 2.7.1
• Pkg-config 0.28
• Procps-ng 3.3.6
• Psmisc 22.20

- Sed 4.2.2
- TCL 8.6.0
- Texinfo 5.0
- Tzdata 2012j
- Udev 197 (извлечен из systemd-197)
- Util-Linux 2.22.2

Добавлены:

- bash-4.2-fixes-11.patch
- binutils-2.23.1-testsuite_fix-1.patch
- coreutils-8.21-i18n-1.patch
- kbd-1.15.5-backspace-1.patch
- make-3.82-upstream_fixes-3.patch

Удалены:

- bash-4.2-fixes-8.patch
- binutils-2.22-build_fix-1.patch
- coreutils-8.19-i18n-1.patch
- gcc-4.7.1-startfiles_fix-1.patch
- glibc-2.16.0-fix_test_installation-1.patch
- glibc-2.16.0-res_query_fix-1.patch
- kbd-1.15.3-backspace-1.patch
- kbd-1.15.3-upstream_fixes-1.patch
- kmod-9-testsuite-1.patch
- make-3.82-upstream_fixes-2.patch
- patch-2.6.1-test_fix-1.patch
- procps-3.2.8-fix_HZ_errors-1.patch
- procps-3.2.8-watch_unicode-1.patch
- sed-4.2.1-testsuite_fixes-1.patch

1.3. Список изменений

Эта книга Linux From Scratch имеет версию 7.3 и была выпущена Март 1, 2013. Если с момента выпуска прошло более шести месяцев, возможно, уже доступна более новая версия. Вы можете проверить ее наличие на одном из зеркал: *http://www. linuxfromscratch.org/mirrors.html*.

Ниже перечислены изменения, произошедшие в книге по сравнению с предыдущим выпуском.

Changelog Entries:

- 2013-03-01
  - [bdubbs] - Upgrade to Linux-3.8.1. Fixes *#3295*.

- 2013-02-27
  - [bdubbs] - Fix a potential test error in procps-ng. Thanks to Pierre Labastie for the patch. Fixes *#3293*.
- 2013-02-26
  - [bdubbs] - Upgrade to File-5.13. Fixes *#3292*.
- 2013-02-26
  - [ken] - Remove the obsolete resizecons program from kbd, again.
- 2013-02-24
  - [matthew] - Upgrade to IPRoute2-3.8.0. Fixes *#3291*.
  - [matthew] - Upgrade to Linux-3.8. Fixes *#3290*.
- 2013-02-19
  - [bdubbs] - Update file name for adjusting CD-ROM rules mode in section 7.5.1.
- 2013-02-18
  - [bdubbs] - Upgrade to Coreutils-8.21. Fixes *#3286*.
  - [bdubbs] - Upgrade to Texinfo-5.0. Fixes *#3284*.
  - [bdubbs] - Upgrade to Linux-3.7.9. Fixes *#3281*.
- 2013-02-13
  - [matthew] - Upgrade to Man-pages-3.47. Fixes *#3284*.
  - [matthew] - Upgrade to GMP-5.1.1. Fixes *#3283*.
  - [matthew] - Use latest Coreutils-i18n patch from Fedora. Fixes *#3282*.
  - [matthew] - Upgrade to Linux-3.7.7. Fixes *#3281*.
  - [matthew] - Upgrade to Groff-1.22.2. Fixes *#3280*.
- 2013-01-30
  - [bdubbs] - Change ncurses instructions to create and install .pc files.
- 2013-01-29
  - [matthew] - Upgrade to Man-Pages-3.46. Fixes *#3278*.
  - [matthew] - Upgrade to Linux-3.7.5. Fixes *#3277*.
- 2013-01-27
  - [bdubbs] - Update to pkg-config-0.28. Fixes *#3276*
- 2013-01-25
  - [bdubbs] - Revise procps-ng install instructions to place files in the proper locations.
- 2013-01-24
  - [bdubbs] - Remove bashisms from init-functions file in the boot scripts.
- 2013-01-24
  - [bdubbs] - Upgrade to e2fsprogs-1.42.7. Fixes *#3274*.
- 2013-01-22
  - [bdubbs] - Upgrade to Linux-3.7.4. Fixes *#3273*.
- 2013-01-21
  - [bdubbs] - Upgrade to Procps-ng-3.3.6. Fixes *#3095*.

- 2013-01-20
  - [matthew] - Upgrade to Linux-3.7.3. Fixes *#3272*.
- 2013-01-11
  - [bdubbs] - Revised explanation for /etc/modprobe.conf. Fixes *#3270*.
  - [bdubbs] - Update udev-lfs init-net-rules.sh script for "en*" devices introduced in systemd-197.
- 2013-01-09
  - [bdubbs] - Reformat 'Rebooting the System' recommendations.
  - [bdubbs] - Update udev-lfs scripts. Update to systemd-197.
- 2013-01-02
  - [matthew] - Upgrade to Bash-4.2.42. Fixes *#3268*.
  - [matthew] - Upgrade to Groff-1.22.1. Fixes *#3266*.
  - [matthew] - Upgrade to Automake-1.13.1. Fixes *#3265*.
  - [matthew] - Upgrade to Coreutils-8.20. Fixes *#3215*.
- 2012-12-31
  - [bdubbs] - Add patch to fix binutils test suite. All binutils tests now pass, so remove the "-k" flag from test invocation. Thanks to Pierre Labastie for the patch.
- 2012-12-30
  - [matthew] - Upgrade to Kbd-1.15.5. Fixes *#3239*.
  - [matthew] - All E2fsprogs tests pass now, so remove the "-k" flag from its invocation.
- 2012-12-28
  - [bdubbs] - Put traceroute in /bin for consistency. Fixes *#3264*.
  - [bdubbs] - Fix the location for mounting /dev/shm inside chroot. Fixes *#3258*.
  - [matthew] - Move the build of Procps to before E2fsprogs as the latter requires **ps** to be available during its testsuite run.
  - [matthew] - Upgrade to Gettext-0.18.2. Fixes *#3263*.
  - [matthew] - Upgrade to Gawk-4.0.2. Fixes *#3262*.
  - [matthew] - Upgrade to Glibc-2.17. Fixes *#3261*.
  - [matthew] - Upgrade to Sed-4.2.2. Fixes *#3260*.
  - [matthew] - Upgrade to GMP-5.1.0. Fixes *#3259*.
  - [matthew] - Upgrade to Tcl-8.6.0. Fixes *#3257*.
  - [matthew] - Upgrade to Man-Pages-3.45. Fixes *#3256*.
- 2012-12-18
  - [bdubbs] - Upgrade to Automake-1.12.6. Fixes *#3253*.
  - [bdubbs] - Upgrade to Linux-3.7.1. Fixes *#3254*.
- 2012-12-16
  - [matthew] - Upgrade to Util-Linux-2.22.2. Fixes *#3250*.
  - [matthew] - Remove a few entries from the acronym list as they are no longer referenced in the book. Fixes *#3249*. Thanks to Chris Staub for the patch.

- [matthew] - Upgrade to Bison-2.7. Fixes *#3247*.
- 2012-12-12
  - [matthew] - Upgrade to IPRoute2-3.7.0. Fixes *#3246*.
  - [matthew] - Update Check's list of installed programs. Fixes *#3245*. Thanks to Chris Staub for the patch.
  - [matthew] - All of Flex's tests pass, so remove the "-k" option to its testsuite invocation. Fixes *#3244*.
  - [matthew] - Upgrade to E2fsprogs-1.42.6. Fixes *#3243*.
  - [matthew] - Remove redundant --enable-addons parameter to Glibc's configure script. Fixes *#3241*.
  - [matthew] - Update IRC server information. Fixes *#3240*. Thanks to Chris Staub for the patch.
  - [matthew] - Upgrade to Kmod-12. Fixes *#3238*.
  - [matthew] - Upgrade to Linux-3.7. Fixes *#3237*.
- 2012-12-03
  - [bdubbs] - Fix build issues in makefile for systemd-196/udev-lfs-196.
- 2012-11-28
  - [bdubbs] - Update makefile and instructions for systemd-196/udev-lfs-196.
- 2012-11-27
  - [matthew] - Upgrade to Linux-3.6.8. Fixes *#3234*.
- 2012-11-26
  - [bdubbs] - Re-emphasize host system requirements in Chapter 5 General Compilation Instructions.
- 2012-11-22
  - [bdubbs] - Upgrade to systemd-196/udev-lfs-196. Fixes *#3233*.
- 2012-11-18
  - [matthew] - Upgrade to Linux-3.6.7. Fixes *#3232*.
  - [matthew] - Upgrade to Automake-1.12.5. Fixes *#3231*.
- 2012-11-14
  - [matthew] - Upgrade to Tzdata-2012j. Fixes *#3227*.
  - [matthew] - Upgrade to Binutils-2.23.1. Fixes *#3226*.
- 2012-11-13
  - [matthew] - Upgrade to Tcl-8.5.13. Fixes *#3224*.
  - [matthew] - Upgrade to Kmod-11. Fixes *#3223*.
  - [matthew] - Upgrade to Man-Pages-3.44. Fixes *#3222*.
  - [matthew] - Upgrade to Bison-2.6.5. Fixes *#3221*.
  - [matthew] - Upgrade to Tzdata-2012i. Fixes *#3220*.
  - [matthew] - Upgrade to Linux-3.6.6. Fixes *#3219*.
- 2012-11-03
  - [matthew] - Upgrade to Perl-5.16.2. Fixes *#3218*.

- [matthew] - Upgrade to Bash-4.2.39. Fixes *#3217*.
- 2012-11-02
  - [matthew] - Change Freshmeat.net references to Freecode. Thanks to Chris Staub for the report and patch. Fixes *#3216*.
  - [matthew] - Upgrade to Check-0.9.9. Fixes *#3214*.
  - [matthew] - Upgrade to Bison-2.6.4. Fixes *#3212*.
  - [matthew] - Upgrade to Linux-3.6.5. Fixes *#3211*.
  - [matthew] - Upgrade to Tzdata-2012h. Fixes *#3209*.
  - [matthew] - Upgrade to Man-Pages-3.43. Fixes *#3208*.
  - [matthew] - Clean up a couple of instructions for Flex, made possible by the upgrade to Flex-2.5.37. Fixes *3206* and *3210*.
- 2012-11-01
  - [bdubbs] - Upgrade to systemd/lfs-udev-195. Fixes *#3197*.
- 2012-10-15
  - [bdubbs] - Add notes to the gcc and binutils sections in Chapter 6 about "link time optimization" and the extra files built by gcc. Fixes *#3200*.
  - [bdubbs] - Upgrade to tzdata-2012f. Fixes *#3205*.
  - [bdubbs] - Update installed program description for several packages. Thanks to Chris Staub for the patch. Fixes *#3203*.
- 2012-10-14
  - [bdubbs] - Remove utmpdump from sysvinit because it is now installed by util-linux. Thanks to Chris Staub for the patch. Fixes *#3202*.
  - [bdubbs] - Change procps to not install the kill program that is now installed by util-linux. Fixes *#3201*.
  - [bdubbs] - Update to util-linux-2.22.1. Fixes *#3199*.
  - [bdubbs] - Update to linux-3.6.2. Fixes *#3198*.
  - [bdubbs] - Add boot/shutdown script customization instructions.
- 2012-10-02
  - [matthew] - Upgrade to IPRoute2-3.6.0. Fixes *#3196*.
  - [matthew] - Upgrade to Linux-3.6. Fixes *#3195*.
  - [matthew] - Upgrade to Psmisc-22.20. Fixes *#3194*.
  - [matthew] - Upgrade to Patch-2.7.1. Fixes *#3193*.
  - [matthew] - Add a patch to allow Kmod's testsuite to pass on 32-bit systems. Fixes *#3191*.
  - [matthew] - Upgrade to GCC-4.7.2. Fixes *#3190*.
  - [matthew] - Use latest upstream fixes patch for Make, which enables WebKitGtk to build with parallel builds. Fixes *#3188*.
  - [matthew] - Upgrade to Man-DB-2.6.3. Fixes *#3187*.
  - [matthew] - Upgrade to Libpipeline-1.2.2. Fixes *#3186*.
  - [matthew] - Upgrade to Automake-1.12.4. Fixes *#3185*.

- [matthew] - Fix Flex instructions; the directory creation for its documentation is performed by the Makefile since r9999.
- 2012-09-27
  - [bdubbs] - Update to systemd/udev-lfs-193. Fixes *#3192*.
- 2012-09-27
  - [bdubbs] - Update to systemd/udev-lfs-192. Fixes *#3189*.
- 2012-09-16
  - [matthew] - Upgrade to Patch-2.7. Fixes *#3182*.
  - [matthew] - Upgrade to MPC-1.0.1. Fixes *#3181*.
  - [matthew] - Upgrade to Kmod-10. Fixes *#3180*.
  - [matthew] - Fix link to Linux User's Guide. Fixes *#3179*.
  - [matthew] - Upgrade to Less-451. Fixes *#3178*.
  - [matthew] - Upgrade to Bash-4.2.37. Fixes *#3177*.
  - [matthew] - Upgrade to Pkg-Config-0.27.1. Fixes *#3174*.
  - [matthew] - Upgrade to Linux-3.5.4. Fixes *#3173*.
- 2012-09-05
  - [bdubbs] - Add udevadm trigger --action=change line to udev script to support initramfs better.
- 2012-09-04
  - [bdubbs] - Update grub packages and naming conventions example.
  - [bdubbs] - Update to util-linux-2.22. Fixes *#3145*.
- 2012-09-02
  - [bdubbs] - Add a patch to Chapter 6 glibc to fix the test-installation.pl script instead of just preventing it from running. Fixes *#3175*.
  - [bdubbs] - Update to systemd-189. Fixes *#3167*.
- 2012-09-01
  - [bdubbs] - LFS-7.2 released.

1.4. Ресурсы

1.4.1. FAQ

Если во время сборки LFS Вы получаете ошибки, у Вас есть вопросы, или считаете, что в книге опечатка, пожалуйста, ознакомьтесь со списком Frequently Asked Questions (FAQ), который находятся по адресу *http://www.linuxfromscratch.org/faq/*.

1.4.2. Списки рассылки

Сервер `linuxfromscratch.org` поддерживает несколько списков рассылки, используемых для разработки проекта LFS. Это списки главной разработки и поддержки, а также некоторые другие. Если FAQ не решил Вашей проблемы, следующим шагом должен стать поиск по спискам рассылки на *http://www. linuxfromscratch.org/search.html*.

Информация по различным спискам, правила подписки, расположение архивов и многое другое доступно здесь: *http://www.linuxfromscratch.org/mail.html*.

1.4.3. IRC

Некоторые члены сообщества LFS имеют возможность помочь посредством Internet Relay Chat (IRC). Перед тем, как воспользоваться их поддержкой, убедитесь, что ваш вопрос уже не отвечен в LFS FAQ или в архивах почтовой рассылки. Канал поддержки называется #LFS-support и расположен на сервере `irc.freenode.net`.

1.4.4. Зеркала

Проект LFS имеет множество зеркал по всему миру, чтобы сделать сделать доступ к веб-сайту и загрузку необходимых пакетов более удобными. Пожалуйста, посетите веб-сайт LFS *http://www.linuxfromscratch.org/mirrors.html*, чтобы получить список текущих активных зеркал.

1.4.5. Контактная информация

Пожалуйста, направляйте все свои вопросы и пожелания в один из списков рассылки LFS (см. выше).

1.5. Помощь

Если у Вас возникли проблемы или какие-то вопросы при работе с этой книгой, пожалуйста, проверьте страницу FAQ *http://www.linuxfromscratch.org/faq/#generalfaq*. Вопрос, скорее всего, уже отвечен там. Если Вашего вопроса нет на этой странице, постарайтесь найти источник проблемы. Следующий совет поможет Вам в поиске правильного направления при решении проблемы: *http://www.linuxfromscratch.org/hints/downloads/files/errors.txt*.

Если Вы не нашли своей проблемы в FAQ, поищите решение в списках рассылки *http://www.linuxfromscratch.org/search.html*.

LFS также имеет многочисленное сообщество, готовое предложить Вам свою помощь через списки рассылки и IRC (см. Раздел 1.4, «Ресурсы»). К сожалению, мы получаем некоторые вопросы каждый день, и большинство из них может быть легко решено прочтением FAQ и поиском по спискам рассылки. Пожалуйста, прежде чем обращаться к нам, попробуйте сами исследовать проблему. Это поможет нам сконцентрироваться на действительно серьезных и сложных вопросах. Если Вы все же так и не нашли решения, пожалуйста включите в Ваш запрос к нам всю необходимую информацию.

1.5.1. Необходимые данные

Кроме краткого описания проблемы, вот необходимые моменты, которые должны быть в Вашем запросе:

• Версия используемой книги (в данном случае 7.3)

• Хост-дистрибутив и его версия, используемая для сборки LFS

• Вывод скрипта Раздел vii, «Требования к хост-системе» [xx]

• Название пакета или секции, где возникла проблема

- Точное сообщение об ошибке или ее точное описание
- Замечание, где Вы отклонялись от книги и как

> **Замечание**
>
> То, что Вы отклонялись от действий, описанных в книге, *не* значит, что мы не станем Вам помогать. В конце концов, LFS - это Ваша система. Ваше сообщение о изменениях в процедуре сборки поможет нам оценить и вычислить возможные причины Вашей пролблемы.

1.5.2. Проблемы при выполнении configure

Если что-то происходит не так при выполнении скрипта **configure**, просмотрите файл config.log. Он может содержать ошибки, произошедшие во время **configure**, которые не были выведены на экран. Включите *уместные* строки, если просите помощи.

1.5.3. Проблемы компиляции

Как вывод команды на экран, так и содержимое различных файлов может быть полезным при определении источника ошибок компиляции. Вывод скрипта **configure** и запуска **make** может быть уместным. Совсем не стоит включать полный вывод, выберите только необходимую и уместную информацию. Ниже пример части из вывода **make**, которую нужно включить в просьбу о помощи:

```
gcc -DALIASPATH=\"/mnt/lfs/usr/share/locale:.\"
-DLOCALEDIR=\"/mnt/lfs/usr/share/locale\"
-DLIBDIR=\"/mnt/lfs/usr/lib\"
-DINCLUDEDIR=\"/mnt/lfs/usr/include\" -DHAVE_CONFIG_H -I. -I.
-g -O2 -c getopt1.c
gcc -g -O2 -static -o make ar.o arscan.o commands.o dir.o
expand.o file.o function.o getopt.o implicit.o job.o main.o
misc.o read.o remake.o rule.o signame.o variable.o vpath.o
default.o remote-stub.o version.o opt1.o
-lutil job.o: In function `load_too_high':
/lfs/tmp/make-3.79.1/job.c:1565: undefined reference
to `getloadavg'
collect2: ld returned 1 exit status
make[2]: *** [make] Error 1
make[2]: Leaving directory `/lfs/tmp/make-3.79.1'
make[1]: *** [all-recursive] Error 1
make[1]: Leaving directory `/lfs/tmp/make-3.79.1'
make: *** [all-recursive-am] Error 2
```

В подобном случае большинство включат в свое сообщение только последнюю строку:

```
make [2]: *** [make] Error 1
```

Этой информации недостаточно, чтобы корректно идентифицировать проблему, поскольку она просто говорит, что что-то пошло не так, а не *что* пошло не так. В данном примере необходимо включать в свое сообщение всю секцию, так как она включает в себя выполненную команду и связанные с ней ошибки.

Великолепная статья о том, как правильно просить помощи в Интернет, доступна здесь: *http://catb.org/~esr/faqs/smart-questions.html*. Прочитайте ее и следуйте советам, это увеличит Ваши шансы на получение помощи.

Часть II. Подготовка к сборке

Глава 2. Подготовка нового раздела

2.1. Вступление

В этой главе будет подготовлен раздел под будущую LFS-систему. Мы создадим сам раздел, файловую систему на нем и примонтируем его.

2.2. Создание нового раздела

Как и большинство других операционных систем, LFS обычно устанавливается на отдельный раздел жесткого диска. Рекомендуемый подход при сборке LFS-системы - использовать доступный свободный раздел, или, если у Вас достаточно неразмеченного пространства, создать новый.

Минимальная система требует раздела размером около 2.8 гигабайт (GB). Этого должно хватить для сохранения всех архивов с исходными текстами и компиляции пакетов. Однако, если Вы собираетесь использовать LFS как основную систему, скорее всего Вы будете устанавливать дополнительное программное обеспечение, которое потребует дополнительного места на диске. Раздела размером в 10 GB должно быть достаточно для дальнейшего расширения системы. LFS-система не будет полностью занимать все это место. Большая часть из требуемого необходима для предоставления свободного временного хранилища. Компиляция пакета может потребовать огромного свободного места на диске, которое будет освобождено после его установки.

Поскольку оперативной памяти не всегда может быть достаточно для процесса компиляции, хорошей идеей будет использовать небольшой раздел диска как раздел подкачки. Он используется ядром для сохранения редко используемых данных, выгрузка которых из оперативной памяти позволяет выделить больше места в ней для активных процессов. LFS-система может использовать тот же раздел подкачки, что и хост-система, в этом случае не обязательно создавать новый.

Запустите программу разметки диска, например **cfdisk** или **fdisk**, и передайте ей в параметрах имя жесткого диска, на котором хотите создать раздел—например, /dev/hda для первичного Integrated Drive Electronics (IDE) диска. Создайте родной Linux-раздел и раздел подкачки, если необходимо. Пожалуйста, прочтите cfdisk(8) или fdisk(8) если не знаете, как пользоваться этими программами.

> **Замечание**
>
> For experienced users, other partitioning schemes are possible. The new LFS system can be on a software *RAID* array or an *LVM* logical volume. However, some of these options require an *initramfs*, which is an advanced topic. These partitioning methodologies are not recommended for first time LFS users.

Запомните обозначение нового раздела (например, hda5). В этой книге он будет подразумеваться под разделом LFS. Также запомните обозначение раздела подкачки. Эти имена будут необходимы в дальнейшем, в том числе и для файла /etc/fstab.

2.2.1. Вопросы разметки диска

Просьбы помочь с разметкой диска часто встречаются в списках рассылки LFS. Это весьма субъективный вопрос. По умолчанию большинство дистрибутивов используют весь диск за исключением одного небольшого раздела подкачки. Это не является оптимальным для LFS по нескольким причинам. Это уменьшает гибкость, делает совместное использование данных между несколькими дистрибутивами или сборками LFS более сложным и затрудняет возможность резервного копирования.

2.2.1.1. Корневой раздел

Корневой раздел LFS (не перепутайте с директорией /root) размером около 10 гигабайт должен быть хорошим компромиссом для большинства систем. Этого будет достаточно для сборки LFS и большей части BLFS, но останется еще место, чтобы создать несколько разделов для экспериментов.

2.2.1.2. Раздел подкачки

Большинство дистрибутивов автоматически создают раздел подкачки. В большинстве случаев рекомендуемый размер раздела - удвоенный объем оперативной памяти, хотя вряд ли Вам понадобится столько. Если место на диске ограничено, сделайте раздел подкачки размером в два гигабайта и следите за процессом подкачивания.

Подкачка - это плохо. Обычно Вы можете понять, что система включила механизм подкачки, просто слыша активную работу диска и замечая, как ситема реагирует на Ваши действия. Первым делом в такой ситуации необходимо проверить, не была ли введена неверная команда, например запрос на редактирование гигабайтного файла. Если подкачка становится нормальным поведением, лучшим решением будет прикупить больше оперативной памяти для системы.

2.2.1.3. Дополнительные разделы

Можно создать еще несколько других разделов, которые не являются обязательными, но о них стоит задуматься, планируя разметку диска. Следующий список не является всеобъемлющим, но вполне может рассматриваться как руководство.

- /boot – Весьма рекомендуется. На этом разделе можно хранить ядра и другую загрузочную информацию. Чтобы минимизировать потенциальные проблемы, связанные с загрузкой с больших дисков, сделайте этот раздел первичным и расположьте его в начале Вашего первого жесткого диска. Вполне достаточно будет выделить под него около 100 мегабайт.

- /home – Весьма рекомендуется. Стоит использовать один домашний раздел для нескольких дистрибутивов или установленных сборок LFS. Размер обычно очень большой, выделите под него все возможное доступное место.

- /usr – Отдельный раздел /usr обычно используется в конфигурации с сервером, управляющим тонкими клиентами или бездисковыми рабочими станциями. Он не является необходимым для LFS. Размера в пять гигабайт должно хватить для большинства установок.

- /opt – Эта директория будет очень полезна для BLFS. Некоторые большие пакеты, такие, как KDE или GNOME, могут быть установлены в нее, что снимает необходимость расположения их файлов в дереве каталогов /usr. Если Вы собираетесь использовать этот раздел, выделите под него от пяти до десяти гигабайт.

- /tmp – Отдельный раздел для директории /tmp выделяется редко, но будет полезен при настройке тонких клиентов. Данный раздел, если он будет использоваться, не стоит делать больше нескольких гигабайт.

- /usr/src – Этот раздел будет полезно использовать для хранения исходных кодов книги BLFS. Его можно сделать общим между несколькими сборками LFS. Также можно прямо на нем и собирать пакеты BLFS. Раздел размером в 30-50 гигабайт позволит Вам чувствовать себя достаточно свободно.

Любой отдельный раздел, который Вы хотите автоматически подключать при загрузке, необходимо указать в файле /etc/fstab. Подробно о том, как это делать, будет сказано в Раздел 8.2, «Creating the /etc/fstab File».

2.3. Создание файловой системы на разделе

Теперь, когда у нас есть новый чистый раздел, на нем можно создать файловую систему. Самой широкораспространенной в мире Linux файловой системой является вторая расширенная система (ext2, Extended 2 File System), но, с широким распространением жестких дисков большой вместимости, журналируемые файловые системы стремительно набирают популярность. Третья расширенная файловая система (ext3, Extended 3 File System) самая популярная модернизация ext2, которая добавляет возможность журналирования и совместима с утилитами E2fsprogs. Мы создадим файловую систему ext3. Инструкции по созданию других файловых систем можно найти здесь: *http://www.linuxfromscratch.org/blfs/view/svn/postlfs/filesystems.html*.

Чтобы создать файловую систему ext3 на разделе LFS, выполните:

```
mke2fs -jv /dev/<xxx>
```

Замените *<xxx>* на имя раздела LFS (hda5 в нашем предыдущем примере).

> **Замечание**
>
> Некоторые хост-системы используют собственные расширения в утилитах созданиях файловых систем (E2fsprogs). Это может вызвать проблемы при загрузке в вашу свежую систему LFS в Главе 9, так как эти расширения не будут поддерживаться установленными в LFS E2fsprogs; Вы получите ошибку наподобие «unsupported filesystem features, upgrade your e2fsprogs». Чтобы проверить, использует ли Ваша хост-система собственные расширения, выполните следующую команду:
>
> ```
> debugfs -R feature /dev/<xxx>
> ```
>
> Если вывод содержит другие возможности, кроме has_journal, ext_attr, resize_inode, dir_index, filetype, sparse_super, large_file или needs_recovery, значит Ваш дистрибутив использует собственные расширения. В таком случае, чтобы предотвратить будущие проблемы, Вам стоит скомпилировать пакет E2fsprogs и использовать полученные программы для повторного создания файловой системы на разделе LFS:
>
> ```
> cd /tmp
> tar -xzvf /path/to/sources/e2fsprogs-1.42.7.tar.gz
> cd e2fsprogs-1.42.7
> mkdir -v build
> cd build
> ../configure
> make #note that we intentionally don't 'make install' here!
> ./misc/mke2fs -jv /dev/<xxx>
> cd /tmp
> rm -rfv e2fsprogs-1.42.7
> ```

Если Вы используете уже имеющийся раздел подкачки , нет необходимости форматировать его. Если же Вы создали новый, необходимо его инициализировать следующей командой:

```
mkswap /dev/<yyy>
```

Замените <yyy> именем раздела подкачки.

2.4. Монтирование нового раздела

Сейчас, когда новый раздел был создан и отформатирован в необходимую файловую систему, необходимо сделать его доступным. Для этого раздел должен быть примонтирован в выбранную точку монтирования. В дальнейшем в этой книге предполагается, что файловая система примонтирована к /mnt/lfs, однако Вы полностью свободны в выборе точки монтирования.

Выберите точку монтирования и присвойте путь до нее переменной LFS командой:

```
export LFS=/mnt/lfs
```

Далее, создайте точку монтирования и примонтируйте файловую систему LFS командой:

```
mkdir -pv $LFS
mount -v -t ext3 /dev/<xxx> $LFS
```

Замените <*xxx*> на имя раздела LFS.

Если Вы используете несколько разделов для LFS (например, один для / и другой для /usr), примонтируйте их с помощью:

```
mkdir -pv $LFS
mount -v -t ext3 /dev/<xxx> $LFS
mkdir -v $LFS/usr
mount -v -t ext3 /dev/<yyy> $LFS/usr
```

Замените <*xxx*> и <*yyy*> на правильные имена разделов.

Убедитесь, что новый раздел не подключен с слишком строгими правами (такими как опции nosuid, nodev, или noatime). Запустите **mount** без параметров, чтобы увидеть, какие опции были установлены для раздела LFS. Если nosuid, nodev, и/или noatime установлены, раздел необходимо перемонтировать.

Если Вы используете раздел подкачки, убедитесь, что он включен командой **swapon**:

```
/sbin/swapon -v /dev/<zzz>
```

Замените <*zzz*> на имя раздела подкачки.

Теперь, когда подготовлено место для работы, пришло время загрузить пакеты.

Глава 3. Пакеты и патчи

3.1. Introduction

This chapter includes a list of packages that need to be downloaded in order to build a basic Linux system. The listed version numbers correspond to versions of the software that are known to work, and this book is based on their use. We highly recommend against using newer versions because the build commands for one version may not work with a newer version. The newest package versions may also have problems that require work-arounds. These work-arounds will be developed and stabilized in the development version of the book.

Download locations may not always be accessible. If a download location has changed since this book was published, Google (*http://www.google.com/*) provides a useful search engine for most packages. If this search is unsuccessful, try one of the alternative means of downloading discussed at *http://www.linuxfromscratch.org/lfs/packages.html#packages*.

Downloaded packages and patches will need to be stored somewhere that is conveniently available throughout the entire build. A working directory is also required to unpack the sources and build them. `$LFS/sources` can be used both as the place to store the tarballs and patches and as a working directory. By using this directory, the required elements will be located on the LFS partition and will be available during all stages of the building process.

To create this directory, execute the following command, as user `root`, before starting the download session:

```
mkdir -v $LFS/sources
```

Make this directory writable and sticky. «Sticky» means that even if multiple users have write permission on a directory, only the owner of a file can delete the file within a sticky directory. The following command will enable the write and sticky modes:

```
chmod -v a+wt $LFS/sources
```

An easy way to download all of the packages and patches is by using *wget-list* as an input to **wget**. For example:

```
wget -i wget-list -P $LFS/sources
```

Additionally, starting with LFS-7.0, there is a separate file, *md5sums*, can be used to verify that all the correct packages are available before proceeding. Place that file in `$LFS/sources` and run:

```
pushd $LFS/sources
md5sum -c md5sums
popd
```

3.2. Все пакеты

Загрузите или получите иным способом нижеследующие пакеты:

• **Autoconf (2.69) - 1,186 KB:**
Домашняя страница: *http://www.gnu.org/software/autoconf/*
Загрузить: *http://ftp.gnu.org/gnu/autoconf/autoconf-2.69.tar.xz*
MD5 сумма: `50f97f4159805e374639a73e2636f22e`

- **Automake (1.13.1) - 1,392 KB:**

Домашняя страница: *http://www.gnu.org/software/automake/*

Загрузить: *http://ftp.gnu.org/gnu/automake/automake-1.13.1.tar.xz*

MD5 сумма: a60380ab11e1481376b7747d1b42ced2

- **Bash (4.2) - 6,845 KB:**

Домашняя страница: *http://www.gnu.org/software/bash/*

Загрузить: *http://ftp.gnu.org/gnu/bash/bash-4.2.tar.gz*

MD5 сумма: 3fb927c7c33022f1c327f14a81c0d4b0

- **Binutils (2.23.1) - 20,953 KB:**

Домашняя страница: *http://www.gnu.org/software/binutils/*

Загрузить: *http://ftp.gnu.org/gnu/binutils/binutils-2.23.1.tar.bz2*

MD5 сумма: 33adb18c3048d057ac58d07a3f1adb38

- **Bison (2.7) - 1,735 KB:**

Домашняя страница: *http://www.gnu.org/software/bison/*

Загрузить: *http://ftp.gnu.org/gnu/bison/bison-2.7.tar.xz*

MD5 сумма: 234cdfac99257cf99ac4a03c898f37b9

- **Bzip2 (1.0.6) - 764 KB:**

Домашняя страница: *http://www.bzip.org/*

Загрузить: *http://www.bzip.org/1.0.6/bzip2-1.0.6.tar.gz*

MD5 сумма: 00b516f4704d4a7cb50a1d97e6e8e15b

- **Check (0.9.9) - 589 KB:**

Домашняя страница: *http://check.sourceforge.net/*

Загрузить: *http://sourceforge.net/projects/check/files/check/0.9.9/check-0.9.9.tar.gz*

MD5 сумма: f3702f2fcfc19ce3f62dca66c241a168

- **Coreutils (8.21) - 5,248 KB:**

Домашняя страница: *http://www.gnu.org/software/coreutils/*

Загрузить: *http://ftp.gnu.org/gnu/coreutils/coreutils-8.21.tar.xz*

MD5 сумма: 065ba41828644eca5dd8163446de5d64

- **DejaGNU (1.5) - 563 KB:**

Домашняя страница: *http://www.gnu.org/software/dejagnu/*

Загрузить: *http://ftp.gnu.org/gnu/dejagnu/dejagnu-1.5.tar.gz*

MD5 сумма: 3df1cbca885e751e22d3ebd1ac64dc3c

- **Diffutils (3.2) - 1,976 KB:**

Домашняя страница: *http://www.gnu.org/software/diffutils/*

Загрузить: *http://ftp.gnu.org/gnu/diffutils/diffutils-3.2.tar.gz*

MD5 сумма: 22e4deef5d8949a727b159d6bc65c1cc

- **E2fsprogs (1.42.7) - 5,856 KB:**

Домашняя страница: *http://e2fsprogs.sourceforge.net/*

Загрузить: *http://prdownloads.sourceforge.net/e2fsprogs/e2fsprogs-1.42.7.tar.gz*

MD5 сумма: a1ec22ef003688dae9f76c74881b22b9

- **Expect (5.45) - 614 KB:**

Домашняя страница: *http://expect.sourceforge.net/*

Загрузить: *http://prdownloads.sourceforge.net/expect/expect5.45.tar.gz*

MD5 сумма: 44e1a4f4c877e9ddc5a542dfa7ecc92b

- **File (5.13) - 627 KB:**

Домашняя страница: *http://www.darwinsys.com/file/*
Загрузить: *ftp://ftp.astron.com/pub/file/file-5.13.tar.gz*
MD5 сумма: d60c1364ba956eff7d21f8250808fc6d

> ☞ **Замечание**
>
> File (5.13) может быть недоступен по указанному расположению. Администратор сайта сразу удаляет старые версии пакета, как только выходят новые. Список альтернативных мест скачивания, которые могут иметь необходимую версию пакета, расположен здесь: *http://www. linuxfromscratch.org/lfs/download.html#ftp*.

- **Findutils (4.4.2) - 2,100 KB:**

Home page: *http://www.gnu.org/software/findutils/*
Download: *http://ftp.gnu.org/gnu/findutils/findutils-4.4.2.tar.gz*
MD5 sum: 351cc4adb07d54877fa15f75fb77d39f

- **Flex (2.5.37) - 1,280 KB:**

Home page: *http://flex.sourceforge.net*
Download: *http://prdownloads.sourceforge.net/flex/flex-2.5.37.tar.bz2*
MD5 sum: c75940e1fc25108f2a7b3ef42abdae06

- **Gawk (4.0.2) - 1,589 KB:**

Home page: *http://www.gnu.org/software/gawk/*
Download: *http://ftp.gnu.org/gnu/gawk/gawk-4.0.2.tar.xz*
MD5 sum: 8a9b2f1170ac9dcd3eb13716b5ec4021

- **GCC (4.7.2) - 80,942 KB:**

Home page: *http://gcc.gnu.org/*
Download: *http://ftp.gnu.org/gnu/gcc/gcc-4.7.2/gcc-4.7.2.tar.bz2*
MD5 sum: cc308a0891e778cfda7a151ab8a6e762

- **GDBM (1.10) - 640 KB:**

Home page: *http://www.gnu.org/software/gdbm/*
Download: *http://ftp.gnu.org/gnu/gdbm/gdbm-1.10.tar.gz*
MD5 sum: 88770493c2559dc80b561293e39d3570

- **Gettext (0.18.2) - 15,330 KB:**

Home page: *http://www.gnu.org/software/gettext/*
Download: *http://ftp.gnu.org/gnu/gettext/gettext-0.18.2.tar.gz*
MD5 sum: 0c86e5af70c195ab8bd651d17d783928

- **Glibc (2.17) - 10,725 KB:**

Home page: *http://www.gnu.org/software/libc/*
Download: *http://ftp.gnu.org/gnu/glibc/glibc-2.17.tar.xz*
MD5 sum: 87bf675c8ee523ebda4803e8e1cec638

- **GMP (5.1.1) - 1,771 KB:**

Home page: *http://www.gnu.org/software/gmp/*
Download: *ftp://ftp.gmplib.org/pub/gmp-5.1.1/gmp-5.1.1.tar.xz*
MD5 sum: 485b1296e6287fa381e6015b19767989

- **Grep (2.14) - 1,172 KB:**

Home page: *http://www.gnu.org/software/grep/*
Download: *http://ftp.gnu.org/gnu/grep/grep-2.14.tar.xz*
MD5 sum: d4a3f03849d1e17ce56ab76aa5a24cab

- **Groff (1.22.2) - 3,926 KB:**
Home page: *http://www.gnu.org/software/groff/*
Download: *http://ftp.gnu.org/gnu/groff/groff-1.22.2.tar.gz*
MD5 sum: 9f4cd592a5efc7e36481d8d8d8af6d16

- **GRUB (2.00) - 5,016 KB:**
Home page: *http://www.gnu.org/software/grub/*
Download: *http://ftp.gnu.org/gnu/grub/grub-2.00.tar.xz*
MD5 sum: a1043102fbc7bcedbf53e7ee3d17ab91

- **Gzip (1.5) - 704 KB:**
Home page: *http://www.gnu.org/software/gzip/*
Download: *http://ftp.gnu.org/gnu/gzip/gzip-1.5.tar.xz*
MD5 sum: 2a431e169b6f62f7332ef6d47cc53bae

- **Iana-Etc (2.30) - 201 KB:**
Home page: *http://freshmeat.net/projects/iana-etc/*
Download: *http://anduin.linuxfromscratch.org/sources/LFS/lfs-packages/*
conglomeration//iana-etc/iana-etc-2.30.tar.bz2
MD5 sum: 3ba3afb1d1b261383d247f46cb135ee8

- **Inetutils (1.9.1) - 1,941 KB:**
Home page: *http://www.gnu.org/software/inetutils/*
Download: *http://ftp.gnu.org/gnu/inetutils/inetutils-1.9.1.tar.gz*
MD5 sum: 944f7196a2b3dba2d400e9088576000c

- **IPRoute2 (3.8.0) - 398 KB:**
Home page: *http://www.kernel.org/pub/linux/utils/net/iproute2/*
Download: *http://www.kernel.org/pub/linux/utils/net/iproute2/iproute2-3.8.0.tar.xz*
MD5 sum: 951622fd770428116dc165acba375414

- **Kbd (1.15.5) - 1,690 KB:**
Home page: *http://ftp.altlinux.org/pub/people/legion/kbd*
Download: *http://ftp.altlinux.org/pub/people/legion/kbd/kbd-1.15.5.tar.gz*
MD5 sum: 34c71feead8ab9c01ec638acea8cd877

- **Kmod (12) - 1,245 KB:**
Download: *http://www.kernel.org/pub/linux/utils/kernel/kmod/kmod-12.tar.xz*
MD5 sum: 3d63b146c8ee5a04dfbef4be97f8226b

- **Less (451) - 303 KB:**
Home page: *http://www.greenwoodsoftware.com/less/*
Download: *http://www.greenwoodsoftware.com/less/less-451.tar.gz*
MD5 sum: 765f082658002b2b46b86af4a0da1842

- **LFS-Bootscripts (20130123) - 33 KB:**
Download: *http://www.linuxfromscratch.org/lfs/downloads/7.3/lfs-bootscripts-20130123.*
tar.bz2
MD5 sum: 2a53fcba68e9f5ed6770c47f05987959

- **Libpipeline (1.2.2) - 733 KB:**
Home page: *http://libpipeline.nongnu.org/*
Download: *http://download.savannah.gnu.org/releases/libpipeline/libpipeline-1.2.2.tar.*
gz
MD5 sum: 4367a3f598d171fd43dfa8620ed16d55

- **Libtool (2.4.2) - 2,571 KB:**

Home page: *http://www.gnu.org/software/libtool/*

Download: *http://ftp.gnu.org/gnu/libtool/libtool-2.4.2.tar.gz*

MD5 sum: d2f3b7d4627e69e13514a40e72a24d50

- **Linux (3.8.1) - 69,3292 KB:**

Home page: *http://www.kernel.org/*

Download: *http://www.kernel.org/pub/linux/kernel/v3.x/linux-3.8.1.tar.xz*

MD5 sum: 093b172f907d5455a6746418ad18f5bc

> **Замечание**
>
> The Linux kernel is updated relatively often, many times due to discoveries of security vulnerabilities. The latest available 3.8.x kernel version should be used, unless the errata page says otherwise.
>
> For users with limited speed or expensive bandwidth who wish to update the Linux kernel, a baseline version of the package and patches can be downloaded separately. This may save some time or cost for a subsequent patch level upgrade within a minor release.

- **M4 (1.4.16) - 1,229 KB:**

Home page: *http://www.gnu.org/software/m4/*

Download: *http://ftp.gnu.org/gnu/m4/m4-1.4.16.tar.bz2*

MD5 sum: 8a7cef47fecab6272eb86a6be6363b2f

- **Make (3.82) - 1,213 KB:**

Home page: *http://www.gnu.org/software/make/*

Download: *http://ftp.gnu.org/gnu/make/make-3.82.tar.bz2*

MD5 sum: 1a11100f3c63fcf5753818e59d63088f

- **Man-DB (2.6.3) - 1,356 KB:**

Home page: *http://www.nongnu.org/man-db/*

Download: *http://download.savannah.gnu.org/releases/man-db/man-db-2.6.3.tar.xz*

MD5 sum: a593a095599ae97bcacf8d038659a146

- **Man-pages (3.47) - 1,108 KB:**

Home page: *http://www.kernel.org/doc/man-pages/*

Download: *http://www.kernel.org/pub/linux/docs/man-pages/man-pages-3.47.tar.xz*

MD5 sum: 2046259794d3003f4dc4dbe4b688ba2f

- **MPC (1.0.1) - 610 KB:**

Home page: *http://www.multiprecision.org/*

Download: *http://www.multiprecision.org/mpc/download/mpc-1.0.1.tar.gz*

MD5 sum: b32a2e1a3daa392372fbd586d1ed3679

- **MPFR (3.1.1) - 1,047 KB:**

Home page: *http://www.mpfr.org/*

Download: *http://www.mpfr.org/mpfr-3.1.1/mpfr-3.1.1.tar.xz*

MD5 sum: 91d51c41fcf2799e4ee7a7126fc95c17

- **Ncurses (5.9) - 2,760 KB:**

Home page: *http://www.gnu.org/software/ncurses/*

Download: *ftp://ftp.gnu.org/gnu/ncurses/ncurses-5.9.tar.gz*

MD5 sum: 8cb9c412e5f2d96bc6f459aa8c6282a1

- **Patch (2.7.1) - 660 KB:**

Home page: *http://savannah.gnu.org/projects/patch/*

Download: *http://ftp.gnu.org/gnu/patch/patch-2.7.1.tar.xz*

MD5 sum: e9ae5393426d3ad783a300a338c09b72

- **Perl (5.16.2) - 13,403 KB:**

Home page: *http://www.perl.org/*

Download: *http://www.cpan.org/src/5.0/perl-5.16.2.tar.bz2*

MD5 sum: 2818ab01672f005a4e552a713aa27b08

- **Pkg-config (0.28) - 1,892 KB:**

Home page: *http://www.freedesktop.org/wiki/Software/pkg-config*

Download: *http://pkgconfig.freedesktop.org/releases/pkg-config-0.28.tar.gz*

MD5 sum: aa3c86e67551adc3ac865160e34a2a0d

- **Procps (3.3.6) - 528 KB:**

Home page: *http://sourceforge.net/projects/procps-ng*

Download: *http://sourceforge.net/projects/procps-ng/files/Production/procps-ng-3.3.6. tar.xz*

MD5 sum: 0a050d9be531921db3cd38f1371e73e3

- **Psmisc (22.20) - 422 KB:**

Home page: *http://psmisc.sourceforge.net/*

Download: *http://prdownloads.sourceforge.net/psmisc/psmisc-22.20.tar.gz*

MD5 sum: a25fc99a6dc7fa7ae6e4549be80b401f

- **Readline (6.2) - 2,225 KB:**

Home page: *http://cnswww.cns.cwru.edu/php/chet/readline/rltop.html*

Download: *http://ftp.gnu.org/gnu/readline/readline-6.2.tar.gz*

MD5 sum: 67948acb2ca081f23359d0256e9a271c

- **Sed (4.2.2) - 1,035 KB:**

Home page: *http://www.gnu.org/software/sed/*

Download: *http://ftp.gnu.org/gnu/sed/sed-4.2.2.tar.bz2*

MD5 sum: 7ffe1c7cdc3233e1e0c4b502df253974

- **Shadow (4.1.5.1) - 2,142 KB:**

Home page: *http://pkg-shadow.alioth.debian.org/*

Download: *http://pkg-shadow.alioth.debian.org/releases/shadow-4.1.5.1.tar.bz2*

MD5 sum: a00449aa439c69287b6d472191dc2247

- **Sysklogd (1.5) - 85 KB:**

Home page: *http://www.infodrom.org/projects/sysklogd/*

Download: *http://www.infodrom.org/projects/sysklogd/download/sysklogd-1.5.tar.gz*

MD5 sum: e053094e8103165f98ddafe828f6ae4b

- **Sysvinit (2.88dsf) - 108 KB:**

Home page: *http://savannah.nongnu.org/projects/sysvinit*

Download: *http://download.savannah.gnu.org/releases/sysvinit/sysvinit-2.88dsf.tar.bz2*

MD5 sum: 6eda8a97b86e0a6f59dabbf25202aa6f

- **Tar (1.26) - 2,285 KB:**

Home page: *http://www.gnu.org/software/tar/*

Download: *http://ftp.gnu.org/gnu/tar/tar-1.26.tar.bz2*

MD5 sum: 2cee42a2ff4f1cd4f9298eeeb2264519

- **Tcl (8.6.0) - 8,435 KB:**
Home page: *http://tcl.sourceforge.net/*
Download: *http://prdownloads.sourceforge.net/tcl/tcl8.6.0-src.tar.gz*
MD5 sum: 573aa5fe678e9185ef2b3c56b24658d3

- **Time Zone Data (2012j) - 209 KB:**
Home page: *http://www.iana.org/time-zones*
Download: *http://www.iana.org//time-zones/repository/releases/tzdata2012j.tar.gz*
MD5 sum: ba2f92ae7ad099090e8f86cff2f2d799

- **Texinfo (5.0) - 3,000 KB:**
Home page: *http://www.gnu.org/software/texinfo/*
Download: *http://ftp.gnu.org/gnu/texinfo/texinfo-5.0.tar.xz*
MD5 sum: ef2fad34c71ddc95b20c7d6a08c0d7a6

- **Systemd (197) - 2,012 KB:**
Home page: *http://www.freedesktop.org/wiki/Software/systemd/*
Download: *http://www.freedesktop.org/software/systemd/systemd-197.tar.xz*
MD5 sum: 56a860dceadfafe59f40141eb5223743

- **Udev-lfs Tarball (197) - 17 KB:**
Download: *http://anduin.linuxfromscratch.org/sources/other/udev-lfs-197-2.tar.bz2*
MD5 sum: f4272c121514caf0c2a6245fbffeb047

- **Util-linux (2.22.2) - 3,028 KB:**
Home page: *http://userweb.kernel.org/~kzak/util-linux/*
Download: *http://www.kernel.org/pub/linux/utils/util-linux/v2.22/util-linux-2.22.2.tar.xz*
MD5 sum: eeacbfdd2556acd899a2d0ffdb446185

- **Vim (7.3) - 8,675 KB:**
Home page: *http://www.vim.org*
Download: *ftp://ftp.vim.org/pub/vim/unix/vim-7.3.tar.bz2*
MD5 sum: 5b9510a17074e2b37d8bb38ae09edbf2

- **Xz Utils (5.0.4) - 894 KB:**
Home page: *http://tukaani.org/xz*
Download: *http://tukaani.org/xz/xz-5.0.4.tar.xz*
MD5 sum: 161015c4a65b1f293d31810e1df93090

- **Zlib (1.2.7) - 493 KB:**
Home page: *http://www.zlib.net/*
Download: *http://www.zlib.net/zlib-1.2.7.tar.bz2*
MD5 sum: 2ab442d169156f34c379c968f3f482dd

Total size of these packages: about 915 MB

3.3. Needed Patches

In addition to the packages, several patches are also required. These patches correct any mistakes in the packages that should be fixed by the maintainer. The patches also make small modifications to make the packages easier to work with. The following patches will be needed to build an LFS system:

- **Bash Upstream Fixes Patch - 55 KB:**
Download: *http://www.linuxfromscratch.org/patches/lfs/7.3/bash-4.2-fixes-11.patch*
MD5 sum: 366672f68e7cf214bdbef2ef14b13c23

- **Binutils Test Suite Patch - 2.0 KB:**

Download: *http://www.linuxfromscratch.org/patches/lfs/7.3/binutils-2.23.1-testsuite_fix-1.patch*

MD5 sum: `cb47fae1bc572d45f4b0cff8ae8ecba8`

- **Bzip2 Documentation Patch - 1.6 KB:**

Download: *http://www.linuxfromscratch.org/patches/lfs/7.3/bzip2-1.0.6-install_docs-1.patch*

MD5 sum: `6a5ac7e89b791aae556de0f745916f7f`

- **Coreutils Internationalization Fixes Patch - 132 KB:**

Download: *http://www.linuxfromscratch.org/patches/lfs/7.3/coreutils-8.21-i18n-1.patch*

MD5 sum: `ada0ea6e1c00c4b7e0d634f49827943e`

- **Flex Regression Tests Patch - 2.8 KB:**

Download: *http://www.linuxfromscratch.org/patches/lfs/7.3/flex-2.5.37-bison-2.6.1-1.patch*

MD5 sum: `d5b001ef9bdbbe32e2f27576d97d8ff0`

- **Kbd Backspace/Delete Fix Patch - 12 KB:**

Download: *http://www.linuxfromscratch.org/patches/lfs/7.3/kbd-1.15.5-backspace-1.patch*

MD5 sum: `f75cca16a38da6caa7d52151f7136895`

- **Make Upstream Fixes Patch - 10 KB:**

Download: *http://www.linuxfromscratch.org/patches/lfs/7.3/make-3.82-upstream_fixes-3.patch*

MD5 sum: `95027ab5b53d01699845d9b7e1dc878d`

- **Perl Libc Patch - 1.6 KB:**

Download: *http://www.linuxfromscratch.org/patches/lfs/7.3/perl-5.16.2-libc-1.patch*

MD5 sum: `daf5c64fd7311e924966842680535f8f`

- **Readline Upstream Fixes Patch - 1.3 KB:**

Download: *http://www.linuxfromscratch.org/patches/lfs/7.3/readline-6.2-fixes-1.patch*

MD5 sum: `3c185f7b76001d3d0af614f6f2cd5dfa`

Total size of these patches: about 218.3 KB

In addition to the above required patches, there exist a number of optional patches created by the LFS community. These optional patches solve minor problems or enable functionality that is not enabled by default. Feel free to peruse the patches database located at *http://www.linuxfromscratch.org/patches/downloads/* and acquire any additional patches to suit your system needs.

Глава 4. Последние приготовления

4.1. О переменной $LFS

На протяжении всей книги будет использоваться переменная окружения LFS. Крайне важно следить за тем, чтобы эта переменная всегда была объявлена. Она должна содержать путь до точки монтирования, выбранной для раздела LFS. Проверьте, что переменная LFS установлена правильно, командой:

```
echo $LFS
```

Убедитесь, что вывод содержит путь до точки монтирования раздела LFS, которой является /mnt/lfs в нашем примере. Если вывод неверен, переменной может быть присвоено правильное значение с помошью нижеследующей команды:

```
export LFS=/mnt/lfs
```

Объявление этой переменной необходимо для того, чтобы такие команды, как **mkdir $LFS/tools** можно было ввести как есть или просто скопировать. Оболочка автоматически заменит «$LFS» на «/mnt/lfs» (вместо /mnt/lfs, конечно, будет значение, присвоенное Вами этой переменной) когда будет обрабатывать команду.

Не забывайте проверять, что $LFS объявлена, когда покидаете и вновь входите в рабочее окружение (например, при выполнении команды **su** для получения привелегий root или другого пользователя).

4.2. Создание директории $LFS/tools

Все программы, скомпилированные в Chapter 5 будут установлены в директорию $LFS/tools, чтобы отделить их от программ, собираемых в Глава 6. Эти программы являются временными инструментами и не будут являться частью итоговой системы LFS. Благодаря тому, что они будут установлены в отдельную директорию, их можно будет легко удалить после их использования. Это также не позволит временным программам остаться в рабочих директориях хост-системы в случае ошибки в Chapter 5.

Создайте необходимую директорию следующей командой от имени root:

```
mkdir -v $LFS/tools
```

Следующим шагом будет создание символической ссылки /tools на хост-системе. Она будет указывать на только что созданную директорию на разделе LFS. Выполните следующую команду (также от имени root):

```
ln -sv $LFS/tools /
```

> **Замечание**
>
> Эта команда корректна. Утилита **ln** имеет несколько вариантов указания аргументов, поэтому прочтите **info coreutils ln** и ln(1), прежде чем сообщать нам об ошибке в книге.

Создание символической ссылки позволяет собрать инструментарий так, что он всегда будет использовать абсолютный путь /tools. Это означает, что компилятор, ассемблер и компоновщик будут работать как в главе 5 (где мы все еще используем некоторые инструменты из состава хост-системы), так и в последующих (когда мы с помощью **chroot** переместимся в новое окружение на разделе LFS).

4.3. Добавление пользователя LFS

Если Вы зашли как пользователь root, самая незначительная ошибка может повредить или уничтожить систему. Поэтому мы рекомендуем собирать пакеты в этой главе из-под непривилегированного пользователя. Вы можете использовать своего собственного пользователя, но проще всего установить чистое рабочее окружение, создав нового пользователя lfs, члена новой группы (также именуемой lfs), и исползовать этого пользователя на протяжении всего процесса установки. Выполните следующие команды от имени root , чтобы добавить нового пользователя:

```
groupadd lfs
useradd -s /bin/bash -g lfs -m -k /dev/null lfs
```

Значение опций командной строки:

-s /bin/bash
  Это делает **bash** оболочкой по умолчанию для пользователя lfs.

-g lfs
  Эта опция добавляет пользователя lfs в группу lfs.

-m
  Это указывает создать домашнюю директорию для lfs.

-k /dev/null
  Этот параметр предотвращает возможное копирование файлов из директории шаблонов (по умолчанию это /etc/skel), изменяя ее местоположение на специальное пустое устройство.

lfs
  Это имя для создаваемых пользователя и группы.

Чтобы иметь возможность зайти в систему как пользователь lfs (в противоположность переключению на пользователя lfs когда Вы зашли как root, что не требует наличия пароля у пользователя lfs), присвоим lfs пароль:

```
passwd lfs
```

Дадим lfs полный доступ к директории $LFS/tools, делая пользователя lfs ее владельцем:

```
chown -v lfs $LFS/tools
```

Если Вы создали отдельную рабочую директорию, как было предложено, необходимо сделать пользователя lfs и ее владельцем также:

```
chown -v lfs $LFS/sources
```

Далее, зайдите в систему как lfs. Это может быть сделано через виртуальный терминал, менеджер дисплея или с помощью следующей команды:

```
su - lfs
```

Параметр «-» говорит **su** запустить login shell в противоположность non-login shell. Различия между этими двумя типами оболочек подробно изложены в bash(1) и в **info bash**.

4.4. Установка рабочего окружения

Установим правильное рабочее окружение, создав два новых файла настроек для оболочки **bash**. Выполните из-под пользователя lfs следующую команду для создания .bash_profile:

```
cat > ~/.bash_profile << "EOF"
exec env -i HOME=$HOME TERM=$TERM PS1='\u:\w\$ ' /bin/bash
EOF
```

Когда Вы зашли под пользовтелем lfs, выполняемая оболочка обычно является так называемой *login shell*, которая считывает файл /etc/profile с хост-системы (обычно содержащий некоторые настройки и переменные окружения, общие для всей системы), а затем файл .bash_profile. Команда **exec env -i.../bin/bash** в файле .bash_profile заменяет запущенную оболочку на новую с абсолютно пустым окружением, исключая переменные HOME, TERM и PS1. Это позволяет убедться, что никакие потенциально нежелательные переменные окружения из хост-системы не просочатся в окружение сборки.

Свежезапущенная оболочка представляет собой *non-login shell*, которая не считывает файлы /etc/profile и .bash_profile, вместо этого читая файл .bashrc. Создадим .bashrc:

```
cat > ~/.bashrc << "EOF"
set +h
umask 022
LFS=/mnt/lfs
LC_ALL=POSIX
LFS_TGT=$(uname -m)-lfs-linux-gnu
PATH=/tools/bin:/bin:/usr/bin
export LFS LC_ALL LFS_TGT PATH
EOF
```

Команда **set +h** отключает функцию хэширования **bash**. Хэширование чаще всего полезно— **bash** использует хэш-таблицу для запоминания полного пути к исполняемым файлам, чтобы не просматривать заново все каталоги PATH при поиске однажды уже вызванной программы. Но наши инструменты должны включаться в работу сразу после установки. Благодаря отключению функции хеширования оболочка будет всегда просматривать PATH перед выполнением программы, и находить наши свежесобранные инструменты в $LFS/tools как только они станут доступны, не запоминая предыдущие версии тех же программ, расположенные в другом месте.

Устанавливая пользовательскую маску создания файла (umask) в 022, мы указываем, что новые файлы и директории будут доступны для записи только владельцу, но читать и выполнять их смогут все (предполагая значения по умолчанию, испльзуемые системным вызовом open(2), файлы будут создаваться с правами 644, а папки - 755).

Переменная окружения LFS должна содержать путь до выбранной точки монтирования.

Переменная `LC_ALL` управляет локализацией некоторых программ, требуя от них форматировать сообщения в соответствии с правилами, принятыми в указанной стране. Если хост-система использует версию Glibc старше 2.2.4, установка переменной `LC_ALL` в значение, отличное от «POSIX» или «C» (на протяжении этой главы) может привести к неожиданным проблемам, если Вы зайдете во временное окружение с помощью **chroot** и захотите вернуться в него позже. Установка `LC_ALL` в «POSIX» или «C » (оба значения эквивалентны) гарантирует, что все будет работать так, как ожидается.

Переменная `LFS_TGT` устанавливает нестандартное, но совместимое определение платформы для использования при сборке наших кросс-компилятора и компоновщика и затем - временного инструментария. Более подробная информация изложена в Раздел 5.2, «Toolchain Technical Notes».

Благодаря тому, что мы поместили `/tools/bin` перед стандартными директориями PATH, все программы, устанавливаемые в Chapter 5 будит подхватываться оболочкой сразу после их установки. Это, в совокупности с отключеным хэшированием, минимизирует риск случайного использования старых программ из хост-системы во временном окружении в Главе 5.

Заканчивая подготовку окружения к сборке временных инструментов, считаем только что созданный профиль:

```
source ~/.bash_profile
```

4.5. O SBU

Многие люди хотят знать, хотя бы приблизительно, сколько времени займет компиляция и установка каждого пакета. Поскольку Linux From Scratch может быть собран на многих, абсолютно разных, компьютерах, невозможно привести конкретное время. Самый большой пакет (Glibc) на новейших системах будет собираться около 20 минут, но на старых компьютерах его сборка может затянуться на три дня! Вместо того, чтобы указывать точное время, вводится понятие стандартной единицы сборки (Standard Build Unit, SBU).

Концепция SBU работает следующим образом. Самым первым из пакетов в этой книге компилируется Binutils в Chapter 5. Время, которое займет компиляция этого пакета, будет принято за одну стандартную единицу сборки или 1 SBU. Время, требуемое каждому из остальных пакетов на компиляцию, измеряется относительно этого времени.

Например, представим пакет, которому для компиляции требуется 4.5 SBU. Это означает, что если Вам потребовалось 10 минут для компиляции и установки Binutils на первом шаге, сборка этого воображаемого пакета займет *приблизительно* 45 минут. На самом деле, большинство пакетов собираются быстрее, чем Binutils.

В целом, SBU не являются весьма точным способом измерения, поскольку зависят от множества факторов, таких, как версия GCC на хост-системе. Они представлены здесь для того, чтобы дать приблизительное представление о длительности сборки пакета. Поэтому в некоторых случаях время может отличаться в ту или иную сторону на десятки минут.

Чтобы ознакомиться с реальным временем сборки пакетов для некоторых компьютеров, мы рекомендуем посетить домашнюю страницу LinuxFromScratch SBU: *http://www.linuxfromscratch.org/~sbu/*.

> **Замечание**
>
> На большинстве современных систем с несколькими процессорами (или ядрами) время компиляции пакета может быть сокращено за счет выполнения "параллельной сборки". Для этого можно установить соответствующую переменную окружения или непосредственно указать программе **make** количество доступных процессоров. Например, для процессоров Core2Duo можно указать make всегда выполнять построение в 2 потока:
>
> ```
> export MAKEFLAGS='-j 2'
> ```
>
> или каждый раз производить сборку так:
>
> ```
> make -j2
> ```
>
> При использовании многопоточной компиляции SBU будут варьироваться гораздо сильнее, чем обычно. Также станет намного сложнее анализировать вывод процесса сборки, поскольку строки от различных потоков перемешаются между собой. Если Вы получили ошибку, Вам прийдется вернуться к однопоточному режиму, чтобы выявить проблему.

4.6. О выполнении тестов

Большинство пакетов предорставляют набор тестов. Запуск тестов для только что собранного пакета - хорошая идея, поскольку это позволит проверить, что все компоненты были скомпилированы корректно. Успешное прохождение пакетом всех тестов обычно гарантирует, что пакет будет работать именно так, как задумано разработчиком. Если тесты провалены, значит в пакете наверняка содержится ошибка.

Некоторые тесты более важны, нежели другие. Например, проверка ключевого набора инструментов—GCC, Binutils и Glibc—является критически необходимой из-за того, что эти пакеты играют главную роль в построении правильно работающей системы. Тесты GCC и Glibc могут занять очень много времени, особенно на старом оборудовании, но настоятельно рекомендуется не пропускать их.

> **Замечание**
>
> Опыт показывает, что немного преждевременно запускать тесты в Chapter 5. Дело в том, что хост-система вполне может некоторым образом влиять на них, приводя к неожиданным ошибкам. Поскольку инструменты, собираемые в Chapter 5 являются временными и скорее всего будут удалены после сборки системы, мы рекомендуем обычному читателю не выполнять тесты в Chapter 5. Инструкции по выполнению этих тестов предоставлены в основном для разработчиков, но и они не обязаны следовать им.

Известная проблема при выполнении тестов Binutils и GCC - исчерпание числа доступных псевдотерминалов (PTY). Из-за этого многие проверки будут провалены. Это может происходить по нескольким причинам, но в самом типичном случае означает, что на хост-дистрибутиве неверно настроена файловая система devpts. Эта проблема подробно рассматривается здесь: *http://www.linuxfromscratch.org//lfs/faq.html#no-ptys*.

Иногда проверка пакета завершается неуспешно, но по причинам, которые известны разработчикам и не являются критическими. Сверьтесь с *http://www. linuxfromscratch.org/lfs/build-logs/7.3/* чтобы узнать, известны эти ошибки или нет. Данная страница действительна для всех тестов в этой книге.

Глава 5. Constructing a Temporary System

5.1. Вступление

Эта глава рассказывает, как собрать минимальную Linux-систему. Система будет содержать только инструменты, необходимые для того, чтобы начать построение окончательной LFS-системы в Глава 6 и предоставляющие несколько более удобное рабочее окружение, чем необходимо для абсолютного минимализма.

Процесс построения этой минимальной системы разбит на две части. Первым шагом будет сборка нового и независимого от хост-системы набора инструментов (компилятора, ассемблера, компоновщика и некоторых полезных утилит). На втором шаге с помощью этого инструментария создаются другие необходимые программы.

Файлы, компилируемые в этой главе, будут устанавливаться в дерево каталогов `$LFS/tools`, чтобы держать их отдельно от файлов, устанавливаемых в следующей главе, и файлов хост-системы. Поскольку собираемые пакеты являются временными, мы не хотим засорять ими будующую LFS-систему.

5.2. Toolchain Technical Notes

This section explains some of the rationale and technical details behind the overall build method. It is not essential to immediately understand everything in this section. Most of this information will be clearer after performing an actual build. This section can be referred to at any time during the process.

The overall goal of Chapter 5 is to produce a temporary area that contains a known-good set of tools that can be isolated from the host system. By using **chroot**, the commands in the remaining chapters will be contained within that environment, ensuring a clean, trouble-free build of the target LFS system. The build process has been designed to minimize the risks for new readers and to provide the most educational value at the same time.

> **Замечание**
>
> Before continuing, be aware of the name of the working platform, often referred to as the target triplet. A simple way to determine the name of the target triplet is to run the **config.guess** script that comes with the source for many packages. Unpack the Binutils sources and run the script: **./config.guess** and note the output. For example, for a modern 32-bit Intel processor the output will likely be *i686-pc-linux-gnu*.
>
> Also be aware of the name of the platform's dynamic linker, often referred to as the dynamic loader (not to be confused with the standard linker **ld** that is part of Binutils). The dynamic linker provided by Glibc finds and loads the shared libraries needed by a program, prepares the program to run, and then runs it. The name of the dynamic linker for a 32-bit Intel machine will be `ld-linux.so.2`. A sure-fire way to determine the name of the dynamic linker is to inspect a random binary from the host system by running: **readelf -l <name of binary> | grep interpreter** and noting the output. The authoritative reference covering all platforms is in the `shlib-versions` file in the root of the Glibc source tree.

Some key technical points of how the Chapter 5 build method works:

- Slightly adjusting the name of the working platform, by changing the "vendor" field target triplet by way of the `LFS_TGT` variable, ensures that the first build of Binutils and GCC produces a compatible cross-linker and cross-compiler. Instead of producing binaries for another architecture, the cross-linker and cross-compiler will produce binaries compatible with the current hardware.

- The temporary libraries are cross-compiled. Because a cross-compiler by its nature cannot rely on anything from its host system, this method removes potential contamination of the target system by lessening the chance of headers or libraries from the host being incorporated into the new tools. Cross-compilation also allows for the possibility of building both 32-bit and 64-bit libraries on 64-bit capable hardware.

- Careful manipulation of the GCC source tells the compiler which target dynamic linker will be used.

Binutils is installed first because the **configure** runs of both GCC and Glibc perform various feature tests on the assembler and linker to determine which software features to enable or disable. This is more important than one might first realize. An incorrectly configured GCC or Glibc can result in a subtly broken toolchain, where the impact of such breakage might not show up until near the end of the build of an entire distribution. A test suite failure will usually highlight this error before too much additional work is performed.

Binutils installs its assembler and linker in two locations, `/tools/bin` and `/tools/$LFS_TGT/bin`. The tools in one location are hard linked to the other. An important facet of the linker is its library search order. Detailed information can be obtained from **ld** by passing it the `--verbose` flag. For example, an **ld --verbose | grep SEARCH** will illustrate the current search paths and their order. It shows which files are linked by **ld** by compiling a dummy program and passing the `--verbose` switch to the linker. For example, **gcc dummy.c -Wl,--verbose 2>&1 | grep succeeded** will show all the files successfully opened during the linking.

The next package installed is GCC. An example of what can be seen during its run of **configure** is:

```
checking what assembler to use... /tools/i686-lfs-linux-gnu/bin/as
checking what linker to use... /tools/i686-lfs-linux-gnu/bin/ld
```

This is important for the reasons mentioned above. It also demonstrates that GCC's configure script does not search the PATH directories to find which tools to use. However, during the actual operation of **gcc** itself, the same search paths are not necessarily used. To find out which standard linker **gcc** will use, run: **gcc -print-prog-name=ld**.

Detailed information can be obtained from **gcc** by passing it the `-v` command line option while compiling a dummy program. For example, **gcc -v dummy.c** will show detailed information about the preprocessor, compilation, and assembly stages, including **gcc**'s included search paths and their order.

Next installed are sanitized Linux API headers. These allow the standard C library (Glibc) to interface with features that the Linux kernel will provide.

The next package installed is Glibc. The most important considerations for building Glibc are the compiler, binary tools, and kernel headers. The compiler is generally not an issue since Glibc will always use the compiler relating to the `--host` parameter passed to its configure script, e.g. in our case, **i686-lfs-linux-gnu-gcc**. The binary tools and kernel headers can be a bit more complicated. Therefore, take no risks and use the available configure switches to enforce the correct selections. After the run of **configure**, check the contents of the `config.make` file in the `glibc-build` directory for all important details.

Note the use of `CC="i686-lfs-gnu-gcc"` to control which binary tools are used and the use of the `-nostdinc` and `-isystem` flags to control the compiler's include search path. These items highlight an important aspect of the Glibc package—it is very self-sufficient in terms of its build machinery and generally does not rely on toolchain defaults.

During the second pass of Binutils, we are able to utilize the `--with-lib-path` configure switch to control **ld**'s library search path.

For the second pass of GCC, its sources also need to be modified to tell GCC to use the new dynamic linker. Failure to do so will result in the GCC programs themselves having the name of the dynamic linker from the host system's `/lib` directory embedded into them, which would defeat the goal of getting away from the host. From this point onwards, the core toolchain is self-contained and self-hosted. The remainder of the Chapter 5 packages all build against the new Glibc in `/tools`.

Upon entering the chroot environment in Глава 6, the first major package to be installed is Glibc, due to its self-sufficient nature mentioned above. Once this Glibc is installed into `/usr`, we will perform a quick changeover of the toolchain defaults, and then proceed in building the rest of the target LFS system.

5.3. General Compilation Instructions

When building packages there are several assumptions made within the instructions:

- Several of the packages are patched before compilation, but only when the patch is needed to circumvent a problem. A patch is often needed in both this and the next chapter, but sometimes in only one or the other. Therefore, do not be concerned if instructions for a downloaded patch seem to be missing. Warning messages about *offset* or *fuzz* may also be encountered when applying a patch. Do not worry about these warnings, as the patch was still successfully applied.

- During the compilation of most packages, there will be several warnings that scroll by on the screen. These are normal and can safely be ignored. These warnings are as they appear—warnings about deprecated, but not invalid, use of the C or C++ syntax. C standards change fairly often, and some packages still use the older standard. This is not a problem, but does prompt the warning.

- Check one last time that the `LFS` environment variable is set up properly:

```
echo $LFS
```

Make sure the output shows the path to the LFS partition's mount point, which is `/mnt/lfs`, using our example.

- Finally, two last important items must be emphasized:

> **⚠ Важно**
>
> The build instructions assume that the Host System Requirements, including symbolic links, have been set properly:
>
> - **bash** is the shell in use.
> - **sh** is a symbolic link to **bash**.
> - **/usr/bin/awk** is a symbolic link to **gawk**.
> - **/usr/bin/yacc** is a symbolic link to **bison** or a small script that executes bison.

> ⚠️ **Важно**
>
> To re-emphasize the build process:
>
> 1. Place all the sources and patches in a directory that will be accessible from the chroot environment such as `/mnt/lfs/sources/`. Do *not* put sources in `/mnt/lfs/tools/`.
> 2. Change to the sources directory.
> 3. For each package:
>   a. Using the **tar** program, extract the package to be built. In Chapter 5, ensure you are the *lfs* user when extracting the package.
>   b. Change to the directory created when the package was extracted.
>   c. Follow the book's instructions for building the package.
>   d. Change back to the sources directory.
>   e. Delete the extracted source directory and any `<package>-build` directories that were created in the build process unless instructed otherwise.

5.4. Binutils-2.23.1 - Шаг 1

The Binutils package contains a linker, an assembler, and other tools for handling object files.

Приблизительное время сборки:	1 SBU
Требует свободного места на диске:	391 MB

5.4.1. Installation of Cross Binutils

> **Замечание**
>
> Go back and re-read the notes in the previous section. Understanding the notes labeled important will save you a lot of problems later.

It is important that Binutils be the first package compiled because both Glibc and GCC perform various tests on the available linker and assembler to determine which of their own features to enable.

The Binutils documentation recommends building Binutils outside of the source directory in a dedicated build directory:

```
mkdir -v ../binutils-build
cd ../binutils-build
```

> **Замечание**
>
> In order for the SBU values listed in the rest of the book to be of any use, measure the time it takes to build this package from the configuration, up to and including the first install. To achieve this easily, wrap the commands in a **time** command like this: **time { ./configure ... && ... && make install; }**.

> **Замечание**
>
> The approximate build SBU values and required disk space in Chapter 5 does not include test suite data.

Now prepare Binutils for compilation:

```
../binutils-2.23.1/configure      \
    --prefix=/tools           \
    --with-sysroot=$LFS        \
    --with-lib-path=/tools/lib \
    --target=$LFS_TGT          \
    --disable-nls              \
    --disable-werror
```

The meaning of the configure options:

--prefix=/tools
   This tells the configure script to prepare to install the Binutils programs in the /tools directory.

--with-sysroot=$LFS
> For cross compilation, this tells the build system to look in $LFS for the target system libraries as needed.

--with-lib-path=/tools/lib
> This specifies which library path the linker should be configured to use.

`--target=$LFS_TGT`
> Because the machine description in the LFS_TGT variable is slightly different than the value returned by the **config.guess** script, this switch will tell the **configure** script to adjust Binutil's build system for building a cross linker.

--disable-nls
> This disables internationalization as i18n is not needed for the temporary tools.

--disable-werror
> This prevents the build from stopping in the event that there are warnings from the host's compiler.

Continue with compiling the package:

```
make
```

Compilation is now complete. Ordinarily we would now run the test suite, but at this early stage the test suite framework (Tcl, Expect, and DejaGNU) is not yet in place. The benefits of running the tests at this point are minimal since the programs from this first pass will soon be replaced by those from the second.

If building on x86_64, create a symlink to ensure the sanity of the toolchain:

```
case $(uname -m) in
  x86_64) mkdir -v /tools/lib && ln -sv lib /tools/lib64 ;;
esac
```

Install the package:

```
make install
```

Подробная информация об этом пакете расположена в Раздел 6.13.2, «Содержимое Binutils.»

5.5. GCC-4.7.2 - Шаг 1

The GCC package contains the GNU compiler collection, which includes все же запустить тестирование C and C++ compilers.

Приблизительное время сборки:	5.5 SBU
Требует свободного места на диске:	1.4 GB

5.5.1. Установка Кросс-GCC

Для GCC необходимы пакеты GMP, MPC и MPFR. Поскольку они могут быть не включены в Ваш хост-дистрибутив, необходимо собрать их вместе с GCC. Распакуем каждый пакет в директорию, содержащую исходный код GCC, и переименуем получившиеся подкаталоги таким образом, чтобы скрипты сборки GCC смогли найти их и автоматически задействовать:

> **Замечание**
>
> There are frequent misunderstandings about this chapter. The procedures are the same as every other chapter as explained earlier (Package build instructions). First extract the gcc tarball from the sources directory and then change to the directory created. Only then should you proceed with the instructions below.

```
tar -Jxf ../mpfr-3.1.1.tar.xz
mv -v mpfr-3.1.1 mpfr
tar -Jxf ../gmp-5.1.1.tar.xz
mv -v gmp-5.1.1 gmp
tar -zxf ../mpc-1.0.1.tar.gz
mv -v mpc-1.0.1 mpc
```

The following command will change the location of GCC's default dynamic linker to use the one installed in /tools. It also removes /usr/include from GCC's include search path. Issue:

```
for file in \
 $(find gcc/config -name linux64.h -o -name linux.h -o -name sysv4.h)
do
  cp -uv $file{,.orig}
  sed -e 's@/lib\(64\)\?\(32\)\?/ld@/tools&@g' \
      -e 's@/usr@/tools@g' $file.orig > $file
  echo '
#undef STANDARD_STARTFILE_PREFIX_1
#undef STANDARD_STARTFILE_PREFIX_2
#define STANDARD_STARTFILE_PREFIX_1 "/tools/lib/"
#define STANDARD_STARTFILE_PREFIX_2 ""' >> $file
  touch $file.orig
done
```

In case the above seems hard to follow, let's break it down a bit. First we find all the files under the gcc/config directory that are named either linux.h, linux64.h or sysv4.h. For each file found, we copy it to a file of the same name but with an added suffix of

«.orig». Then the first sed expression prepends «/tools» to every instance of «/lib/ld», «/lib64/ld» or «/lib32/ld», while the second one replaces hard-coded instances of «/usr». Next, we add our define statements which alter the default startfile prefix to the end of the file. Note that the trailing «/» in «/tools/lib/» is required. Finally, we use **touch** to update the timestamp on the copied files. When used in conjunction with **cp -u**, this prevents unexpected changes to the original files in case the commands are inadvertently run twice.

GCC doesn't detect stack protection correctly, which causes problems for the build of Glibc-2.17, so fix that by issuing the following command:

```
sed -i '/k prot/agcc_cv_libc_provides_ssp=yes' gcc/configure
```

Do not build the .info files. They are not needed here and are broken with the current version of **makeinfo**.

```
sed -i 's/BUILD_INFO=info/BUILD_INFO=/' gcc/configure
```

The GCC documentation recommends building GCC outside of the source directory in a dedicated build directory:

```
mkdir -v ../gcc-build
cd ../gcc-build
```

Prepare GCC for compilation:

```
../gcc-4.7.2/configure                \
    --target=$LFS_TGT                 \
    --prefix=/tools                   \
    --with-sysroot=$LFS               \
    --with-newlib                     \
    --without-headers                 \
    --with-local-prefix=/tools \
    --with-native-system-header-dir=/tools/include \
    --disable-nls                     \
    --disable-shared                  \
    --disable-multilib                \
    --disable-decimal-float      \
    --disable-threads                 \
    --disable-libmudflap         \
    --disable-libssp                  \
    --disable-libgomp                 \
    --disable-libquadmath        \
    --enable-languages=c              \
    --with-mpfr-include=$(pwd)/../gcc-4.7.2/mpfr/src \
    --with-mpfr-lib=$(pwd)/mpfr/src/.libs
```

The meaning of the configure options:

--with-newlib
    Since a working C library is not yet available, this ensures that the inhibit_libc constant is defined when building libgcc. This prevents the compiling of any code that requires libc support.

--without-headers
When creating a complete cross-compiler, GCC requires standard headers compatible with the target system. For our purposes these headers will not be needed. This switch prevents GCC from looking for them.

--with-local-prefix=/tools
The local prefix is the location in the system that GCC will search for locally installed include files. The default is /usr/local. Setting this to /tools helps keep the host location of /usr/local out of this GCC's search path.

--with-native-system-header-dir=/tools/include
By default GCC searches /usr/include for system headers. In conjunction with the sysroot switch, this would translate normally to $LFS/usr/include. However the headers that will be installed in the next two sections will go to $LFS/tools/include. This switch ensures that gcc will find them correctly. In the second pass of GCC, this same switch will ensure that no headers from the host system are found.

--disable-shared
This switch forces GCC to link its internal libraries statically. We do this to avoid possible issues with the host system.

--disable-decimal-float, --disable-threads, --disable-libmudflap, --disable-libssp, --disable-libgomp, --disable-libquadmath
These switches disable support for the decimal floating point extension, threading, libmudflap, libssp and libgomp and libquadmath respectively. These features will fail to compile when building a cross-compiler and are not necessary for the task of cross-compiling the temporary libc.

--disable-multilib
On x86_64, LFS does not yet support a multilib configuration. This switch is harmless for x86.

--enable-languages=c
This option ensures that only the C compiler is built. This is the only language needed now.

Compile GCC by running:

```
make
```

Compilation is now complete. At this point, the test suite would normally be run, but, as mentioned before, the test suite framework is not in place yet. The benefits of running the tests at this point are minimal since the programs from this first pass will soon be replaced.

Install the package:

```
make install
```

Using *--disable-shared* means that the libgcc_eh.a file isn't created and installed. The Glibc package depends on this library as it uses *-lgcc_eh* within its build system. This dependency can be satisfied by creating a symlink to libgcc.a, since that file will end up containing the objects normally contained in libgcc_eh.a:

```
ln -sv libgcc.a `$LFS_TGT-gcc -print-libgcc-file-name | sed 's/libgcc/&_eh/'`
```

Подробная информация об этом пакете расположена в Раздел 6.17.2, «Содержимое GCC.»

5.6. Linux-3.8.1 API Headers

The Linux API Headers (in linux-3.8.1.tar.xz) expose the kernel's API for use by Glibc.

Приблизительное время сборки:	0.1 SBU
Требует свободного места на диске:	511 MB

5.6.1. Installation of Linux API Headers

The Linux kernel needs to expose an Application Programming Interface (API) for the system's C library (Glibc in LFS) to use. This is done by way of sanitizing various C header files that are shipped in the Linux kernel source tarball.

Make sure there are no stale files and dependencies lying around from previous activity:

```
make mrproper
```

Now test and extract the user-visible kernel headers from the source. They are placed in an intermediate local directory and copied to the needed location because the extraction process removes any existing files in the target directory.

```
make headers_check
make INSTALL_HDR_PATH=dest headers_install
cp -rv dest/include/* /tools/include
```

Подробная информация об этом пакете расположена в Раздел 6.7.2, «Содержимое Linux API Headers.»

5.7. Glibc-2.17

The Glibc package contains the main C library. This library provides все же запустить тестирование basic routines for allocating memory, searching directories, opening and closing files, reading and writing files, string handling, pattern matching, arithmetic, and so on.

Приблизительное время сборки:	5.4 SBU
Требует свободного места на диске:	554 MB

5.7.1. Installation of Glibc

In some cases, particularly LFS 7.1, the rpc headers were not installed properly. Test to see if they are installed in the host system and install if they are not:

```
if [ ! -r /usr/include/rpc/types.h ]; then
  su -c 'mkdir -p /usr/include/rpc'
  su -c 'cp -v sunrpc/rpc/*.h /usr/include/rpc'
fi
```

The Glibc documentation recommends building Glibc outside of the source directory in a dedicated build directory:

```
mkdir -v ../glibc-build
cd ../glibc-build
```

Next, prepare Glibc for compilation:

```
../glibc-2.17/configure                               \
    --prefix=/tools                                   \
    --host=$LFS_TGT                                   \
    --build=$(../glibc-2.17/scripts/config.guess) \
    --disable-profile                                 \
    --enable-kernel=2.6.25                            \
    --with-headers=/tools/include                     \
    libc_cv_forced_unwind=yes                         \
    libc_cv_ctors_header=yes                          \
    libc_cv_c_cleanup=yes
```

The meaning of the configure options:

--host=$LFS_TGT, --build=$(../glibc-2.17/scripts/config.guess)
  The combined effect of these switches is that Glibc's build system configures itself to cross-compile, using the cross-linker and cross-compiler in /tools.

--disable-profile
  This builds the libraries without profiling information. Omit this option if profiling on the temporary tools is necessary.

--enable-kernel=2.6.25
  This tells Glibc to compile the library with support for 2.6.25 and later Linux kernels. Workarounds for older kernels are not enabled.

`--with-headers=/tools/include`

> This tells Glibc to compile itself against the headers recently installed to the tools directory, so that it knows exactly what features the kernel has and can optimize itself accordingly.

`libc_cv_forced_unwind=yes`

> The linker installed during Раздел 5.4, «Binutils-2.23.1 - Шаг 1» was cross-compiled and as such cannot be used until Glibc has been installed. This means that the configure test for force-unwind support will fail, as it relies on a working linker. The libc_cv_forced_unwind=yes variable is passed in order to inform **configure** that force-unwind support is available without it having to run the test.

`libc_cv_c_cleanup=yes`

> Simlarly, we pass libc_cv_c_cleanup=yes through to the **configure** script so that the test is skipped and C cleanup handling support is configured.

`libc_cv_ctors_header=yes`

> Simlarly, we pass libc_cv_ctors_header=yes through to the **configure** script so that the test is skipped and gcc constructor support is configured.

During this stage the following warning might appear:

```
configure: WARNING:
*** These auxiliary programs are missing or
*** incompatible versions: msgfmt
*** some features will be disabled.
*** Check the INSTALL file for required versions.
```

Отсутствующая или несовместимая утилита **msgfmt** обычно не приводит к проблемам. Эта программа является частью пакета Gettext, который должен предоставляться хост-системой.

Скомпилируем пакет:

make

Этот пакет поставляется с набором тестов, однако, мы не сможем их запустить сейчас, поскольку еще не установили компилятор C++.

> ### Замечание
>
> Для успешного выполнения тестирования также необходимо установить данные локалей. Данные локалей предоставляют системе информацию о том, в каком формате необходимо осуществлять ввод и вывод даты, времени и валют. Если тестирование (как и рекомендуется) не будет запускаться в этой главе, нет нужды устанавливать локали сейчас. Необходимые локали будут установлены в следующей главе. Чтобы все же установить локали Glibc, следуйте инструкциям из Раздел 6.9, «Glibc-2.17.»

Установим пакет:

make install

> ### ⚠ Предостережение
>
> At this point, it is imperative to stop and ensure that the basic functions (compiling and linking) of the new toolchain are working as expected. To perform a sanity check, run the following commands:
>
> ```
> echo 'main(){}' > dummy.c
> $LFS_TGT-gcc dummy.c
> readelf -l a.out | grep ': /tools'
> ```
>
> If everything is working correctly, there should be no errors, and the output of the last command will be of the form:
>
> ```
> [Requesting program interpreter: /tools/lib/ld-linux.so.2]
> ```
>
> Note that /tools/lib, or /tools/lib64 for 64-bit machines appears as the prefix of the dynamic linker.
>
> If the output is not shown as above or there was no output at all, then something is wrong. Investigate and retrace the steps to find out where the problem is and correct it. This issue must be resolved before continuing on.
>
> Once all is well, clean up the test files:
>
> ```
> rm -v dummy.c a.out
> ```

> ### ☞ Замечание
>
> Building Binutils in the next section will serve as an additional check that the toolchain has been built properly. If Binutils fails to build, it is an indication that something has gone wrong with the previous Binutils, GCC, or Glibc installations.

Подробная информация об этом пакете расположена в Раздел 6.9.4, «Содержимое Glibc.»

5.8. Binutils-2.23.1 - Шаг 2

The Binutils package contains a linker, an assembler, and other tools for handling object files.

Приблизительное время сборки:	1.1 SBU
Требует свободного места на диске:	407 MB

5.8.1. Installation of Binutils

Create a separate build directory again:

```
mkdir -v ../binutils-build
cd ../binutils-build
```

Prepare Binutils for compilation:

```
CC=$LFS_TGT-gcc              \
AR=$LFS_TGT-ar               \
RANLIB=$LFS_TGT-ranlib       \
../binutils-2.23.1/configure \
    --prefix=/tools          \
    --disable-nls            \
    --with-lib-path=/tools/lib
```

The meaning of the new configure options:

CC=$LFS_TGT-gcc AR=$LFS_TGT-ar RANLIB=$LFS_TGT-ranlib
> Because this is really a native build of Binutils, setting these variables ensures that the build system uses the cross-compiler and associated tools instead of the ones on the host system.

--with-lib-path=/tools/lib
> This tells the configure script to specify the library search path during the compilation of Binutils, resulting in /tools/lib being passed to the linker. This prevents the linker from searching through library directories on the host.

Compile the package:

```
make
```

Install the package:

```
make install
```

Now prepare the linker for the «Re-adjusting» phase in the next chapter:

```
make -C ld clean
make -C ld LIB_PATH=/usr/lib:/lib
cp -v ld/ld-new /tools/bin
```

The meaning of the make parameters:

-C ld clean
> This tells the make program to remove all compiled files in the ld subdirectory.

-C ld LIB_PATH=/usr/lib:/lib
> This option rebuilds everything in the `ld` subdirectory. Specifying the `LIB_PATH` Makefile variable on the command line allows us to override the default value of the temporary tools and point it to the proper final path. The value of this variable specifies the linker's default library search path. This preparation is used in the next chapter.

Подробная информация об этом пакете расположена в Раздел 6.13.2, «Содержимое Binutils.»

5.9. GCC-4.7.2 - Шаг 2

The GCC package contains the GNU compiler collection, which includes все же запустить тестирование C and C++ compilers.

Приблизительное время сборки:	7.1 SBU
Требует свободного места на диске:	1.8 GB

5.9.1. Installation of GCC

Our first build of GCC has installed a couple of internal system headers. Normally one of them, `limits.h` will in turn include the corresponding system `limits.h` header, in this case, `/tools/include/limits.h`. However, at the time of the first build of gcc `/tools/include/limits.h` did not exist, so the internal header that GCC installed is a partial, self-contained file and does not include the extended features of the system header. This was adequate for building the temporary libc, but this build of GCC now requires the full internal header. Create a full version of the internal header using a command that is identical to what the GCC build system does in normal circumstances:

```
cat gcc/limitx.h gcc/glimits.h gcc/limity.h > \
  `dirname $($LFS_TGT-gcc -print-libgcc-file-name)`/include-fixed/limits.h
```

For x86 machines, a bootstrap build of GCC uses the `-fomit-frame-pointer` compiler flag. Non-bootstrap builds omit this flag by default, and the goal should be to produce a compiler that is exactly the same as if it were bootstrapped. Apply the following **sed** command to force the build to use the flag:

```
cp -v gcc/Makefile.in{,.tmp}
sed 's/^T_CFLAGS =$/& -fomit-frame-pointer/' gcc/Makefile.in.tmp \
  > gcc/Makefile.in
```

Once again, change the location of GCC's default dynamic linker to use the one installed in `/tools`.

```
for file in \
 $(find gcc/config -name linux64.h -o -name linux.h -o -name sysv4.h)
do
  cp -uv $file{,.orig}
  sed -e 's@/lib\(64\)\?\(32\)\?/ld@/tools&@g' \
  -e 's@/usr@/tools@g' $file.orig > $file
  echo '
#undef STANDARD_STARTFILE_PREFIX_1
#undef STANDARD_STARTFILE_PREFIX_2
#define STANDARD_STARTFILE_PREFIX_1 "/tools/lib/"
#define STANDARD_STARTFILE_PREFIX_2 ""' >> $file
  touch $file.orig
done
```

Как и при первой сборке GCC, необходимы пакеты GMP, MPC и MPFR. Распакуем архивы исходников и присвоим директориям требуемые имена:

```
tar -Jxf ../mpfr-3.1.1.tar.xz
mv -v mpfr-3.1.1 mpfr
tar -Jxf ../gmp-5.1.1.tar.xz
mv -v gmp-5.1.1 gmp
tar -zxf ../mpc-1.0.1.tar.gz
mv -v mpc-1.0.1 mpc
```

Again, do not build the .info files. They are not needed here and are broken with the current version of **makeinfo**.

```
sed -i 's/BUILD_INFO=info/BUILD_INFO=/' gcc/configure
```

Снова создадим отдельную директорию для сборки:

```
mkdir -v ../gcc-build
cd ../gcc-build
```

Перед тем, как приступить к сборке GCC, не забудьте сбросить все переменные окружения, переопределяющие флаги оптимизации.

Теперь подготовим GCC к компиляции:

```
CC=$LFS_TGT-gcc \
AR=$LFS_TGT-ar                     \
RANLIB=$LFS_TGT-ranlib             \
../gcc-4.7.2/configure            \
    --prefix=/tools               \
    --with-local-prefix=/tools  \
    --with-native-system-header-dir=/tools/include \
    --enable-clocale=gnu          \
    --enable-shared               \
    --enable-threads=posix        \
    --enable-__cxa_atexit         \
    --enable-languages=c,c++      \
    --disable-libstdcxx-pch       \
    --disable-multilib            \
    --disable-bootstrap           \
    --disable-libgomp             \
    --with-mpfr-include=$(pwd)/../gcc-4.7.2/mpfr/src \
    --with-mpfr-lib=$(pwd)/mpfr/src/.libs
```

The meaning of the new configure options:

--enable-clocale=gnu
This option ensures the correct locale model is selected for the C++ libraries under all circumstances. If the configure script finds the *de_DE* locale installed, it will select the correct gnu locale model. However, if the *de_DE* locale is not installed, there is the risk of building Application Binary Interface (ABI)-incompatible C++ libraries because the incorrect generic locale model may be selected.

--enable-threads=posix
This enables C++ exception handling for multi-threaded code.

--enable-__cxa_atexit

This option allows use of __cxa_atexit, rather than atexit, to register C++ destructors for local statics and global objects. This option is essential for fully standards-compliant handling of destructors. It also affects the C++ ABI, and therefore results in C++ shared libraries and C++ programs that are interoperable with other Linux distributions.

--enable-languages=c,c++

This option ensures that both the C and C++ compilers are built.

--disable-libstdcxx-pch

Do not build the pre-compiled header (PCH) for libstdc++. It takes up a lot of space, and we have no use for it.

--disable-bootstrap

For native builds of GCC, the default is to do a "bootstrap" build. This does not just compile GCC, but compiles it several times. It uses the programs compiled in a first round to compile itself a second time, and then again a third time. The second and third iterations are compared to make sure it can reproduce itself flawlessly. This also implies that it was compiled correctly. However, the LFS build method should provide a solid compiler without the need to bootstrap each time.

Compile the package:

```
make
```

Install the package:

```
make install
```

As a finishing touch, create a symlink. Many programs and scripts run **cc** instead of **gcc**, which is used to keep programs generic and therefore usable on all kinds of UNIX systems where the GNU C compiler is not always installed. Running **cc** leaves the system administrator free to decide which C compiler to install:

```
ln -sv gcc /tools/bin/cc
```

> ⚠️ **Предостережение**
>
> At this point, it is imperative to stop and ensure that the basic functions (compiling and linking) of the new toolchain are working as expected. To perform a sanity check, run the following commands:
>
> ```
> echo 'main(){}' > dummy.c
> cc dummy.c
> readelf -l a.out | grep ': /tools'
> ```
>
> If everything is working correctly, there should be no errors, and the output of the last command will be of the form:
>
> ```
> [Requesting program interpreter: /tools/lib/ld-linux.so.2]
> ```
>
> Note that `/tools/lib`, or `/tools/lib64` for 64-bit machines appears as the prefix of the dynamic linker.
>
> If the output is not shown as above or there was no output at all, then something is wrong. Investigate and retrace the steps to find out where the problem is and correct it. This issue must be resolved before continuing on. First, perform the sanity check again, using **gcc** instead of **cc**. If this works, then the `/tools/bin/cc` symlink is missing. Install the symlink as per above. Next, ensure that the PATH is correct. This can be checked by running **echo $PATH** and verifying that `/tools/bin` is at the head of the list. If the PATH is wrong it could mean that you are not logged in as user `lfs` or that something went wrong back in Раздел 4.4, «Установка рабочего окружения.»
>
> Once all is well, clean up the test files:
>
> ```
> rm -v dummy.c a.out
> ```

Подробная информация об этом пакете расположена в Раздел 6.17.2, «Содержимое GCC.»

5.10. Tcl-8.6.0

Пакет Tcl содержит Tool Command Language, управляющий язык инструментов.

Приблизительное время сборки:	0.4 SBU
Требует свободного места на диске:	33 MB

5.10.1. Installation of Tcl

This package and the next three (Expect, DejaGNU, and Check) are installed to support running the test suites for GCC and Binutils and other packages. Installing four packages for testing purposes may seem excessive, but it is very reassuring, if not essential, to know that the most important tools are working properly. Even if the test suites are not run in this chapter (they are not mandatory), these packages are required to run the test suites in Глава 6.

Prepare Tcl for compilation:

```
cd unix
./configure --prefix=/tools
```

Build the package:

```
make
```

Compilation is now complete. As discussed earlier, running the test suite is not mandatory for the temporary tools here in this chapter. To run the Tcl test suite anyway, issue the following command:

```
TZ=UTC make test
```

The Tcl test suite may experience failures under certain host conditions that are not fully understood. Therefore, test suite failures here are not surprising, and are not considered critical. The *TZ=UTC* parameter sets the time zone to Coordinated Universal Time (UTC), also known as Greenwich Mean Time (GMT), but only for the duration of the test suite run. This ensures that the clock tests are exercised correctly. Details on the TZ environment variable are provided in Глава 7.

Install the package:

```
make install
```

Make the installed library writable so debugging symbols can be removed later:

```
chmod -v u+w /tools/lib/libtcl8.6.so
```

Install Tcl's headers. The next package, Expect, requires them to build.

```
make install-private-headers
```

Now make a necessary symbolic link:

```
ln -sv tclsh8.6 /tools/bin/tclsh
```

5.10.2. Contents of Tcl

Installed programs:	tclsh (link to tclsh8.6) and tclsh8.6
Installed library:	libtcl8.6.so, libtclstub8.6.a

Short Descriptions

tclsh8.6	The Tcl command shell
tclsh	A link to tclsh8.6
libtcl8.6.so	The Tcl library
libtclstub8.6.a	The Tcl Stub library

5.11. Expect-5.45

Пакет Expect содержит программу для добавления диалогов в интерактивные программы.

Приблизительное время сборки:	0.1 SBU
Требует свободного места на диске:	4.4 MB

5.11.1. Установка Expect

Сначала заставим скрипт configure использовать /bin/stty вместо /usr/local/bin/stty, который он может найти на хост-системе. Это гарантирует, что наши утилиты тестирования будут работать до окончания построения финальной системы:

```
cp -v configure{,.orig}
sed 's:/usr/local/bin:/bin:' configure.orig > configure
```

Теперь подготовим Expect к компиляции:

```
./configure --prefix=/tools --with-tcl=/tools/lib \
  --with-tclinclude=/tools/include
```

Значение опций configure:

--with-tcl=/tools/lib

Это указывает скрипту configure искать Tcl в директории наших временных инструментов; в противном случае он может подхватить установку Tcl хост-системы.

--with-tclinclude=/tools/include

Говорит Expect, где следует искать заголовочные файлы Tcl.

Скомпилируем пакет:

```
make
```

Компиляция завершена. Как говорилось ранее, необязательно выполнять тесты для временных инструментов в этой главе. Чтобы все же запустить тестирование Expect, выполните следующую команду:

```
make test
```

Тестирование Expect может закончиться неудачно из-за некоторых условий хост-системы, которые мы не можем проконтролировать. Поэтому ошибки при проверке не являются сюрпризом, и не следует считать их критичными.

Установим пакет:

```
make SCRIPTS="" install
```

Значение параметров make:

SCRIPTS=""

Это предотвращает установку некоторых скриптов Expect, которые не нужны нам.

5.11.2. Содержимое Expect

Установленная программа: expect

Установленная библиотека: libexpect-5.45.a

Краткое описание

expect   Взаимодействует с другими интерактивными программами в соответствии со скриптом

`libexpect-5.45.a`   Содержит функции, которые позволяют использовать Expect как расширение Tcl или напрямую из C или C++ (без Tcl)

5.12. DejaGNU-1.5

Пакет DejaGNU содержит утилиты для тестирования других программ.

Приблизительное время сборки:	менее 0.1 SBU
Требует свободного места на диске:	4.1 MB

5.12.1. Установка DejaGNU

Подготовим DejaGNU для компиляции:

```
./configure --prefix=/tools
```

Соберем и установим пакет:

```
make install
```

Чтобы проверить результат, выполните:

```
make check
```

5.12.2. Содержание DejaGNU

Установленная программа:	runtest

Краткое описание

runtest Скрипт-обертка, который ищет подходящую оболочку **expect** и затем запускает DejaGNU

5.13. Check-0.9.9

Check – система модульного тестирования для C.

Приблизительное время сборки:	0.1 SBU
Требует свободного места на диске:	6.9 MB

5.13.1. Installation of Check

Prepare Check for compilation:

```
./configure --prefix=/tools
```

Build the package:

```
make
```

Compilation is now complete. As discussed earlier, running the test suite is not mandatory for the temporary tools here in this chapter. To run the Check test suite anyway, issue the following command:

```
make check
```

Note that the Check test suite may take a relatively long (up to 4 SBU) time.

Install the package:

```
make install
```

5.13.2. Contents of Check

Installed program:	checkmk
Installed library:	libcheck.{a,so}

Short Descriptions

checkmk	Awk script for generating C unit tests for use with the Check unit testing framework
libcheck.{a,so}	Contains functions that allow Check to be called from a test program

5.14. Ncurses-5.9

The Ncurses package contains libraries for terminal-independent handling of character screens.

Приблизительное время сборки:	0.5 SBU
Требует свободного места на диске:	35 MB

5.14.1. Установка Ncurses

Подготовим Ncurses к компиляции:

```
./configure --prefix=/tools --with-shared \
    --without-debug --without-ada --enable-overwrite
```

Значение ключей configure:

--without-ada

> Запрещает Ncurses собирать поддержку для компилятора Ada, который может присутствовать на хост-системе, но не будет доступен после того, как мы войдем в окружение **chroot**.

--enable-overwrite

> Это указывает Ncurses установить заголовочные файлы в /tools/include вместо /tools/include/ncurses, чтобы другие пакеты могли успешно найти их.

Скомпилируем пакет:

```
make
```

Этот пакет имеет набор тестов, но они могут быть запущены только после его установки. Тесты располагаются в директории test/. Более подробная информация находится в файле README в этой же директории.

Установим пакет:

```
make install
```

Подробная информация об этом пакете расположена в Раздел 6.21.2, «Содержимое Ncurses.»

5.15. Bash-4.2

The Bash package contains the Bourne-Again SHell.

Приблизительное время сборки:	0.4 SBU
Требует свободного места на диске:	48 MB

5.15.1. Установка Bash

Сначала применим следующий патч, исправляющий разнообразные ошибки, выявленные с момента релиза:

```
patch -Np1 -i ../bash-4.2-fixes-11.patch
```

Подготовим Bash к компиляции:

```
./configure --prefix=/tools --without-bash-malloc
```

Значение опций configure:

--without-bash-malloc
> Эта опция отключает использование встроенной функции выделения памяти Bash (malloc), которая часто вызывает ошибки сегментирования. При отключении этой опции Bash будет использовать функцию malloc из Glibc, которая гораздо более надежна.

Скомпилируем пакет:

```
make
```

Компиляция завершена. Как говорилось ранее, необязательно выполнять тесты для временных инструментов в этой главе. Чтобы все же запустить тестирование Bash, выполните следующую команду:

```
make tests
```

Установим пакет:

```
make install
```

Сделаем ссылку для программ, которые используют **sh** как оболочку:

```
ln -sv bash /tools/bin/sh
```

Подробная информация об этом пакете расположена в Раздел 6.33.2, «Содержимое Bash.»

5.16. Bzip2-1.0.6

The Bzip2 package contains programs for compressing and decompressing files. Compressing text files with **bzip2** yields a much better compression percentage than with the traditional **gzip**.

Приблизительное время сборки:	менее 0.1 SBU
Требует свободного места на диске:	5.7 MB

5.16.1. Установка Bzip2

Пакет Bzip2 не содержит скрипта **configure**. Скомпилируем его:

```
make
```

Установим пакет:

```
make PREFIX=/tools install
```

Подробная информация об этом пакете расположена в Раздел 6.19.2, «Содержимое Bzip2.»

5.17. Coreutils-8.21

The Coreutils package contains utilities for showing and setting the basic system characteristics.

Приблизительное время сборки:	0.8 SBU
Требует свободного места на диске:	133 MB

5.17.1. Installation of Coreutils

Prepare Coreutils for compilation:

```
./configure --prefix=/tools --enable-install-program=hostname
```

The meaning of the configure options:

--enable-install-program=hostname
This enables the **hostname** binary to be built and installed – it is disabled by default but is required by the Perl test suite.

Compile the package:

```
make
```

Compilation is now complete. As discussed earlier, running the test suite is not mandatory for the temporary tools here in this chapter. To run the Coreutils test suite anyway, issue the following command:

```
make RUN_EXPENSIVE_TESTS=yes check
```

The *RUN_EXPENSIVE_TESTS=yes* parameter tells the test suite to run several additional tests that are considered relatively expensive (in terms of CPU power and memory usage) on some platforms, but generally are not a problem on Linux.

Install the package:

```
make install
```

Подробная информация об этом пакете расположена в Раздел 6.27.2, «Содержимое Coreutils.»

5.18. Diffutils-3.2

The Diffutils package contains programs that show the differences between files or directories.

Приблизительное время сборки:	0.2 SBU
Требует свободного места на диске:	8.5 MB

5.18.1. Installation of Diffutils

Fix an incompatibility between this package and Glibc-2.17:

```
sed -i -e '/gets is a/d' lib/stdio.in.h
```

Prepare Diffutils for compilation:

```
./configure --prefix=/tools
```

Compile the package:

```
make
```

Compilation is now complete. As discussed earlier, running the test suite is not mandatory for the temporary tools here in this chapter. To run the Diffutils test suite anyway, issue the following command:

```
make check
```

Install the package:

```
make install
```

Подробная информация об этом пакете расположена в Раздел 6.40.2, «Содержимое Diffutils.»

5.19. File-5.13

The File package contains a utility for determining the type of a given file or files.

Приблизительное время сборки:	0.1 SBU
Требует свободного места на диске:	12.4 MB

5.19.1. Установка File

Подготовим File к компиляции:

```
./configure --prefix=/tools
```

Скомпилируем пакет:

```
make
```

Компиляция завершена. Как говорилось ранее, необязательно выполнять тесты для временных инструментов в этой главе. Чтобы все же запустить тестирование File, выполните следующую команду:

```
make check
```

Установим пакет:

```
make install
```

Подробная информация об этом пакете расположена в Раздел 6.12.2, «Содержимое File.»

5.20. Findutils-4.4.2

The Findutils package contains programs to find files. These programs are provided to recursively search through a directory tree and to create, maintain, and search a database (often faster than the recursive find, but unreliable if the database has not been recently updated).

Приблизительное время сборки:	0.2 SBU
Требует свободного места на диске:	27 MB

5.20.1. Установка Findutils

Подготовим Findutils к компиляции:

```
./configure --prefix=/tools
```

Компилируем пакет:

```
make
```

Компиляция завершена. Как говорилось ранее, необязательно выполнять тесты для временных инструментов в этой главе. Чтобы все же запустить тестирование Findutils, выполните следующую команду:

```
make check
```

Установим пакет:

```
make install
```

Подробная информация об этом пакете расположена в Раздел 6.42.2, «Содержимое Findutils.»

5.21. Gawk-4.0.2

The Gawk package contains programs for manipulating text files.

Приблизительное время сборки:	0.2 SBU
Требует свободного места на диске:	30 MB

5.21.1. Установка Gawk

Подготовим Gawk к компиляции:

```
./configure --prefix=/tools
```

Скомпилируем пакет:

```
make
```

Компиляция завершена. Как говорилось ранее, необязательно выполнять тесты для временных инструментов в этой главе. Чтобы все же запустить тестирование Gawk, выполните следующую команду:

```
make check
```

Установим пакет:

```
make install
```

Подробная информация об этом пакете расположена в Раздел 6.41.2, «Содержимое Gawk.»

5.22. Gettext-0.18.2

The Gettext package contains utilities for internationalization and localization. These allow programs to be compiled with NLS (Native Language Support), enabling them to output messages in the user's native language.

| **Приблизительное время сборки:** | 0.6 SBU |
| **Требует свободного места на диске:** | 101 MB |

5.22.1. Installation of Gettext

For our temporary set of tools, we only need to build and install one binary from Gettext.

Prepare Gettext for compilation:

```
cd gettext-tools
EMACS="no" ./configure --prefix=/tools --disable-shared
```

The meaning of the configure option:

EMACS="no"

This prevents the configure script from determining where to install Emacs Lisp files as the test is known to hang on some hosts.

--disable-shared

We do not need to install any of the shared Gettext libraries at this time, therefore there is no need to build them.

Compile the package:

```
make -C gnulib-lib
make -C src msgfmt
```

As only one binary has been compiled, it is not possible to run the test suite without compiling additional support libraries from the Gettext package. It is therefore not recommended to attempt to run the test suite at this stage.

Install the **msgfmt** binary:

```
cp -v src/msgfmt /tools/bin
```

Подробная информация об этом пакете расположена в Раздел 6.44.2, «Содержимое Gettext.»

5.23. Grep-2.14

The Grep package contains programs for searching through files.

Приблизительное время сборки:	0.2 SBU
Требует свободного места на диске:	21 MB

5.23.1. Installation of Grep

Prepare Grep for compilation:

```
./configure --prefix=/tools
```

Compile the package:

```
make
```

Compilation is now complete. As discussed earlier, running the test suite is not mandatory for the temporary tools here in this chapter. To run the Grep test suite anyway, issue the following command:

```
make check
```

Install the package:

```
make install
```

Подробная информация об этом пакете расположена в Раздел 6.31.2, «Contents of Grep.»

5.24. Gzip-1.5

The Gzip package contains programs for compressing and decompressing files.

Приблизительное время сборки:	0.2 SBU
Требует свободного места на диске:	10 MB

5.24.1. Установка Gzip

Подготовим Gzip к компиляции:

```
./configure --prefix=/tools
```

Скомпилируем пакет:

```
make
```

Компиляция завершена. Как говорилось ранее, необязательно выполнять тесты для временных инструментов в этой главе. Чтобы все же запустить тестирование Gzip, выполните следующую команду:

```
make check
```

Установим пакет:

```
make install
```

Подробная информация об этом пакете расположена в Раздел 6.49.2, «Содержимое Gzip.»

5.25. M4-1.4.16

The M4 package contains a macro processor.

Приблизительное время сборки:	0.2 SBU
Требует свободного места на диске:	16.6 MB

5.25.1. Installation of M4

Fix an incompatibility between this package and Glibc-2.17:

```
sed -i -e '/gets is a/d' lib/stdio.in.h
```

Prepare M4 for compilation:

```
./configure --prefix=/tools
```

Compile the package:

```
make
```

Compilation is now complete. As discussed earlier, running the test suite is not mandatory for the temporary tools here in this chapter. To run the M4 test suite anyway, issue the following command:

```
make check
```

Install the package:

```
make install
```

Подробная информация об этом пакете расположена в Раздел 6.29.2, «Содержимое M4.»

5.26. Make-3.82

The Make package contains a program for compiling packages.

Приблизительное время сборки:	0.1 SBU
Требует свободного места на диске:	11.2 MB

5.26.1. Установка Make

Подготовим Make к компиляции:

```
./configure --prefix=/tools
```

Скомпилируем пакет:

```
make
```

Компиляция завершена. Как говорилось ранее, необязательно выполнять тесты для временных инструментов в этой главе. Чтобы все же запустить тестирование Make, выполните следующую команду:

```
make check
```

Установим пакет:

```
make install
```

Подробная информация об этом пакете расположена в Раздел 6.54.2, «Содержимое Make.»

5.27. Patch-2.7.1

The Patch package contains a program for modifying or creating files by applying a «patch» file typically created by the **diff** program.

Приблизительное время сборки:	0.1 SBU
Требует свободного места на диске:	3.4 MB

5.27.1. Установка Patch

Подготовим Patch к компиляции:

```
./configure --prefix=/tools
```

Скомпилируем пакет:

```
make
```

Компиляция завершена. Как говорилось ранее, необязательно выполнять тесты для временных инструментов в этой главе. Чтобы все же запустить тестирование Patch, выполните следующую команду:

```
make check
```

Установим пакет:

```
make install
```

Подробная информация об этом пакете расположена в Раздел 6.56.2, «Contents of Patch.»

5.28. Perl-5.16.2

The Perl package contains the Practical Extraction and Report Language.

Приблизительное время сборки:	1.8 SBU
Требует свободного места на диске:	237 MB

5.28.1. Installation of Perl

First apply the following patch to adapt some hard-wired paths to the C library:

```
patch -Np1 -i ../perl-5.16.2-libc-1.patch
```

Prepare Perl for compilation:

```
sh Configure -des -Dprefix=/tools
```

Build the package:

```
make
```

Although Perl comes with a test suite, it would be better to wait until it is installed in the next chapter.

Only a few of the utilities and libraries, need to be installed at this time:

```
cp -v perl cpan/podlators/pod2man /tools/bin
mkdir -pv /tools/lib/perl5/5.16.2
cp -Rv lib/* /tools/lib/perl5/5.16.2
```

Details on this package are located in Раздел 6.37.2, «Содержимое Perl.»

5.29. Sed-4.2.2

The Sed package contains a stream editor.

Приблизительное время сборки:	0.1 SBU
Требует свободного места на диске:	10.5 MB

5.29.1. Установка Sed

Подготовим Sed к компиляции:

```
./configure --prefix=/tools
```

Скомпилируем пакет:

```
make
```

Компиляция завершена. Как говорилось ранее, необязательно выполнять тесты для временных инструментов в этой главе. Чтобы все же запустить тестирование Sed, выполните следующую команду:

```
make check
```

Установим пакет:

```
make install
```

Подробная информация об этом пакете расположена в Раздел 6.18.2, «Содержимое Sed.»

5.30. Tar-1.26

The Tar package contains an archiving program.

Приблизительное время сборки:	0.4 SBU
Требует свободного места на диске:	20.6 MB

5.30.1. Installation of Tar

Fix an incompatibility between this package and Glibc-2.17:

```
sed -i -e '/gets is a/d' gnu/stdio.in.h
```

Prepare Tar for compilation:

```
./configure --prefix=/tools
```

Compile the package:

```
make
```

Compilation is now complete. As discussed earlier, running the test suite is not mandatory for the temporary tools here in this chapter. To run the Tar test suite anyway, issue the following command:

```
make check
```

Install the package:

```
make install
```

Подробная информация об этом пакете расположена в Раздел 6.59.2, «Contents of Tar.»

5.31. Texinfo-5.0

The Texinfo package contains programs for reading, writing, and converting info pages.

Приблизительное время сборки:	0.3 SBU
Требует свободного места на диске:	94 MB

5.31.1. Установка Texinfo

Подготовим Texinfo к компиляции:

```
./configure --prefix=/tools
```

Скомпилируем пакет:

```
make
```

Компиляция завершена. Как говорилось ранее, необязательно выполнять тесты для временных инструментов в этой главе. Чтобы все же запустить тестирование Texinfo, выполните следующую команду:

```
make check
```

Установим пакет:

```
make install
```

Подробная информация об этом пакете расположена в Раздел 6.60.2, «Содержимое Texinfo.»

5.32. Xz-5.0.4

The Xz package contains programs for compressing and decompressing files. It provides capabilities for the lzma and the newer xz compression formats. Compressing text files with **xz** yields a better compression percentage than with the traditional **gzip** or **bzip2** commands.

Приблизительное время сборки:	0.2 SBU
Требует свободного места на диске:	16.3 MB

5.32.1. Установка Xz-Utils

Подготовим Xz к компиляции:

```
./configure --prefix=/tools
```

Скомпилируем пакет:

```
make
```

Компиляция завершена. Как говорилось ранее, необязательно выполнять тесты для временных инструментов в этой главе. Чтобы все же запустить тестирование Xz, выполните следующую команду:

```
make check
```

Установим пакет:

```
make install
```

Подробная информация об этом пакете расположена в Раздел 6.46.2, «Contents of Xz.»

5.33. Очистка

Шаги, предлагаемые в этой секции, не являются обязательными, однако, если раздел LFS очень мал, неплохо будет узнать, какие ненужные элементы можно удалить. Собранные исполняемые файлы и библиотеки содержат около 70 MB ненужной на данном этапе отладочной информации. Удалите ее командами:

```
strip --strip-debug /tools/lib/*
strip --strip-unneeded /tools/{,s}bin/*
```

Эти команды пропустят некоторые файлы, сообщая что не могут распознать их формат. Большинство из них являются скриптами, а не двоичными файлами.

Будьте внимательны и *не* используйте параметр *--strip-unneeded* при обработке библиотек. Статические библиотеки будут полностью испорчены и весь инструментарий прийдется собирать заново.

Чтобы освободить еще немного, удалите документацию:

```
rm -rf /tools/{,share}/{info,man,doc}
```

На данном этапе у Вас должно остаться как минимум 850 MB свободного места в разделе $LFS. Именно столько потребуется для сборки и установки Glibc в следующей главе. Если Вы сможете собрать Glibc, Вам хватит места и на все остальное.

5.34. Смена владельца

> **Замечание**
>
> Все следующие команды в этой книге должны быть выполнены от имени пользователя root, а не lfs. Поэтому дважды проверьте, что переменная $LFS объявлена в окружении root.

В данный момент директория $LFS/tools принадлежит пользователю lfs , который существует только на хост-системе. Если директория $LFS/tools будет сохранена для последующего использования, файлы будут принадлежать идентификатору пользователя, которому не соответствует ни одна учетная запись. Это очень опасно, поскольку позже созданная учетная запись пользователя может получить такой же идентификатор, и сможет сделать с файлами и папками в директории $LFS/tools что угодно, возможно, даже полностью разрушить их.

Чтобы предотвратить это, Вы можете добавить пользователя lfs в новую систему LFS позже, при создании файла /etc/passwd, позаботившись о присвоении ему тех же идентификаторов пользователя и группы, что и на хост-системе. Но еще лучше просто сменить владельца директории $LFS/tools на пользователя root выполнив следующую команду:

```
chown -R root:root $LFS/tools
```

Хотя директория $LFS/tools может быть удалена после завершения сборки LFS-системы, ее можно оставить для сборки последующих LFS-систем *той же версии книги*. Как лучше всего сохранить $LFS/tools - Ваше личное дело.

Предостережение

Если Вы собираетесь сохранить временные инструменты для использования при сборке будущих LFS-систем, необходимо *сейчас* сохранить их. Последующие команды в главе 6 изменят их, сделав непригодными для будущих сборок.

Часть III. Сборка системы LFS

Глава 6. Установка базовых системных пакетов

6.1. Introduction

In this chapter, we enter the building site and start constructing the LFS system in earnest. That is, we chroot into the temporary mini Linux system, make a few final preparations, and then begin installing the packages.

The installation of this software is straightforward. Although in many cases the installation instructions could be made shorter and more generic, we have opted to provide the full instructions for every package to minimize the possibilities for mistakes. The key to learning what makes a Linux system work is to know what each package is used for and why you (or the system) may need it.

We do not recommend using optimizations. They can make a program run slightly faster, but they may also cause compilation difficulties and problems when running the program. If a package refuses to compile when using optimization, try to compile it without optimization and see if that fixes the problem. Even if the package does compile when using optimization, there is the risk it may have been compiled incorrectly because of the complex interactions between the code and build tools. Also note that the `-march` and `-mtune` options using values not specified in the book have not been tested. This may cause problems with the toolchain packages (Binutils, GCC and Glibc). The small potential gains achieved in using compiler optimizations are often outweighed by the risks. First-time builders of LFS are encouraged to build without custom optimizations. The subsequent system will still run very fast and be stable at the same time.

The order that packages are installed in this chapter needs to be strictly followed to ensure that no program accidentally acquires a path referring to `/tools` hard-wired into it. For the same reason, do not compile separate packages in parallel. Compiling in parallel may save time (especially on dual-CPU machines), but it could result in a program containing a hard-wired path to `/tools`, which will cause the program to stop working when that directory is removed.

Before the installation instructions, each installation page provides information about the package, including a concise description of what it contains, approximately how long it will take to build, and how much disk space is required during this building process. Following the installation instructions, there is a list of programs and libraries (along with brief descriptions of these) that the package installs.

> **Замечание**
>
> The SBU values and required disk space includes test suite data for all applicable packages in Chapter 6.

6.2. Preparing Virtual Kernel File Systems

Various file systems exported by the kernel are used to communicate to and from the kernel itself. These file systems are virtual in that no disk space is used for them. The content of the file systems resides in memory.

Begin by creating directories onto which the file systems will be mounted:

```
mkdir -v $LFS/{dev,proc,sys}
```

6.2.1. Creating Initial Device Nodes

When the kernel boots the system, it requires the presence of a few device nodes, in particular the console and null devices. The device nodes must be created on the hard disk so that they are available before **udevd** has been started, and additionally when Linux is started with *init=/bin/bash*. Create the devices by running the following commands:

```
mknod -m 600 $LFS/dev/console c 5 1
mknod -m 666 $LFS/dev/null c 1 3
```

6.2.2. Mounting and Populating /dev

The recommended method of populating the /dev directory with devices is to mount a virtual filesystem (such as tmpfs) on the /dev directory, and allow the devices to be created dynamically on that virtual filesystem as they are detected or accessed. Device creation is generally done during the boot process by Udev. Since this new system does not yet have Udev and has not yet been booted, it is necessary to mount and populate /dev manually. This is accomplished by bind mounting the host system's /dev directory. A bind mount is a special type of mount that allows you to create a mirror of a directory or mount point to some other location. Use все же запустить тестирование following command to achieve this:

```
mount -v --bind /dev $LFS/dev
```

6.2.3. Mounting Virtual Kernel File Systems

Now mount the remaining virtual kernel filesystems:

```
mount -vt devpts devpts $LFS/dev/pts
mount -vt proc proc $LFS/proc
mount -vt sysfs sysfs $LFS/sys
```

In some host systems, /dev/shm is a symbolic link to /run/shm. Inside a chroot environment, this temporary file system needs to be mounted separate from the host file system:

```
if [ -h $LFS/dev/shm ]; then
  link=$(readlink $LFS/dev/shm)
  mkdir -p $LFS/$link
  mount -vt tmpfs shm $LFS/$link
  unset link
else
  mount -vt tmpfs shm $LFS/dev/shm
fi
```

6.3. Package Management

Package Management is an often requested addition to the LFS Book. A Package Manager allows tracking the installation of files making it easy to remove and upgrade packages. As well as the binary and library files, a package manager will handle the installation of configuration files. Before you begin to wonder, NO—this section will not talk about nor recommend any particular package manager. What it provides is a roundup of the more

popular techniques and how they work. The perfect package manager for you may be among these techniques or may be a combination of two or more of these techniques. This section briefly mentions issues that may arise when upgrading packages.

Some reasons why no package manager is mentioned in LFS or BLFS include:

* Dealing with package management takes the focus away from the goals of these books—teaching how a Linux system is built.

* There are multiple solutions for package management, each having its strengths and drawbacks. Including one that satisfies all audiences is difficult.

There are some hints written on the topic of package management. Visit the *Hints Project* and see if one of them fits your need.

6.3.1. Upgrade Issues

A Package Manager makes it easy to upgrade to newer versions when they are released. Generally the instructions in the LFS and BLFS Book can be used to upgrade to the newer versions. Here are some points that you should be aware of when upgrading packages, especially on a running system.

* If one of the toolchain packages (Glibc, GCC or Binutils) needs to be upgraded to a newer minor version, it is safer to rebuild LFS. Though you *may* be able to get by rebuilding all все же запустить тестирование packages in their dependency order, we do not recommend it. For example, if glibc-2.2.x needs to be updated to glibc-2.3.x, it is safer to rebuild. For micro version updates, a simple reinstallation usually works, but is not guaranteed. For example, upgrading from glibc-2.3.4 to glibc-2.3.5 will not usually cause any problems.

* If a package containing a shared library is updated, and if the name of the library changes, then all the packages dynamically linked to the library need to be recompiled to link against the newer library. (Note that there is no correlation between the package version and the name of the library.) For example, consider a package foo-1.2.3 that installs a shared library with name `libfoo.so.1`. Say you upgrade все же запустить тестирование package to a newer version foo-1.2.4 that installs a shared library with name `libfoo.so.2`. In this case, all packages that are dynamically linked to `libfoo.so.1` need to be recompiled to link against `libfoo.so.2`. Note that you should not remove the previous libraries until the dependent packages are recompiled.

6.3.2. Package Management Techniques

The following are some common package management techniques. Before making a decision on a package manager, do some research on the various techniques, particularly the drawbacks of the particular scheme.

6.3.2.1. It is All in My Head!

Yes, this is a package management technique. Some folks do not find все же запустить тестирование need for a package manager because they know the packages intimately and know what files are installed by each package. Some users also do not need any package management because they plan on rebuilding the entire system when a package is changed.

6.3.2.2. Install in Separate Directories

This is a simplistic package management that does not need any extra package to manage the installations. Each package is installed in a separate directory. For example, package foo-1.1 is installed in /usr/pkg/foo-1.1 and a symlink is made from /usr/pkg/foo to /usr/pkg/foo-1.1. When installing a new version foo-1.2, it is installed in /usr/pkg/foo-1.2 and the previous symlink is replaced by a symlink to the new version.

Environment variables such as PATH, LD_LIBRARY_PATH, MANPATH, INFOPATH and CPPFLAGS need to be expanded to include /usr/pkg/foo. For more than a few packages, this scheme becomes unmanageable.

6.3.2.3. Symlink Style Package Management

This is a variation of the previous package management technique. Each package is installed similar to the previous scheme. But instead of making the symlink, each file is symlinked into the /usr hierarchy. This removes the need to expand the environment variables. Though the symlinks can be created by the user to automate the creation, many package managers have been written using this approach. A few of the popular ones include Stow, Epkg, Graft, and Depot.

The installation needs to be faked, so that the package thinks that it is installed in /usr though in reality it is installed in the /usr/pkg hierarchy. Installing in this manner is not usually a trivial task. For example, consider that you are installing a package libfoo-1.1. The following instructions may not install the package properly:

```
./configure --prefix=/usr/pkg/libfoo/1.1
make
make install
```

The installation will work, but the dependent packages may not link to libfoo as you would expect. If you compile a package that links against libfoo, you may notice that it is linked to /usr/pkg/libfoo/1.1/lib/libfoo.so.1 instead of /usr/lib/libfoo.so.1 as you would expect. The correct approach is to use the DESTDIR strategy to fake installation of the package. This approach works as follows:

```
./configure --prefix=/usr
make
make DESTDIR=/usr/pkg/libfoo/1.1 install
```

Most packages support this approach, but there are some which do not. For the non-compliant packages, you may either need to manually install the package, or you may find that it is easier to install some problematic packages into /opt.

6.3.2.4. Timestamp Based

In this technique, a file is timestamped before the installation of все же запустить тестирование package. After the installation, a simple use of the **find** command with the appropriate options can generate a log of all the files installed after the timestamp file was created. A package manager written with this approach is install-log.

Though this scheme has the advantage of being simple, it has two drawbacks. If, during installation, the files are installed with any timestamp other than the current time, those files will not be tracked by все же запустить тестирование package manager. Also, this scheme can only be used when one package is installed at a time. The logs are not reliable if two packages are being installed on two different consoles.

6.3.2.5. Tracing Installation Scripts

In this approach, the commands that the installation scripts perform are recorded. There are two techniques that one can use:

The `LD_PRELOAD` environment variable can be set to point to a library to be preloaded before installation. During installation, this library tracks the packages that are being installed by attaching itself to various executables such as **cp**, **install**, **mv** and tracking the system calls that modify the filesystem. For this approach to work, all the executables need to be dynamically linked without the suid or sgid bit. Preloading the library may cause some unwanted side-effects during installation. Therefore, it is advised that one performs some tests to ensure that the package manager does not break anything and logs all the appropriate files.

The second technique is to use **strace**, which logs all system calls made during the execution of the installation scripts.

6.3.2.6. Creating Package Archives

In this scheme, the package installation is faked into a separate tree as described in the Symlink style package management. After the installation, a package archive is created using the installed files. This archive is then used to install the package either on the local machine or can even be used to install the package on other machines.

This approach is used by most of the package managers found in the commercial distributions. Examples of package managers that follow this approach are RPM (which, incidentally, is required by the *Linux Standard Base Specification*), pkg-utils, Debian's apt, and Gentoo's Portage system. A hint describing how to adopt this style of package management for LFS systems is located at *http://www.linuxfromscratch.org/ hints/downloads/files/fakeroot.txt*.

Creation of package files that include dependency information is complex and is beyond the scope of LFS.

Slackware uses a **tar** based system for package archives. This system purposely does not handle package dependencies as more complex package managers do. For details of Slackware package management, see *http://www.slackbook.org/html/package-management.html*.

6.3.2.7. User Based Management

This scheme, unique to LFS, was devised by Matthias Benkmann, and is available from the *Hints Project*. In this scheme, each package is installed as a separate user into the standard locations. Files belonging to a package are easily identified by checking the user ID. The features and shortcomings of this approach are too complex to describe in this section. For the details please see the hint at *http://www.linuxfromscratch.org/hints/ downloads/files/more_control_and_pkg_man.txt*.

6.3.3. Deploying LFS on Multiple Systems

One of the advantages of an LFS system is that there are no files that depend on the position of files on a disk system. Cloning an LFS build to another computer with an architecture similar to the base system is as simple as using **tar** on the LFS partition that contains все же запустить тестирование root directory (about 250MB uncompressed for

a base LFS build), copying that file via network transfer or CD-ROM to the new system and expanding it. From that point, a few configuration files will have to be changed. Configuration files that may need to be updated include: /etc/hosts, /etc/fstab, /etc/passwd, /etc/group, /etc/shadow, /etc/ld.so.conf, /etc/sysconfig/rc.site, /etc/sysconfig/network, and /etc/sysconfig/ifconfig.eth0.

A custom kernel may need to be built for the new system depending on differences in system hardware and the original kernel configuration.

Finally the new system has to be made bootable via Раздел 8.4, «Using GRUB to Set Up the Boot Process».

6.4. Entering the Chroot Environment

It is time to enter the chroot environment to begin building and installing the final LFS system. As user root, run the following command to enter the realm that is, at the moment, populated with only the temporary tools:

```
chroot "$LFS" /tools/bin/env -i \
    HOME=/root                  \
    TERM="$TERM"                \
    PS1='\u:\w\$ '              \
    PATH=/bin:/usr/bin:/sbin:/usr/sbin:/tools/bin \
    /tools/bin/bash --login +h
```

The -i option given to the **env** command will clear all variables of the chroot environment. After that, only the HOME, TERM, PS1, and PATH variables are set again. The TERM=$TERM construct will set the TERM variable inside chroot to the same value as outside chroot. This variable is needed for programs like **vim** and **less** to operate properly. If other variables are needed, such as CFLAGS or CXXFLAGS, this is a good place to set them again.

From this point on, there is no need to use the LFS variable anymore, because all work will be restricted to the LFS file system. This is because the Bash shell is told that $LFS is now the root (/) directory.

Notice that /tools/bin comes last in the PATH. This means that a temporary tool will no longer be used once its final version is installed. This occurs when the shell does not «remember» the locations of executed binaries—for this reason, hashing is switched off by passing the +h option to **bash**.

Note that the **bash** prompt will say I have no name! This is normal because the /etc/passwd file has not been created yet.

> **Замечание**
>
> It is important that all the commands throughout the remainder of this chapter and the following chapters are run from within the chroot environment. If you leave this environment for any reason (rebooting for example), ensure that the virtual kernel filesystems are mounted as explained in Раздел 6.2.2, «Mounting and Populating /dev» and Раздел 6.2.3, «Mounting Virtual Kernel File Systems» and enter chroot again before continuing with the installation.

6.5. Creating Directories

It is time to create some structure in the LFS file system. Create a standard directory tree by issuing the following commands:

```
mkdir -pv /{bin,boot,etc/{opt,sysconfig},home,lib,mnt,opt,run}
mkdir -pv /{media/{floppy,cdrom},sbin,srv,var}
install -dv -m 0750 /root
install -dv -m 1777 /tmp /var/tmp
mkdir -pv /usr/{,local/}{bin,include,lib,sbin,src}
mkdir -pv /usr/{,local/}share/{doc,info,locale,man}
mkdir -v  /usr/{,local/}share/{misc,terminfo,zoneinfo}
mkdir -pv /usr/{,local/}share/man/man{1..8}
for dir in /usr /usr/local; do
  ln -sv share/{man,doc,info} $dir
done
case $(uname -m) in
 x86_64) ln -sv lib /lib64 && ln -sv lib /usr/lib64 ;;
esac
mkdir -v /var/{log,mail,spool}
ln -sv /run /var/run
ln -sv /run/lock /var/lock
mkdir -pv /var/{opt,cache,lib/{misc,locate},local}
```

Directories are, by default, created with permission mode 755, but this is not desirable for all directories. In the commands above, two changes are made—one to the home directory of user root, and another to the directories for temporary files.

The first mode change ensures that not just anybody can enter the /root directory—the same as a normal user would do with his or her home directory. The second mode change makes sure that any user can write to the /tmp and /var/tmp directories, but cannot remove another user's files from them. The latter is prohibited by the so-called «sticky bit,» the highest bit (1) in the 1777 bit mask.

6.5.1. FHS Compliance Note

The directory tree is based on the Filesystem Hierarchy Standard (FHS) (available at *http://www.pathname.com/fhs/*). In addition to все же запустить тестирование FHS, we create compatibility symlinks for the man, doc, and info directories since many packages still try to install their documentation into /usr/<directory> or /usr/local/<directory> as opposed to /usr/share/<directory> or /usr/local/share/<directory>. The FHS also stipulates the existence of /usr/local/games and /usr/share/games. The FHS is not precise as to все же запустить тестирование structure of the /usr/local/share subdirectory, so we create only the directories that are needed. However, feel free to create these directories if you prefer to conform more strictly to the FHS.

6.6. Creating Essential Files and Symlinks

Some programs use hard-wired paths to programs which do not exist yet. In order to satisfy these programs, create a number of symbolic links which will be replaced by real files throughout the course of this chapter after the software has been installed:

```
ln -sv /tools/bin/{bash,cat,echo,pwd,stty} /bin
ln -sv /tools/bin/perl /usr/bin
ln -sv /tools/lib/libgcc_s.so{,.1} /usr/lib
ln -sv /tools/lib/libstdc++.so{,.6} /usr/lib
sed 's/tools/usr/' /tools/lib/libstdc++.la > /usr/lib/libstdc++.la
ln -sv bash /bin/sh
```

A proper Linux system maintains a list of the mounted file systems in the file /etc/mtab. Normally, this file would be created when we mount a new file system. Since we will not be mounting any file systems inside our chroot environment, create an empty file for utilities that expect the presence of /etc/mtab:

```
touch /etc/mtab
```

In order for user root to be able to login and for the name «root» to be recognized, there must be relevant entries in the /etc/passwd and /etc/group files.

Create the /etc/passwd file by running the following command:

```
cat > /etc/passwd << "EOF"
root:x:0:0:root:/root:/bin/bash
bin:x:1:1:bin:/dev/null:/bin/false
nobody:x:99:99:Unprivileged User:/dev/null:/bin/false
EOF
```

The actual password for root (the «x» used here is just a placeholder) will be set later.

Create the /etc/group file by running the following command:

```
cat > /etc/group << "EOF"
root:x:0:
bin:x:1:
sys:x:2:
kmem:x:3:
tape:x:4:
tty:x:5:
daemon:x:6:
floppy:x:7:
disk:x:8:
lp:x:9:
dialout:x:10:
audio:x:11:
video:x:12:
utmp:x:13:
usb:x:14:
cdrom:x:15:
mail:x:34:
nogroup:x:99:
EOF
```

The created groups are not part of any standard—they are groups decided on in part by the requirements of the Udev configuration in this chapter, and in part by common convention employed by a number of existing Linux distributions. The Linux Standard Base (LSB, available at *http://www.linuxbase.org*) recommends only that, besides the group root with a Group ID (GID) of 0, a group bin with a GID of 1 be present. All other group names and GIDs can be chosen freely by the system administrator since well-written programs do not depend on GID numbers, but rather use the group's name.

To remove the «I have no name!» prompt, start a new shell. Since a full Glibc was installed in Chapter 5 and the /etc/passwd and /etc/group files have been created, user name and group name resolution will now work:

```
exec /tools/bin/bash --login +h
```

Note the use of the *+h* directive. This tells **bash** not to use its internal path hashing. Without this directive, **bash** would remember the paths to binaries it has executed. To ensure the use of the newly compiled binaries as soon as they are installed, the *+h* directive will be used for the duration of this chapter.

The **login**, **agetty**, and **init** programs (and others) use a number of log files to record information such as who was logged into the system and when. However, these programs will not write to the log files if they do not already exist. Initialize the log files and give them proper permissions:

```
touch /var/log/{btmp,lastlog,wtmp}
chgrp -v utmp /var/log/lastlog
chmod -v 664  /var/log/lastlog
chmod -v 600  /var/log/btmp
```

The /var/log/wtmp file records all logins and logouts. The /var/log/lastlog file records when each user last logged in. The /var/log/btmp file records the bad login attempts.

> **Замечание**
>
> The /run/utmp file records the users that are currently logged in. This file is created dynamically in the boot scripts.

6.7. Linux-3.8.1 API Headers

The Linux API Headers (in linux-3.8.1.tar.xz) expose the kernel's API for use by Glibc.

Приблизительное время сборки:	0.1 SBU
Требует свободного места на диске:	515 MB

6.7.1. Установка Linux API Headers

The Linux kernel needs to expose an Application Programming Interface (API) for the system's C library (Glibc in LFS) to use. This is done by way of sanitizing various C header files that are shipped in the Linux kernel source tarball.

Make sure there are no stale files and dependencies lying around from previous activity:

```
make mrproper
```

Now test and extract the user-visible kernel headers from the source. They are placed in an intermediate local directory and copied to the needed location because the extraction process removes any existing files in the target directory. There are also some hidden files used by the kernel developers and not needed by LFS that are removed from the intermediate directory.

```
make headers_check
make INSTALL_HDR_PATH=dest headers_install
find dest/include \( -name .install -o -name ..install.cmd \) -delete
cp -rv dest/include/* /usr/include
```

6.7.2. Содержимое Linux API Headers

Installed headers:	/usr/include/asm/*.h, /usr/include/asm-generic/*.h, /usr/include/drm/*.h, /usr/include/linux/*.h, /usr/include/mtd/*.h, /usr/include/rdma/*.h, /usr/include/scsi/*.h, /usr/include/sound/*.h, /usr/include/video/*.h, /usr/include/xen/*.h
Установленные каталоги:	/usr/include/asm, /usr/include/asm-generic, /usr/include/drm, /usr/include/linux, /usr/include/mtd, /usr/include/rdma, /usr/include/scsi, /usr/include/sound, /usr/include/video, /usr/include/xen

Краткое описание

/usr/include/asm/*.h	The Linux API ASM Headers
/usr/include/asm-generic/*.h	The Linux API ASM Generic Headers
/usr/include/drm/*.h	The Linux API DRM Headers
/usr/include/linux/*.h	The Linux API Linux Headers
/usr/include/mtd/*.h	The Linux API MTD Headers
/usr/include/rdma/*.h	The Linux API RDMA Headers
/usr/include/scsi/*.h	The Linux API SCSI Headers

```
/usr/include/sound/*.h          The Linux API Sound Headers
/usr/include/video/*.h          The Linux API Video Headers
/usr/include/xen/*.h            The Linux API Xen Headers
```

6.8. Man-pages-3.47

The Man-pages package contains over 1,900 man pages.

Приблизительное время сборки:	менее 0.1 SBU
Требует свободного места на диске:	22 MB

6.8.1. Установка Man-pages

Install Man-pages by running:

```
make install
```

6.8.2. Содержимое Man-pages

Installed files: various man pages

Краткое описание

man pages	Describe C programming language functions, important device files, and significant configuration files

6.9. Glibc-2.17

The Glibc package contains the main C library. This library provides все же запустить тестирование basic routines for allocating memory, searching directories, opening and closing files, reading and writing files, string handling, pattern matching, arithmetic, and so on.

Приблизительное время сборки:	17.6 SBU
Требует свободного места на диске:	852 MB

6.9.1. Установка Glibc

> **Замечание**
>
> Some packages outside of LFS suggest installing GNU libiconv in order to translate data from one encoding to another. The project's home page (*http://www.gnu.org/software/libiconv/*) says «This library provides an `iconv()` implementation, for use on systems which don't have one, or whose implementation cannot convert from/to Unicode.» Glibc provides an `iconv()` implementation and can convert from/to Unicode, therefore libiconv is not required on an LFS system.

The Glibc build system is self-contained and will install perfectly, even though the compiler specs file and linker are still pointing at `/tools`. The specs and linker cannot be adjusted before the Glibc install because the Glibc autoconf tests would give false results and defeat the goal of achieving a clean build.

The Glibc documentation recommends building Glibc outside of the source directory in a dedicated build directory:

```
mkdir -v ../glibc-build
cd ../glibc-build
```

Подготовим Glibc к компиляции:

```
../glibc-2.17/configure  \
    --prefix=/usr        \
    --disable-profile    \
    --enable-kernel=2.6.25 \
    --libexecdir=/usr/lib/glibc
```

The meaning of the new configure options:

--libexecdir=/usr/lib/glibc
    This changes the location of the **pt_chown** program from its default of /usr/libexec to /usr/lib/glibc.

Скомпилируем пакет:

```
make
```

> **⚠ Важно**
>
> In this section, the test suite for Glibc is considered critical. Do not skip it under any circumstance.

Generally a few tests do not pass, but you can generally ignore any of the test failures listed below. Now test the build results:

```
make -k check 2>&1 | tee glibc-check-log
grep Error glibc-check-log
```

You will probably see an expected (ignored) failure in the *posix/annexc* and *conform/run-conformtest* tests. In addition the Glibc test suite is somewhat dependent on the host system. This is a list of the most common issues:

- The *nptl/tst-clock2*, *nptl/tst-attr3*, *tst/tst-cputimer1*, and *rt/tst-cpuclock2* tests have been known to fail. The reason is not completely understood, but indications are that minor timing issues can trigger these failures.

- The math tests sometimes fail when running on systems where the CPU is not a relatively new genuine Intel or authentic AMD processor.

- When running on older and slower hardware or on systems under load, some tests can fail because of test timeouts being exceeded. Modifying the make check command to set a TIMEOUTFACTOR is reported to help eliminate these errors (e.g. **TIMEOUTFACTOR=16 make -k check**).

- Other tests known to fail on some architectures are posix/bug-regex32, misc/tst-writev, elf/check-textrel, nptl/tst-getpid2, and stdio-common/bug22.

Though it is a harmless message, the install stage of Glibc will complain about the absence of `/etc/ld.so.conf`. Prevent this warning with:

```
touch /etc/ld.so.conf
```

Установим пакет:

```
make install
```

Install NIS and RPC related headers that are not installed by default; these are required to rebuild glibc and by several BLFS packages:

```
cp -v ../glibc-2.17/sunrpc/rpc/*.h /usr/include/rpc
cp -v ../glibc-2.17/sunrpc/rpcsvc/*.h /usr/include/rpcsvc
cp -v ../glibc-2.17/nis/rpcsvc/*.h /usr/include/rpcsvc
```

The locales that can make the system respond in a different language were not installed by the above command. None of the locales are required, but if some of them are missing, test suites of the future packages would skip important testcases.

Individual locales can be installed using the **localedef** program. E.g., the first **localedef** command below combines the /usr/share/i18n/locales/cs_CZ charset-independent locale definition with the /usr/share/i18n/charmaps/UTF-8.gz charmap definition

and appends the result to the /usr/lib/locale/locale-archive file. The following instructions will install the minimum set of locales necessary for the optimal coverage of tests:

```
mkdir -pv /usr/lib/locale
localedef -i cs_CZ -f UTF-8 cs_CZ.UTF-8
localedef -i de_DE -f ISO-8859-1 de_DE
localedef -i de_DE@euro -f ISO-8859-15 de_DE@euro
localedef -i de_DE -f UTF-8 de_DE.UTF-8
localedef -i en_GB -f UTF-8 en_GB.UTF-8
localedef -i en_HK -f ISO-8859-1 en_HK
localedef -i en_PH -f ISO-8859-1 en_PH
localedef -i en_US -f ISO-8859-1 en_US
localedef -i en_US -f UTF-8 en_US.UTF-8
localedef -i es_MX -f ISO-8859-1 es_MX
localedef -i fa_IR -f UTF-8 fa_IR
localedef -i fr_FR -f ISO-8859-1 fr_FR
localedef -i fr_FR@euro -f ISO-8859-15 fr_FR@euro
localedef -i fr_FR -f UTF-8 fr_FR.UTF-8
localedef -i it_IT -f ISO-8859-1 it_IT
localedef -i it_IT -f UTF-8 it_IT.UTF-8
localedef -i ja_JP -f EUC-JP ja_JP
localedef -i ru_RU -f KOI8-R ru_RU.KOI8-R
localedef -i ru_RU -f UTF-8 ru_RU.UTF-8
localedef -i tr_TR -f UTF-8 tr_TR.UTF-8
localedef -i zh_CN -f GB18030 zh_CN.GB18030
```

In addition, install the locale for your own country, language and character set.

Alternatively, install all locales listed in the glibc-2.17/localedata/SUPPORTED file (it includes every locale listed above and many more) at once with the following time-consuming command:

```
make localedata/install-locales
```

Then use the **localedef** command to create and install locales not listed in the glibc-2.17/localedata/SUPPORTED file in the unlikely case you need them.

6.9.2. Configuring Glibc

The /etc/nsswitch.conf file needs to be created because, although Glibc provides defaults when this file is missing or corrupt, все же запустить тестирование Glibc defaults do not work well in a networked environment. The time zone also needs to be configured.

Create a new file /etc/nsswitch.conf by running the following:

```
cat > /etc/nsswitch.conf << "EOF"
# Begin /etc/nsswitch.conf

passwd: files
group: files
shadow: files

hosts: files dns
networks: files

protocols: files
services: files
ethers: files
rpc: files

# End /etc/nsswitch.conf
EOF
```

Install timezone data:

```
tar -xf ../tzdata2012j.tar.gz

ZONEINFO=/usr/share/zoneinfo
mkdir -pv $ZONEINFO/{posix,right}

for tz in etcetera southamerica northamerica europe africa antarctica  \
          asia australasia backward pacificnew solar87 solar88 solar89 \
          systemv; do
    zic -L /dev/null    -d $ZONEINFO        -y "sh yearistype.sh" ${tz}
    zic -L /dev/null    -d $ZONEINFO/posix -y "sh yearistype.sh" ${tz}
    zic -L leapseconds -d $ZONEINFO/right -y "sh yearistype.sh" ${tz}
done

cp -v zone.tab iso3166.tab $ZONEINFO
zic -d $ZONEINFO -p America/New_York
unset ZONEINFO
```

The meaning of the zic commands:

zic -L /dev/null ...

This creates posix timezones, without any leap seconds. It is conventional to put these in both zoneinfo and zoneinfo/posix. It is necessary to put the POSIX timezones in zoneinfo, otherwise various test-suites will report errors. On an embedded system, where space is tight and you do not intend to ever update the timezones, you could save 1.9MB by not using the posix directory, but some applications or test-suites might give less good results

zic -L leapseconds ...

This creates right timezones, including leap seconds. On an embedded system, where space is tight and you do not intend to ever update the timezones, or care about the correct time, you could save 1.9MB by omitting the right directory.

```
zic ... -p ...
```
This creates the `posixrules` file. We use New York because POSIX requires the daylight savings time rules to be in accordance with US rules.

One way to determine the local time zone is to run the following script:

```
tzselect
```

After answering a few questions about the location, the script will output the name of the time zone (e.g., *America/Edmonton*). There are also some other possible timezones listed in `/usr/share/zoneinfo` such as *Canada/Eastern* or *EST5EDT* that are not identified by the script but can be used.

Then create the `/etc/localtime` file by running:

```
cp -v --remove-destination /usr/share/zoneinfo/<xxx> \
    /etc/localtime
```

Replace *<xxx>* with the name of the time zone selected (e.g., Canada/Eastern).

The meaning of the cp option:

```
--remove-destination
```
This is needed to force removal of the already existing symbolic link. The reason for copying the file instead of using a symlink is to cover the situation where `/usr` is on a separate partition. This could be important when booted into single user mode.

6.9.3. Configuring the Dynamic Loader

By default, the dynamic loader (`/lib/ld-linux.so.2`) searches through `/lib` and `/usr/lib` for dynamic libraries that are needed by programs as they are run. However, if there are libraries in directories other than `/lib` and `/usr/lib`, these need to be added to the `/etc/ld.so.conf` file in order for the dynamic loader to find them. Two directories that are commonly known to contain additional libraries are `/usr/local/lib` and `/opt/lib`, so add those directories to the dynamic loader's search path.

Create a new file `/etc/ld.so.conf` by running the following:

```
cat > /etc/ld.so.conf << "EOF"
# Begin /etc/ld.so.conf
/usr/local/lib
/opt/lib

EOF
```

If desired, the dynamic loader can also search a directory and include the contents of files found there. Generally the files in this include directory are one line specifying the desired library path. To add this capability run the following commands:

```
cat >> /etc/ld.so.conf << "EOF"
# Add an include directory
include /etc/ld.so.conf.d/*.conf

EOF
mkdir /etc/ld.so.conf.d
```

6.9.4. Содержимое Glibc

Установленные программы:	catchsegv, gencat, getconf, getent, iconv, iconvconfig, ldconfig, ldd, lddlibc4, locale, localedef, makedb, mtrace, nscd, pcprofiledump, pldd, pt_chown, rpcgen, sln, sotruss, sprof, tzselect, xtrace, zdump, and zic
Установленные библиотеки:	ld.so, libBrokenLocale.{a,so}, libSegFault.so, libanl.{a,so}, libbsd-compat.a, libc.{a,so}, libc_nonshared.a, libcidn.so, libcrypt.{a,so}, libdl.{a,so}, libg.a, libieee.a, libm.{a,so}, libmcheck.a, libmemusage.so, libnsl.{a,so}, libnss_compat.so, libnss_dns.so, libnss_files.so, libnss_hesiod.so, libnss_nis.so, libnss_nisplus.so, libpcprofile.so, libpthread.{a,so}, libpthread_nonshared.a, libresolv.{a,so}, librpcsvc.a, librt.{a,so}, libthread_db.so, and libutil.{a,so}
Установленные каталоги:	/usr/include/arpa, /usr/include/bits, /usr/include/gnu, /usr/include/net, /usr/include/netash, /usr/include/netatalk, /usr/include/netax25, /usr/include/neteconet, /usr/include/netinet, /usr/include/netipx, /usr/include/netiucv, /usr/include/netpacket, /usr/include/netrom, /usr/include/netrose, /usr/include/nfs, /usr/include/protocols, /usr/include/rpc, /usr/include/rpcsvc, /usr/include/sys, /usr/lib/audit, /usr/lib/gconv, /usr/lib/glibc, /usr/lib/locale, /usr/share/i18n, /usr/share/zoneinfo, /var/db

Краткое описание

catchsegv	Can be used to create a stack trace when a program terminates with a segmentation fault
gencat	Generates message catalogues
getconf	Displays the system configuration values for file system specific variables
getent	Gets entries from an administrative database
iconv	Performs character set conversion
iconvconfig	Creates fastloading **iconv** module configuration files
ldconfig	Configures the dynamic linker runtime bindings
ldd	Reports which shared libraries are required by each given program or shared library
lddlibc4	Assists **ldd** with object files
locale	Prints various information about the current locale
localedef	Compiles locale specifications
makedb	Creates a simple database from textual input
mtrace	Reads and interprets a memory trace file and displays a summary in human-readable format
nscd	A daemon that provides a cache for the most common name service requests
pcprofiledump	Dumps information generated by PC profiling
pldd	Lists dynamic shared objects used by running processes

pt_chown	A helper program for **grantpt** to set the owner, group and access permissions of a slave pseudo terminal
rpcgen	Generates C code to implement the Remote Procedure Call (RPC) protocol
sln	A statically linked **ln** program
sotruss	Traces shared library procedure calls of a specified command
sprof	Reads and displays shared object profiling data
tzselect	Asks the user about the location of the system and reports все же запустить тестирование corresponding time zone description
xtrace	Traces the execution of a program by printing the currently executed function
zdump	The time zone dumper
zic	The time zone compiler
ld.so	The helper program for shared library executables
libBrokenLocale	Used internally by Glibc as a gross hack to get broken programs (e.g., some Motif applications) running. See comments in `glibc-2.17/locale/broken_cur_max.c` for more information
libSegFault	The segmentation fault signal handler, used by **catchsegv**
libanl	An asynchronous name lookup library
libbsd-compat	Provides the portability needed in order to run certain Berkeley Software Distribution (BSD) programs under Linux
libc	The main C library
libcidn	Used internally by Glibc for handling internationalized domain names in the `getaddrinfo()` function
libcrypt	The cryptography library
libdl	The dynamic linking interface library
libg	Dummy library containing no functions. Previously was a runtime library for **g++**
libieee	Linking in this module forces error handling rules for math functions as defined by the Institute of Electrical and Electronic Engineers (IEEE). The default is POSIX.1 error handling
libm	The mathematical library
libmcheck	Turns on memory allocation checking when linked to
libmemusage	Used by **memusage** to help collect information about the memory usage of a program
libnsl	The network services library
libnss	The Name Service Switch libraries, containing functions for resolving host names, user names, group names, aliases, services, protocols, etc.
libpcprofile	Contains profiling functions used to track the amount of CPU time spent in specific source code lines
libpthread	The POSIX threads library

`libresolv`	Contains functions for creating, sending, and interpreting packets to the Internet domain name servers
`librpcsvc`	Contains functions providing miscellaneous RPC services
`librt`	Contains functions providing most of the interfaces specified by the POSIX.1b Realtime Extension
`libthread_db`	Contains functions useful for building debuggers for multi-threaded programs
`libutil`	Contains code for «standard» functions used in many different Unix utilities

6.10. Adjusting the Toolchain

Now that the final C libraries have been installed, it is time to adjust the toolchain so that it will link any newly compiled program against these new libraries.

First, backup the /tools linker, and replace it with the adjusted linker we made in chapter 5. We'll also create a link to its counterpart in /tools/$(gcc -dumpmachine)/bin:

```
mv -v /tools/bin/{ld,ld-old}
mv -v /tools/$(gcc -dumpmachine)/bin/{ld,ld-old}
mv -v /tools/bin/{ld-new,ld}
ln -sv /tools/bin/ld /tools/$(gcc -dumpmachine)/bin/ld
```

Next, amend the GCC specs file so that it points to the new dynamic linker. Simply deleting all instances of «/tools» should leave us with the correct path to the dynamic linker. Also adjust the specs file so that GCC knows where to find the correct headers and Glibc start files. A **sed** command accomplishes this:

```
gcc -dumpspecs | sed -e 's@/tools@@g' \
    -e '/\*startfile_prefix_spec:/{n;s@.*@/usr/lib/ @}' \
    -e '/\*cpp:/{n;s@$@ -isystem /usr/include@}' > \
    `dirname $(gcc --print-libgcc-file-name)`/specs
```

It is a good idea to visually inspect the specs file to verify the intended change was actually made.

It is imperative at this point to ensure that the basic functions (compiling and linking) of the adjusted toolchain are working as expected. To do this, perform the following sanity checks:

```
echo 'main(){}' > dummy.c
cc dummy.c -v -Wl,--verbose &> dummy.log
readelf -l a.out | grep ': /lib'
```

If everything is working correctly, there should be no errors, and the output of the last command will be (allowing for platform-specific differences in dynamic linker name):

```
[Requesting program interpreter: /lib/ld-linux.so.2]
```

Note that /lib is now the prefix of our dynamic linker.

Now make sure that we're setup to use the correct startfiles:

```
grep -o '/usr/lib.*/crt[1in].*succeeded' dummy.log
```

If everything is working correctly, there should be no errors, and the output of the last command will be:

```
/usr/lib/crt1.o succeeded
/usr/lib/crti.o succeeded
/usr/lib/crtn.o succeeded
```

Verify that the compiler is searching for the correct header files:

```
grep -B1 '^ /usr/include' dummy.log
```

This command should return successfully with the following output:

```
#include <...> search starts here:
 /usr/include
```

Next, verify that the new linker is being used with the correct search paths:

```
grep 'SEARCH.*/usr/lib' dummy.log |sed 's|; |\n|g'
```

If everything is working correctly, there should be no errors, and the output of the last command (allowing for platform-specific target triplets) will be:

```
SEARCH_DIR("/tools/i686-pc-linux-gnu/lib")
SEARCH_DIR("/usr/lib")
SEARCH_DIR("/lib");
```

Next make sure that we're using the correct libc:

```
grep "/lib.*/libc.so.6 " dummy.log
```

If everything is working correctly, there should be no errors, and the output of the last command (allowing for a lib64 directory on 64-bit hosts) will be:

```
attempt to open /lib/libc.so.6 succeeded
```

Lastly, make sure GCC is using the correct dynamic linker:

```
grep found dummy.log
```

If everything is working correctly, there should be no errors, and the output of the last command will be (allowing for platform-specific differences in dynamic linker name and a lib64 directory on 64-bit hosts):

```
found ld-linux.so.2 at /lib/ld-linux.so.2
```

If the output does not appear as shown above or is not received at all, then something is seriously wrong. Investigate and retrace the steps to find out where the problem is and correct it. The most likely reason is that something went wrong with the specs file adjustment. Any issues will need to be resolved before continuing on with the process.

Once everything is working correctly, clean up the test files:

```
rm -v dummy.c a.out dummy.log
```

6.11. Zlib-1.2.7

The Zlib package contains compression and decompression routines used by some programs.

Приблизительное время сборки:	0.1 SBU
Требует свободного места на диске:	3.9 MB

6.11.1. Installation of Zlib

Prepare Zlib for compilation:

```
./configure --prefix=/usr
```

Скомпилируем пакет:

```
make
```

Чтобы запустить тестирование пакета, выполните:

```
make check
```

Установим пакет:

```
make install
```

The shared library needs to be moved to /lib, and as a result the .so file in /usr/lib will need to be recreated:

```
mv -v /usr/lib/libz.so.* /lib
ln -sfv ../../lib/libz.so.1.2.7 /usr/lib/libz.so
```

6.11.2. Содержимое Zlib

Установленные библиотеки:	libz.{a,so}

Краткое описание

libz   Contains compression and decompression functions used by some programs

6.12. File-5.13

The File package contains a utility for determining the type of a given file or files.

Приблизительное время сборки:	0.1 SBU
Требует свободного места на диске:	12.5 MB

6.12.1. Установка File

Подготовим File к компиляции:

```
./configure --prefix=/usr
```

Скомпилируем пакет:

```
make
```

Чтобы запустить тестирование пакета, выполните:

```
make check
```

Установим пакет:

```
make install
```

6.12.2. Содержимое File

Установленные программы:	file
Установленная библиотека:	libmagic.{a,so}

Краткое описание

file	Tries to classify each given file; it does this by performing several tests—file system tests, magic number tests, and language tests
libmagic	Contains routines for magic number recognition, used by the **file** program

6.13. Binutils-2.23.1

The Binutils package contains a linker, an assembler, and other tools for handling object files.

Приблизительное время сборки:	1.9 SBU
Требует свободного места на диске:	343 MB

6.13.1. Установка Binutils

Verify that the PTYs are working properly inside the chroot environment by performing a simple test:

```
expect -c "spawn ls"
```

This command should output the following:

```
spawn ls
```

If, instead, the output includes the message below, then the environment is not set up for proper PTY operation. This issue needs to be resolved before running the test suites for Binutils and GCC:

```
The system has no more ptys.
Ask your system administrator to create more.
```

Suppress the installation of an outdated standards.info file as a newer one is installed later on in the Autoconf instructions:

```
rm -fv etc/standards.info
sed -i.bak '/^INFO/s/standards.info //' etc/Makefile.in
```

Fix some test suite scripts so all tests pass:

```
patch -Np1 -i ../binutils-2.23.1-testsuite_fix-1.patch
```

The Binutils documentation recommends building Binutils outside of the source directory in a dedicated build directory:

```
mkdir -v ../binutils-build
cd ../binutils-build
```

Prepare Binutils for compilation:

```
../binutils-2.23.1/configure --prefix=/usr --enable-shared
```

> **Замечание**
>
> There is an optional argument to **configure**, --enable-lto, that can be used to allow the **ar**, **nm**, and **ranlib** commands to accept a --plugin parameter. This is used to allow **gcc** to do "link time optimization" if specified. No packages in LFS or BLFS currently use this capability.

Compile the package:

```
make tooldir=/usr
```

The meaning of the make parameter:

tooldir=/usr
  Normally, the tooldir (the directory where the executables will ultimately be located) is set to $(exec_prefix)/$(target_alias). For example, x86_64 machines would expand that to /usr/x86_64-unknown-linux-gnu. Because this is a custom system, this target-specific directory in /usr is not required. $(exec_prefix)/$(target_alias) would be used if the system was used to cross-compile (for example, compiling a package on an Intel machine that generates code that can be executed on PowerPC machines).

> **Важно**
>
> The test suite for Binutils in this section is considered critical. Do not skip it under any circumstances.

Test the results:

```
make check
```

Установим пакет:

```
make tooldir=/usr install
```

Install the libiberty header file that is needed by some packages:

```
cp -v ../binutils-2.23.1/include/libiberty.h /usr/include
```

6.13.2. Содержимое Binutils

Установленные программы:	addr2line, ar, as, c++filt, elfedit, gprof, ld, ld.bfd, nm, objcopy, objdump, ranlib, readelf, size, strings, and strip
Установленные библиотеки:	libiberty.a, libbfd.{a,so}, and libopcodes.{a,so}
Установленный каталог:	/usr/lib/ldscripts

Краткое описание

addr2line
  Translates program addresses to file names and line numbers; given an address and the name of an executable, it uses the debugging information in the executable to determine which source file and line number are associated with the address

ar
  Creates, modifies, and extracts from archives

as
  An assembler that assembles the output of **gcc** into object files

c++filt
  Used by the linker to de-mangle C++ and Java symbols and to keep overloaded functions from clashing

elfedit
  Updates the ELF header of ELF files

gprof
  Displays call graph profile data

ld	A linker that combines a number of object and archive files into a single file, relocating their data and tying up symbol references
ld.bfd	Hard link to **ld**
nm	Lists the symbols occurring in a given object file
objcopy	Translates one type of object file into another
objdump	Displays information about the given object file, with options controlling the particular information to display; the information shown is useful to programmers who are working on the compilation tools
ranlib	Generates an index of the contents of an archive and stores it in the archive; the index lists all of the symbols defined by archive members that are relocatable object files
readelf	Displays information about ELF type binaries
size	Lists the section sizes and the total size for the given object files
strings	Outputs, for each given file, the sequences of printable characters that are of at least the specified length (defaulting to four); for object files, it prints, by default, only the strings from все же запустить тестирование initializing and loading sections while for other types of files, it scans the entire file
strip	Discards symbols from object files
libiberty	Contains routines used by various GNU programs, including **getopt**, **obstack**, **strerror**, **strtol**, and **strtoul**
libbfd	The Binary File Descriptor library
libopcodes	A library for dealing with opcodes—the «readable text» versions of instructions for the processor; it is used for building utilities like **objdump**.

6.14. GMP-5.1.1

The GMP package contains math libraries. These have useful functions for arbitrary precision arithmetic.

Приблизительное время сборки:	1.2 SBU
Требует свободного места на диске:	50 MB

6.14.1. Установка GMP

> ☞ **Замечание**
>
> If you are building for 32-bit x86, but you have a CPU which is capable of running 64-bit code *and* you have specified CFLAGS in the environment, the configure script will attempt to configure for 64-bits and fail. Avoid this by invoking the configure command below with
>
> ```
> ABI=32 ./configure ...
> ```

Подготовим GMP к компиляции:

```
./configure --prefix=/usr --enable-cxx
```

The meaning of the new configure options:

--enable-cxx
　　This parameter enables C++ support

Скомпилируем пакет:

```
make
```

> ⚠ **Важно**
>
> The test suite for GMP in this section is considered critical. Do not skip it under any circumstances.

Test the results:

```
make check 2>&1 | tee gmp-check-log
```

Ensure that all 184 tests in the test suite passed. Check the results by issuing the following command:

```
awk '/tests passed/{total+=$2} ; END{print total}' gmp-check-log
```

Установим пакет:

```
make install
```

If desired, install the documentation:

```
mkdir -v /usr/share/doc/gmp-5.1.1
cp    -v doc/{isa_abi_headache,configuration} doc/*.html \
         /usr/share/doc/gmp-5.1.1
```

6.14.2. Содержимое GMP

Installed Libraries: libgmp.{a,so}, libgmpxx.{a,so}, and libmp.{a,so}

Установленный /usr/share/doc/gmp-5.1.1
каталог:

Краткое описание

libgmp   Contains precision math functions.

libgmpxx   Contains C++ precision math functions.

libmp   Contains the Berkeley MP math functions.

6.15. MPFR-3.1.1

The MPFR package contains functions for multiple precision math.

Приблизительное время сборки:	0.8 SBU
Требует свободного места на диске:	27 MB

6.15.1. Installation of MPFR

Prepare MPFR for compilation:

```
./configure  --prefix=/usr        \
             --enable-thread-safe \
             --docdir=/usr/share/doc/mpfr-3.1.1
```

Compile the package:

```
make
```

> ⚠️ **Важно**
>
> The test suite for MPFR in this section is considered critical. Do not skip it under any circumstances.

Test the results and ensure that all tests passed:

```
make check
```

Установим пакет:

```
make install
```

Install the documentation:

```
make html
make install-html
```

6.15.2. Содержимое MPFR

Installed Libraries:	libmpfr.{a,so}
Установленный каталог:	/usr/share/doc/mpfr-3.1.1

Краткое описание

libmpfr   Contains multiple-precision math functions.

6.16. MPC-1.0.1

The MPC package contains a library for the arithmetic of complex numbers with arbitrarily high precision and correct rounding of the result.

Приблизительное время сборки:	0.4 SBU
Требует свободного места на диске:	10.2 MB

6.16.1. Установка MPC

Подготовим MPC к компиляции:

```
./configure --prefix=/usr
```

Скомпилируем пакет:

```
make
```

Чтобы запустить тестирование пакета, выполните:

```
make check
```

Установим пакет:

```
make install
```

6.16.2. Содержимое MPC

Installed Libraries: libmpc.{a,so}

Краткое описание

libmpc   Contains complex math functions

6.17. GCC-4.7.2

The GCC package contains the GNU compiler collection, which includes все же запустить тестирование C and C++ compilers.

Приблизительное время сборки:	53.5 SBU
Требует свободного места на диске:	2.0 GB

6.17.1. Установка GCC

Apply a **sed** substitution that will suppress the installation of libiberty.a. The version of libiberty.a provided by Binutils will be used instead:

```
sed -i 's/install_to_$(INSTALL_DEST) //' libiberty/Makefile.in
```

Again, do not build the .info files. They are broken with the current version of **makeinfo**.

```
sed -i 's/BUILD_INFO=info/BUILD_INFO=/' gcc/configure
```

As in Раздел 5.9, «GCC-4.7.2 - Шаг 2», apply the following **sed** to force the build to use the -fomit-frame-pointer compiler flag in order to ensure consistent compiler builds:

```
case `uname -m` in
  i?86) sed -i 's/^T_CFLAGS =$/& -fomit-frame-pointer/' gcc/Makefile.in ;;
esac
```

Also fix an error in one of the check Makefiles:

```
sed -i -e /autogen/d -e /check.sh/d fixincludes/Makefile.in
```

The GCC documentation recommends building GCC outside of the source directory in a dedicated build directory:

```
mkdir -v ../gcc-build
cd ../gcc-build
```

Подготовим GCC к компиляции:

```
../gcc-4.7.2/configure --prefix=/usr          \
                    --libexecdir=/usr/lib    \
                    --enable-shared          \
                    --enable-threads=posix   \
                    --enable-__cxa_atexit    \
                    --enable-clocale=gnu      \
                    --enable-languages=c,c++ \
                    --disable-multilib       \
                    --disable-bootstrap      \
                    --with-system-zlib
```

Note that for other languages, there are some prerequisites that are not available. See the BLFS Book for instructions on how to build all the GCC supported languages.

The meaning of the new configure option:

`--with-system-zlib`
This switch tells GCC to link to the system installed copy of the Zlib library, rather than its own internal copy.

> ### Замечание
>
> There is an optional argument to **configure**, `--enable-lto`, that can be used to allow **gcc** to do do "link time optimization" if specified. No packages in LFS or BLFS currently use this capability.
>
> To use this feature, it must also be enabled in binutils.

Compile the package:

```
make
```

> ### Важно
>
> In this section, the test suite for GCC is considered critical. Do not skip it under any circumstance.

One set of tests in the GCC test suite is known to exhaust the stack, so increase the stack size prior to running the tests:

```
ulimit -s 32768
```

Test the results, but do not stop at errors:

```
make -k check
```

To receive a summary of the test suite results, run:

```
../gcc-4.7.2/contrib/test_summary
```

For only the summaries, pipe the output through **grep -A7 Summ**.

Results can be compared with those located at *http://www.linuxfromscratch.org/lfs/build-logs/7.3/* and *http://gcc.gnu.org/ml/gcc-testresults/*.

A few unexpected failures cannot always be avoided. The GCC developers are usually aware of these issues, but have not resolved them yet. In particular, the libmudflap tests are known to be particularly problematic as a result of a bug in GCC (*http://gcc.gnu.org/bugzilla/show_bug.cgi?id=20003*). Unless the test results are vastly different from those at the above URL, it is safe to continue.

Установим пакет:

```
make install
```

Some packages expect the C preprocessor to be installed in the `/lib` directory. To support those packages, create this symlink:

```
ln -sv ../usr/bin/cpp /lib
```

Many packages use the name **cc** to call the C compiler. To satisfy those packages, create a symlink:

```
ln -sv gcc /usr/bin/cc
```

Now that our final toolchain is in place, it is important to again ensure that compiling and linking will work as expected. We do this by performing все же запустить тестирование same sanity checks as we did earlier in the chapter:

```
echo 'main(){}' > dummy.c
cc dummy.c -v -Wl,--verbose &> dummy.log
readelf -l a.out | grep ': /lib'
```

If everything is working correctly, there should be no errors, and the output of the last command will be (allowing for platform-specific differences in dynamic linker name):

```
[Requesting program interpreter: /lib/ld-linux.so.2]
```

Now make sure that we're setup to use the correct startfiles:

```
grep -o '/usr/lib.*/crt[1in].*succeeded' dummy.log
```

If everything is working correctly, there should be no errors, and the output of the last command will be:

```
/usr/lib/gcc/i686-pc-linux-gnu/4.7.2/../../../crt1.o succeeded
/usr/lib/gcc/i686-pc-linux-gnu/4.7.2/../../../crti.o succeeded
/usr/lib/gcc/i686-pc-linux-gnu/4.7.2/../../../crtn.o succeeded
```

Depending on your machine architecture, the above may differ slightly, the difference usually being the name of the directory after /usr/lib/gcc. If your machine is a 64-bit system, you may also see a directory named lib64 towards the end of the string. The important thing to look for here is that **gcc** has found all three crt*.o files under the /usr/lib directory.

Verify that the compiler is searching for the correct header files:

```
grep -B4 '^ /usr/include' dummy.log
```

This command should return successfully with the following output:

```
#include <...> search starts here:
 /usr/lib/gcc/i686-pc-linux-gnu/4.7.2/include
 /usr/local/include
 /usr/lib/gcc/i686-pc-linux-gnu/4.7.2/include-fixed
 /usr/include
```

Again, note that the directory named after your target triplet may be different than the above, depending on your architecture.

> **Замечание**
>
> As of version 4.3.0, GCC now unconditionally installs the limits.h file into the private include-fixed directory, and that directory is required to be in place.

Next, verify that the new linker is being used with the correct search paths:

```
grep 'SEARCH.*/usr/lib' dummy.log |sed 's|; |\n|g'
```

If everything is working correctly, there should be no errors, and the output of the last command (allowing for platform-specific target triplets) will be:

```
SEARCH_DIR("/usr/i686-pc-linux-gnu/lib")
SEARCH_DIR("/usr/local/lib")
SEARCH_DIR("/lib")
SEARCH_DIR("/usr/lib");
```

A 64-bit system may see a few more directories. For example, here is the output from an x86_64 machine:

```
SEARCH_DIR("/usr/x86_64-unknown-linux-gnu/lib64")
SEARCH_DIR("/usr/local/lib64")
SEARCH_DIR("/lib64")
SEARCH_DIR("/usr/lib64")
SEARCH_DIR("/usr/x86_64-unknown-linux-gnu/lib")
SEARCH_DIR("/usr/local/lib")
SEARCH_DIR("/lib")
SEARCH_DIR("/usr/lib");
```

Next make sure that we're using the correct libc:

```
grep "/lib.*/libc.so.6 " dummy.log
```

If everything is working correctly, there should be no errors, and the output of the last command (allowing for a lib64 directory on 64-bit hosts) will be:

```
attempt to open /lib/libc.so.6 succeeded
```

Lastly, make sure GCC is using the correct dynamic linker:

```
grep found dummy.log
```

If everything is working correctly, there should be no errors, and the output of the last command will be (allowing for platform-specific differences in dynamic linker name and a lib64 directory on 64-bit hosts):

```
found ld-linux.so.2 at /lib/ld-linux.so.2
```

If the output does not appear as shown above or is not received at all, then something is seriously wrong. Investigate and retrace the steps to find out where the problem is and correct it. The most likely reason is that something went wrong with the specs file adjustment. Any issues will need to be resolved before continuing on with the process.

Once everything is working correctly, clean up the test files:

```
rm -v dummy.c a.out dummy.log
```

Finally, move a misplaced file:

```
mkdir -pv /usr/share/gdb/auto-load/usr/lib
mv -v /usr/lib/*gdb.py /usr/share/gdb/auto-load/usr/lib
```

6.17.2. Содержимое GCC

Установленные программы:	c++, cc (link to gcc), cpp, g++, gcc, gcc-ar, gcc-nm, gcc-ranlib, gccbug, and gcov
Установленные библиотеки:	libgcc.a, libgcc_eh.a, libgcc_s.so, libgcov.a, libgomp.{a,so}, liblto_plugin.so, libmudflap.{a,so}, libmudflapth.{a,so}, libquadmath.{a,so}, libssp.{a,so}, libssp_nonshared.a, libstdc++.{a,so} and libsupc++.a
Установленные каталоги:	/usr/include/c++, /usr/lib/gcc, /usr/share/gcc-4.7.2

Краткое описание

c++	The C++ compiler
cc	The C compiler
cpp	The C preprocessor; it is used by the compiler to expand the #include, #define, and similar statements in the source files
g++	The C++ compiler
gcc	The C compiler
gcc-ar	A wrapper around **ar** that adds a plugin to the command line. This program is only used to add "link time optization" and is not useful with the default build options.
gcc-nm	A wrapper around **nm** that adds a plugin to the command line. This program is only used to add "link time optization" and is not useful with the default build options.
gcc-ranlib	A wrapper around **ranlib** that adds a plugin to the command line. This program is only used to add "link time optization" and is not useful with the default build options.
gccbug	A shell script used to help create useful bug reports
gcov	A coverage testing tool; it is used to analyze programs to determine where optimizations will have the most effect
libgcc	Contains run-time support for **gcc**
libgcov	This library is linked in to a program when GCC is instructed to enable profiling
libgomp	GNU implementation of the OpenMP API for multi-platform shared-memory parallel programming in C/C++ and Fortran
liblto_plugin	GCC's Link Time Optimization (LTO) plugin allows GCC to perform optimizations across compilation units.
libmudflap	Contains routines that support GCC's bounds checking functionality
libquadmath	GCC Quad Precision Math Library API
libssp	Contains routines supporting GCC's stack-smashing protection functionality
libstdc++	The standard C++ library
libsupc++	Provides supporting routines for the C++ programming language

6.18. Sed-4.2.2

The Sed package contains a stream editor.

Приблизительное время сборки:	0.2 SBU
Требует свободного места на диске:	6.7 MB

6.18.1. Установка Sed

Подготовим Sed к компиляции:

```
./configure --prefix=/usr --bindir=/bin --htmldir=/usr/share/doc/sed-4.2.2
```

The meaning of the new configure option:

--htmldir
    This sets the directory where the HTML documentation will be installed to.

Скомпилируем пакет:

```
make
```

Generate the HTML documentation:

```
make html
```

Чтобы запустить тестирование пакета, выполните:

```
make check
```

Установим пакет:

```
make install
```

Install the HTML documentation:

```
make -C doc install-html
```

6.18.2. Содержимое Sed

Установленная программа:	sed
Установленный каталог:	/usr/share/doc/sed-4.2.2

Краткое описание

sed   Filters and transforms text files in a single pass

6.19. Bzip2-1.0.6

The Bzip2 package contains programs for compressing and decompressing files. Compressing text files with **bzip2** yields a much better compression percentage than with the traditional **gzip**.

Приблизительное время сборки:	менее 0.1 SBU
Требует свободного места на диске:	6.9 MB

6.19.1. Установка Bzip2

Применим патч that will install the documentation for this package:

```
patch -Np1 -i ../bzip2-1.0.6-install_docs-1.patch
```

The following command ensures installation of symbolic links are relative:

```
sed -i 's@\(ln -s -f \)$(PREFIX)/bin/@\1@' Makefile
```

Ensure the man pages are installed into the correct location:

```
sed -i "s@(PREFIX)/man@(PREFIX)/share/man@g" Makefile
```

Подготовим Bzip2 к компиляции with:

```
make -f Makefile-libbz2_so
make clean
```

The meaning of the make parameter:

-f Makefile-libbz2_so
    This will cause Bzip2 to be built using a different Makefile file, in this case the Makefile-libbz2_so file, which creates a dynamic libbz2.so library and links все же запустить тестирование Bzip2 utilities against it.

Compile and test the package:

```
make
```

Install the programs:

```
make PREFIX=/usr install
```

Install the shared **bzip2** binary into the /bin directory, make some necessary symbolic links, and clean up:

```
cp -v bzip2-shared /bin/bzip2
cp -av libbz2.so* /lib
ln -sv ../../lib/libbz2.so.1.0 /usr/lib/libbz2.so
rm -v /usr/bin/{bunzip2,bzcat,bzip2}
ln -sv bzip2 /bin/bunzip2
ln -sv bzip2 /bin/bzcat
```

6.19.2. Содержимое Bzip2

Установленные программы:	bunzip2 (link to bzip2), bzcat (link to bzip2), bzcmp (link to bzdiff), bzdiff, bzegrep (link to bzgrep), bzfgrep (link to bzgrep), bzgrep, bzip2, bzip2recover, bzless (link to bzmore), and bzmore
Установленные библиотеки:	libbz2.{a,so}
Установленный каталог:	/usr/share/doc/bzip2-1.0.6

Краткое описание

bunzip2	Decompresses bzipped files
bzcat	Decompresses to standard output
bzcmp	Runs **cmp** on bzipped files
bzdiff	Runs **diff** on bzipped files
bzegrep	Runs **egrep** on bzipped files
bzfgrep	Runs **fgrep** on bzipped files
bzgrep	Runs **grep** on bzipped files
bzip2	Compresses files using the Burrows-Wheeler block sorting text compression algorithm with Huffman coding; the compression rate is better than that achieved by more conventional compressors using «Lempel-Ziv» algorithms, like **gzip**
bzip2recover	Tries to recover data from damaged bzipped files
bzless	Runs **less** on bzipped files
bzmore	Runs **more** on bzipped files
libbz2*	The library implementing lossless, block-sorting data compression, using the Burrows-Wheeler algorithm

6.20. Pkg-config-0.28

The pkg-config package contains a tool for passing the include path and/or library paths to build tools during the configure and make file execution.

Приблизительное время сборки:	0.4 SBU
Требует свободного места на диске:	31 MB

6.20.1. Установка Pkg-config

Prepare Pkg-config for compilation:

```
./configure --prefix=/usr          \
            --with-internal-glib  \
            --disable-host-tool    \
            --docdir=/usr/share/doc/pkg-config-0.28
```

The meaning of the new configure options:

--with-internal-glib
> This will allow pkg-config to use it's internal version of glib because an external version is not available in LFS.

--disable-host-tool
> This option disables the creation of an undesired hard link to the pkg-config program.

Compile the package:

```
make
```

To test the results, issue:

```
make check
```

Install the package:

```
make install
```

6.20.2. Contents of Pkg-config

Installed program:	pkg-config
Installed directory:	/usr/share/doc/pkg-config-0.28

Краткое описание

pkg-config   returns meta information for the specified library or package.

6.21. Ncurses-5.9

The Ncurses package contains libraries for terminal-independent handling of character screens.

Приблизительное время сборки:	0.6 SBU
Требует свободного места на диске:	40 MB

6.21.1. Установка Ncurses

Prepare Ncurses for compilation:

```
./configure --prefix=/usr            \
            --mandir=/usr/share/man \
            --with-shared            \
            --without-debug          \
            --enable-pc-files        \
            --enable-widec
```

The meaning of the configure option:

--enable-widec
> This switch causes wide-character libraries (e.g., `libncursesw.so.5.9`) to be built instead of normal ones (e.g., `libncurses.so.5.9`). These wide-character libraries are usable in both multibyte and traditional 8-bit locales, while normal libraries work properly only in 8-bit locales. Wide-character and normal libraries are source-compatible, but not binary-compatible.

--enable-pc-files
> This switch generates and installs .pc files for pkg-config.

Скомпилируем пакет:

```
make
```

This package has a test suite, but it can only be run after the package has been installed. The tests reside in the `test/` directory. See the `README` file in that directory for further details.

Установим пакет:

```
make install
```

Move the shared libraries to the `/lib` directory, where they are expected to reside:

```
mv -v /usr/lib/libncursesw.so.5* /lib
```

Because the libraries have been moved, one symlink points to a non-existent file. Recreate it:

```
ln -sfv ../../lib/libncursesw.so.5 /usr/lib/libncursesw.so
```

Many applications still expect the linker to be able to find non-wide-character Ncurses libraries. Trick such applications into linking with wide-character libraries by means of symlinks and linker scripts:

```
for lib in ncurses form panel menu ; do
    rm -vf                      /usr/lib/lib${lib}.so
    echo "INPUT(-l${lib}w)" > /usr/lib/lib${lib}.so
    ln -sfv lib${lib}w.a      /usr/lib/lib${lib}.a
    ln -sfv ${lib}w.pc         /usr/lib/pkgconfig/${lib}.pc
done

ln -sfv libncurses++w.a /usr/lib/libncurses++.a
```

Finally, make sure that old applications that look for `-lcurses` at build time are still buildable:

```
rm -vf                      /usr/lib/libcursesw.so
echo "INPUT(-lncursesw)" > /usr/lib/libcursesw.so
ln -sfv libncurses.so      /usr/lib/libcurses.so
ln -sfv libncursesw.a      /usr/lib/libcursesw.a
ln -sfv libncurses.a       /usr/lib/libcurses.a
```

If desired, install the Ncurses documentation:

```
mkdir -v        /usr/share/doc/ncurses-5.9
cp -v -R doc/* /usr/share/doc/ncurses-5.9
```

> **Замечание**
>
> The instructions above don't create non-wide-character Ncurses libraries since no package installed by compiling from sources would link against them at runtime. If you must have such libraries because of some binary-only application or to be compliant with LSB, build the package again with the following commands:
>
> ```
> make distclean
> ./configure --prefix=/usr     \
>             --with-shared     \
>             --without-normal \
>             --without-debug   \
>             --without-cxx-binding
> make sources libs
> cp -av lib/lib*.so.5* /usr/lib
> ```

6.21.2. Содержимое Ncurses

Установленные программы:	captoinfo (link to tic), clear, infocmp, infotocap (link to tic), ncursesw5-config, reset (link to tset), tabs, tic, toe, tput, and tset
Установленные библиотеки:	libcursesw.{a,so} (symlink and linker script to libncursesw.{a,so}), libformw.{a,so}, libmenuw.{a,so}, libncurses++w.a, libncursesw.{a,so}, libpanelw.{a,so} and their non-wide-character counterparts without "w" in the library names.
Установленные каталоги:	/usr/share/tabset, /usr/share/terminfo, /usr/share/doc/ncurses-5.9

Краткое описание

captoinfo	Converts a termcap description into a terminfo description
clear	Clears the screen, if possible
infocmp	Compares or prints out terminfo descriptions
infotocap	Converts a terminfo description into a termcap description
ncursesw5-config	Provides configuration information for ncurses
reset	Reinitializes a terminal to its default values
tabs	Clears and sets tab stops on a terminal
tic	The terminfo entry-description compiler that translates a terminfo file from source format into the binary format needed for the ncurses library routines. A terminfo file contains information on the capabilities of a certain terminal
toe	Lists all available terminal types, giving the primary name and description for each
tput	Makes the values of terminal-dependent capabilities available to все же запустить тестирование shell; it can also be used to reset or initialize a terminal or report its long name
tset	Can be used to initialize terminals
libcurses	A link to libncurses
libncurses	Contains functions to display text in many complex ways on a terminal screen; a good example of the use of these functions is the menu displayed during the kernel's **make menuconfig**
libform	Contains functions to implement forms
libmenu	Contains functions to implement menus
libpanel	Contains functions to implement panels

6.22. Util-linux-2.22.2

The Util-linux package contains miscellaneous utility programs. Among them are utilities for handling file systems, consoles, partitions, and messages.

Приблизительное время сборки:	0.7 SBU
Требует свободного места на диске:	83 MB

6.22.1. FHS compliance notes

The FHS recommends using the /var/lib/hwclock directory instead of the usual /etc directory as the location for the adjtime file. To make the **hwclock** program FHS-compliant, run the following:

```
sed -i -e 's@etc/adjtime@var/lib/hwclock/adjtime@g' \
    $(grep -rl '/etc/adjtime' .)

mkdir -pv /var/lib/hwclock
```

6.22.2. Installation of Util-linux

```
./configure --disable-su --disable-sulogin --disable-login
```

The meaning of the configure option:

--disable-*
  These switches disable building su, sulogin, and login. They duplicate the same programs provided by Раздел 6.26, «Shadow-4.1.5.1» and Раздел 6.58, «Sysvinit-2.88dsf». They also require *Linux-PAM* which is not available in LFS.

Скомпилируем пакет:

```
make
```

This package does not come with a test suite.

Установим пакет:

```
make install
```

6.22.3. Содержимое Util-linux

Установленные программы:	addpart, agetty, blkid, blockdev, cal, cfdisk, chcpu, chrt, col, colcrt, colrm, column, ctrlaltdel, cytune, delpart, dmesg, eject, fallocate, fdformat, fdisk, findfs, findmnt, flock, fsck, fsck.cramfs, fsck.minix, fsfreeze, fstrim, getopt, hexdump, hwclock, i386, ionice, ipcmk, ipcrm, ipcs, isosize, ldattach, linux32, linux64, logger, look, losetup, lsblk, lscpu, lslocks, mcookie, mkfs, mkfs.bfs, mkfs.cramfs, mkfs.minix, mkswap, more, mount, mountpoint, namei, partx, pg, pivot_root, prlimit, raw, readprofile, rename, renice, resizepart, rev, rtcwake, script, scriptreplay, setarch, setsid, setterm, sfdisk, swaplabel, swapoff (link to swapon), swapon, switch_root, tailf, taskset, tunelp, ul, umount, unshare, utmpdump, uuidd, uuidgen, wall, wdctl, whereis, wipefs, and x86_64
Установленные библиотеки:	libblkid.{a,so}, libmount.{a,so}, libuuid.{a,so}
Установленные каталоги:	/usr/include/blkid, /usr/include/libmount, /usr/include/uuid, /usr/share/getopt, /var/lib/hwclock

Краткое описание

addpart	Informs the Linux kernel of new partitions
agetty	Opens a tty port, prompts for a login name, and then invokes the **login** program
blkid	A command line utility to locate and print block device attributes
blockdev	Allows users to call block device ioctls from the command line
cal	Displays a simple calendar
cfdisk	Manipulates the partition table of the given device
chcpu	Modifies the state of CPUs
chrt	Manipulates real-time attributes of a process
col	Filters out reverse line feeds
colcrt	Filters **nroff** output for terminals that lack some capabilities, such as overstriking and half-lines
colrm	Filters out the given columns
column	Formats a given file into multiple columns
ctrlaltdel	Sets the function of the Ctrl+Alt+Del key combination to a hard or a soft reset
cytune	Tunes the parameters of the serial line drivers for Cyclades cards
delpart	Asks the Linux kernel to remove a partition
dmesg	Dumps the kernel boot messages
eject	Ejects removable media
fallocate	Preallocates space to a file
fdformat	Low-level formats a floppy disk
fdisk	Manipulates the paritition table of the given device
findfs	Finds a file system by label or Universally Unique Identifier (UUID)

findmnt	Is a command line interface to the libmount library for work with mountinfo, fstab and mtab files
flock	Acquires a file lock and then executes a command with the lock held
fsck	Is used to check, and optionally repair, file systems
fsck.cramfs	Performs a consistency check on the Cramfs file system on the given device
fsck.minix	Performs a consistency check on the Minix file system on the given device
fsfreeze	Is a very simple wrapper around FIFREEZE/FITHAW ioctl kernel driver operations
fstrim	Discards unused blocks on a mounted filesystem
getopt	Parses options in the given command line
hexdump	Dumps the given file in hexadecimal or in another given format
hwclock	Reads or sets the system's hardware clock, also called все же запустить тестирование Real-Time Clock (RTC) or Basic Input-Output System (BIOS) clock
i386	A symbolic link to setarch
ionice	Gets or sets the io scheduling class and priority for a program
ipcmk	Creates various IPC resources
ipcrm	Removes the given Inter-Process Communication (IPC) resource
ipcs	Provides IPC status information
isosize	Reports the size of an iso9660 file system
kill	Sends signals to processes
ldattach	Attaches a line discipline to a serial line
linux32	A symbolic link to setarch
linux64	A symbolic link to setarch
logger	Enters the given message into the system log
look	Displays lines that begin with the given string
losetup	Sets up and controls loop devices
lsblk	Lists information about all or selected block devices in a tree-like format.
lscpu	Prints CPU architecture information
lslocks	Lists local system locks
mcookie	Generates magic cookies (128-bit random hexadecimal numbers) for **xauth**
mkfs	Builds a file system on a device (usually a hard disk partition)
mkfs.bfs	Creates a Santa Cruz Operations (SCO) bfs file system
mkfs.cramfs	Creates a cramfs file system
mkfs.minix	Creates a Minix file system
mkswap	Initializes the given device or file to be used as a swap area
more	A filter for paging through text one screen at a time
mount	Attaches the file system on the given device to a specified directory in the file-system tree

mountpoint	Checks if the directory is a mountpoint
namei	Shows the symbolic links in the given pathnames
partx	Tells the kernel about the presence and numbering of on-disk partitions
pg	Displays a text file one screen full at a time
pivot_root	Makes the given file system the new root file system of the current process
prlimit	Get and set a process' resource limits
raw	Bind a Linux raw character device to a block device
readprofile	Reads kernel profiling information
rename	Renames the given files, replacing a given string with another
renice	Alters the priority of running processes
resizepart	Asks the Linux kernel to resize a partition
rev	Reverses the lines of a given file
rtcwake	Used to enter a system sleep state until specified wakeup time
script	Makes a typescript of a terminal session
scriptreplay	Plays back typescripts using timing information
setarch	Changes reported architecture in a new program environment and sets personality flags
setsid	Runs the given program in a new session
setterm	Sets terminal attributes
sfdisk	A disk partition table manipulator
swaplabel	Allows to change swaparea UUID and label
swapoff	Disables devices and files for paging and swapping
swapon	Enables devices and files for paging and swapping and lists the devices and files currently in use
switch_root	Switches to another filesystem as the root of the mount tree
tailf	Tracks the growth of a log file. Displays the last 10 lines of a log file, then continues displaying any new entries in the log file as they are created
taskset	Retrieves or sets a process' CPU affinity
tunelp	Tunes the parameters of the line printer
ul	A filter for translating underscores into escape sequences indicating underlining for the terminal in use
umount	Disconnects a file system from the system's file tree
unshare	Runs a program with some namespaces unshared from parent
utmpdump	Displays the content of the given login file in a more user-friendly format
uuidd	A daemon used by the UUID library to generate time-based UUIDs in a secure and guranteed-unique fashion.
uuidgen	Creates new UUIDs. Each new UUID can reasonably be considered unique among all UUIDs created, on the local system and on other systems, in the past and in the future

wall	Displays the contents of a file or, by default, its standard input, on the terminals of all currently logged in users
wdctl	Shows hardware watchdog status
whereis	Reports the location of the binary, source, and man page for the given command
wipefs	Wipes a filesystem signature from a device
x86_64	A symbolic link to setarch
libblkid	Contains routines for device identification and token extraction
libmount	Contains routines for block device mounting and unmounting
libuuid	Contains routines for generating unique identifiers for objects that may be accessible beyond the local system

6.23. Psmisc-22.20

The Psmisc package contains programs for displaying information about running processes.

Приблизительное время сборки:	менее 0.1 SBU
Требует свободного места на диске:	4.2 MB

6.23.1. Установка Psmisc

Подготовим Psmisc к компиляции:

```
./configure --prefix=/usr
```

Скомпилируем пакет:

```
make
```

This package does not come with a test suite.

Установим пакет:

```
make install
```

Finally, move the **killall** and **fuser** programs to the location specified by the FHS:

```
mv -v /usr/bin/fuser   /bin
mv -v /usr/bin/killall /bin
```

6.23.2. Содержимое Psmisc

Установленные программы:	fuser, killall, peekfd, prtstat, pstree, and pstree.x11 (link to pstree)

Краткое описание

fuser	Reports the Process IDs (PIDs) of processes that use the given files or file systems
killall	Kills processes by name; it sends a signal to all processes running any of the given commands
peekfd	Peek at file descriptors of a running process, given its PID
prtstat	Prints information about a process
pstree	Displays running processes as a tree
pstree.x11	Same as **pstree**, except that it waits for confirmation before exiting

6.24. Procps-ng-3.3.6

The Procps-ng package contains programs for monitoring processes.

Приблизительное время сборки:	0.2 SBU
Требует свободного места на диске:	13 MB

6.24.1. Installation of Procps-ng

Now prepare procps-ng for compilation:

```
./configure --prefix=/usr                              \
            --exec-prefix=                             \
            --libdir=/usr/lib                          \
            --docdir=/usr/share/doc/procps-ng-3.3.6 \
            --disable-static                           \
            --disable-skill                            \
            --disable-kill
```

The meaning of the configure options:

--disable-skill
  This switch disables the obsolete and unportable skill and snice commands.

--disable-kill
  This switch disables building the kill command that was installed in the util-linux package.

Compile the package:

```
make
```

The test suite needs some custom modifications for LFS. The **which** command is not available, the **pmap** test does not match a newline character in two tests, and the **slabtop** test may return more than 999,999 objects. To run the test suite, run the following commands:

```
pushd testsuite
  sed -i -e 's|exec which sleep|exec echo /tools/bin/sleep|' \
         -e 's|999999|&9|'                              config/unix.exp
  sed -i -e 's|pmap_initname\\\$|pmap_initname|' pmap.test/pmap.exp
  make site.exp
  DEJAGNU=global-conf.exp runtest
popd
```

Install the package:

```
make install
```

Finally move the library to a location that can be found if /usr is not mounted.

```
mv -v /usr/lib/libprocps.so.* /lib
ln -sfv ../../lib/libprocps.so.1.1.0 /usr/lib/libprocps.so
```

6.24.2. Contents of Procps-ng

Installed programs:	free, pgrep, pkill, pmap, ps, pwdx, slabtop, sysctl, tload, top, uptime, vmstat, w, and, watch
Installed library:	libprocps.so

Краткое описание

free	Reports the amount of free and used memory (both physical and swap memory) in the system
pgrep	Looks up processes based on their name and other attributes
pkill	Signals processes based on their name and other attributes
pmap	Reports the memory map of the given process
ps	Lists the current running processes
pwdx	Reports the current working directory of a process
slabtop	Displays detailed kernel slap cache information in real time
sysctl	Modifies kernel parameters at run time
tload	Prints a graph of the current system load average
top	Displays a list of the most CPU intensive processes; it provides an ongoing look at processor activity in real time
uptime	Reports how long the system has been running, how many users are logged on, and the system load averages
vmstat	Reports virtual memory statistics, giving information about processes, memory, paging, block Input/Output (IO), traps, and CPU activity
w	Shows which users are currently logged on, where, and since when
watch	Runs a given command repeatedly, displaying the first screen-full of its output; this allows a user to watch the output change over time
libproc	Contains the functions used by most programs in this package

6.25. E2fsprogs-1.42.7

The E2fsprogs package contains the utilities for handling the `ext2` file system. It also supports the `ext3` and `ext4` journaling file systems.

Приблизительное время сборки:	1.7 SBU
Требует свободного места на диске:	64 MB

6.25.1. Установка E2fsprogs

The E2fsprogs documentation recommends that the package be built in a subdirectory of the source tree:

```
mkdir -v build
cd build
```

Подготовим E2fsprogs к компиляции:

```
../configure --prefix=/usr          \
             --with-root-prefix="" \
             --enable-elf-shlibs   \
             --disable-libblkid    \
             --disable-libuuid     \
             --disable-uuidd       \
             --disable-fsck
```

The meaning of the configure options:

--with-root-prefix=""

Certain programs (such as the **e2fsck** program) are considered essential programs. When, for example, /usr is not mounted, these programs still need to be available. They belong in directories like /lib and /sbin. If this option is not passed to E2fsprogs' configure, the programs are installed into the /usr directory.

--enable-elf-shlibs

This creates the shared libraries which some programs in this package use.

--disable-*

This prevents E2fsprogs from building and installing the `libuuid` and `libblkid` libraries, the `uuidd` daemon, and the **fsck** wrapper, as Util-Linux installed all of все же запустить тестированием earlier.

Скомпилируем пакет:

```
make
```

Чтобы запустить тестирование пакета, выполните:

```
make check
```

One of the E2fsprogs tests will attempt to allocate 256 MB of memory. If you do not have significantly more RAM than this, be sure to enable sufficient swap space for the test. See Раздел 2.3, «Создание файловой системы на разделе» and Раздел 2.4, «Монтирование нового раздела» for details on creating and enabling swap space.

Install the binaries, documentation, and shared libraries:

```
make install
```

Install the static libraries and headers:

```
make install-libs
```

Make the installed static libraries writable so debugging symbols can be removed later:

```
chmod -v u+w /usr/lib/{libcom_err,libe2p,libext2fs,libss}.a
```

This package installs a gzipped `.info` file but doesn't update the system-wide `dir` file. Unzip this file and then update все же запустить тестирование system `dir` file using the following commands.

```
gunzip -v /usr/share/info/libext2fs.info.gz
install-info --dir-file=/usr/share/info/dir /usr/share/info/libext2fs.info
```

If desired, create and install some additional documentation by issuing the following commands:

```
makeinfo -o        doc/com_err.info ../lib/et/com_err.texinfo
install -v -m644 doc/com_err.info /usr/share/info
install-info --dir-file=/usr/share/info/dir /usr/share/info/com_err.info
```

6.25.2. Содержимое E2fsprogs

Установленные программы:	badblocks, chattr, compile_et, debugfs, dumpe2fs, e2freefrag, e2fsck, e2image, e2initrd_helper, e2label, e2undo, e4defrag, filefrag, fsck.ext2, fsck.ext3, fsck.ext4, fsck.ext4dev, logsave, lsattr, mk_cmds, mke2fs, mkfs.ext2, mkfs.ext3, mkfs.ext4, mkfs.ext4dev, mklost+found, resize2fs, and tune2fs
Установленные библиотеки:	libcom_err.{a,so}, libe2p.{a,so}, libext2fs.{a,so}, libquota.a and libss.{a,so}
Установленный каталог:	/usr/include/e2p, /usr/include/et, /usr/include/ext2fs, /usr/include/quota, /usr/include/ss, /usr/share/et, /usr/share/ss

Краткое описание

badblocks	Searches a device (usually a disk partition) for bad blocks
chattr	Changes the attributes of files on an `ext2` file system; it also changes `ext3` file systems, the journaling version of `ext2` file systems
compile_et	An error table compiler; it converts a table of error-code names and messages into a C source file suitable for use with the `com_err` library
debugfs	A file system debugger; it can be used to examine and change все же запустить тестирование state of an `ext2` file system
dumpe2fs	Prints the super block and blocks group information for the file system present on a given device
e2freefrag	Reports free space fragmentation information
e2fsck	Is used to check, and optionally repair `ext2` file systems and `ext3` file systems
e2image	Is used to save critical `ext2` file system data to a file

e2initrd_helper	Prints the FS type of a given filesystem, given either a device name or label
e2label	Displays or changes the file system label on the ext2 file system present on a given device
e2undo	Replays the undo log undo_log for an ext2/ext3/ext4 filesystem found on a device. This can be used to undo a failed operation by an e2fsprogs program.
e4defrag	Online defragmenter for ext4 filesystems
filefrag	Reports on how badly fragmented a particular file might be
fsck.ext2	By default checks ext2 file systems. This is a hard link to **e2fsck**.
fsck.ext3	By default checks ext3 file systems. This is a hard link to **e2fsck**.
fsck.ext4	By default checks ext4 file systems. This is a hard link to **e2fsck**.
fsck.ext4dev	By default checks ext4 development file systems. This is a hard link to **e2fsck**.
logsave	Saves the output of a command in a log file
lsattr	Lists the attributes of files on a second extended file system
mk_cmds	Converts a table of command names and help messages into a C source file suitable for use with the libss subsystem library
mke2fs	Creates an ext2 or ext3 file system on все же запустить тестирование given device
mkfs.ext2	By default creates ext2 file systems. This is a hard link to **mke2fs**.
mkfs.ext3	By default creates ext3 file systems. This is a hard link to **mke2fs**.
mkfs.ext4	By default creates ext4 file systems. This is a hard link to **mke2fs**.
mkfs.ext4dev	By default creates ext4 development file systems. This is a hard link to **mke2fs**.
mklost+found	Used to create a lost+found directory on an ext2 file system; it pre-allocates disk blocks to this directory to lighten the task of **e2fsck**
resize2fs	Can be used to enlarge or shrink an ext2 file system
tune2fs	Adjusts tunable file system parameters on an ext2 file system
libcom_err	The common error display routine
libe2p	Used by **dumpe2fs**, **chattr**, and **lsattr**
libext2fs	Contains routines to enable user-level programs to manipulate an ext2 file system
libquota	Provides an interface for creating and updating quota files and ext4 superblock fields
libss	Used by **debugfs**

6.26. Shadow-4.1.5.1

The Shadow package contains programs for handling passwords in a secure way.

Приблизительное время сборки:	0.2 SBU
Требует свободного места на диске:	42 MB

6.26.1. Установка Shadow

> **Замечание**
>
> If you would like to enforce the use of strong passwords, refer to *http://www. linuxfromscratch.org/blfs/view/svn/postlfs/cracklib.html* for installing CrackLib prior to building Shadow. Then add `--with-libcrack` to the **configure** command below.

Disable the installation of the **groups** program and its man pages, as Coreutils provides a better version:

```
sed -i 's/groups$(EXEEXT) //' src/Makefile.in
find man -name Makefile.in -exec sed -i 's/groups\.1 / /' {} \;
```

Instead of using the default *crypt* method, use the more secure *SHA-512* method of password encryption, which also allows passwords longer than 8 characters. It is also necessary to change все же запустить тестирование obsolete /var/spool/mail location for user mailboxes that Shadow uses by default to the /var/mail location used currently:

```
sed -i -e 's@#ENCRYPT_METHOD DES@ENCRYPT_METHOD SHA512@' \
       -e 's@/var/spool/mail@/var/mail@' etc/login.defs
```

> **Замечание**
>
> If you chose to build Shadow with Cracklib support, run the following:
>
> ```
> sed -i 's@DICTPATH.*@DICTPATH\t/lib/cracklib/pw_dict@' \
>     etc/login.defs
> ```

Подготовим Shadow к компиляции:

```
./configure --sysconfdir=/etc
```

Скомпилируем пакет:

```
make
```

This package does not come with a test suite.

Установим пакет:

```
make install
```

Move a misplaced program to its proper location:

```
mv -v /usr/bin/passwd /bin
```

6.26.2. Configuring Shadow

This package contains utilities to add, modify, and delete users and groups; set and change their passwords; and perform other administrative tasks. For a full explanation of what *password shadowing* means, see the `doc/HOWTO` file within the unpacked source tree. If using Shadow support, keep in mind that programs which need to verify passwords (display managers, FTP programs, pop3 daemons, etc.) must be Shadow-compliant. That is, they need to be able to work with shadowed passwords.

To enable shadowed passwords, run the following command:

```
pwconv
```

To enable shadowed group passwords, run:

```
grpconv
```

Shadow's stock configuration for the **useradd** utility has a few caveats that need some explanation. First, the default action for the **useradd** utility is to create the user and a group of the same name as the user. By default the user ID (UID) and group ID (GID) numbers will begin with 1000. This means if you don't pass parameters to **useradd**, each user will be a member of a unique group on the system. If this behaviour is undesirable, you'll need to pass the *-g* parameter to **useradd**. The default parameters are stored in the `/etc/default/useradd` file. You may need to modify two parameters in this file to suit your particular needs.

/etc/default/useradd Parameter Explanations

> *GROUP=1000*
>
> This parameter sets the beginning of the group numbers used in все же запустить тестирование /etc/group file. You can modify it to anything you desire. Note that **useradd** will never reuse a UID or GID. If the number identified in this parameter is used, it will use the next available number after this. Note also that if you don't have a group 1000 on your system the first time you use **useradd** without the *-g* parameter, you'll get a message displayed on the terminal that says: `useradd: unknown GID 1000`. You may disregard this message and group number 1000 will be used.

> *CREATE_MAIL_SPOOL=yes*
>
> This parameter causes **useradd** to create a mailbox file for the newly created user. **useradd** will make the group ownership of this file to the `mail` group with 0660 permissions. If you would prefer that these mailbox files are not created by **useradd**, issue the following command:
>
> ```
> sed -i 's/yes/no/' /etc/default/useradd
> ```

6.26.3. Setting the root password

Choose a password for user *root* and set it by running:

```
passwd root
```

6.26.4. Содержимое Shadow

Установленные программы:	chage, chfn, chgpasswd, chpasswd, chsh, expiry, faillog, gpasswd, groupadd, groupdel, groupmems, groupmod, grpck, grpconv, grpunconv, lastlog, login, logoutd, newgrp, newusers, nologin, passwd, pwck, pwconv, pwunconv, sg (link to newgrp), su, useradd, userdel, usermod, vigr (link to vipw), and vipw
Установленный каталог:	/etc/default

Краткое описание

chage	Used to change the maximum number of days between obligatory password changes
chfn	Used to change a user's full name and other information
chgpasswd	Used to update group passwords in batch mode
chpasswd	Used to update user passwords in batch mode
chsh	Used to change a user's default login shell
expiry	Checks and enforces the current password expiration policy
faillog	Is used to examine the log of login failures, to set a maximum number of failures before an account is blocked, or to reset the failure count
gpasswd	Is used to add and delete members and administrators to groups
groupadd	Creates a group with the given name
groupdel	Deletes the group with the given name
groupmems	Allows a user to administer his/her own group membership list without the requirement of super user privileges.
groupmod	Is used to modify the given group's name or GID
grpck	Verifies the integrity of the group files `/etc/group` and `/etc/gshadow`
grpconv	Creates or updates the shadow group file from the normal group file
grpunconv	Updates `/etc/group` from `/etc/gshadow` and then deletes the latter
lastlog	Reports the most recent login of all users or of a given user
login	Is used by the system to let users sign on
logoutd	Is a daemon used to enforce restrictions on log-on time and ports
newgrp	Is used to change the current GID during a login session
newusers	Is used to create or update an entire series of user accounts
nologin	Displays a message that an account is not available. Designed to be used as the default shell for accounts that have been disabled
passwd	Is used to change the password for a user or group account
pwck	Verifies the integrity of the password files `/etc/passwd` and `/etc/shadow`
pwconv	Creates or updates the shadow password file from the normal password file
pwunconv	Updates `/etc/passwd` from `/etc/shadow` and then deletes the latter
sg	Executes a given command while the user's GID is set to that of the given group

su	Runs a shell with substitute user and group IDs
useradd	Creates a new user with the given name, or updates the default new-user information
userdel	Deletes the given user account
usermod	Is used to modify the given user's login name, User Identification (UID), shell, initial group, home directory, etc.
vigr	Edits the `/etc/group` or `/etc/gshadow` files
vipw	Edits the `/etc/passwd` or `/etc/shadow` files

6.27. Coreutils-8.21

The Coreutils package contains utilities for showing and setting the basic system characteristics.

Приблизительное время сборки:	3.4 SBU
Требует свободного места на диске:	116 MB

6.27.1. Installation of Coreutils

POSIX requires that programs from Coreutils recognize character boundaries correctly even in multibyte locales. The following patch fixes this non-compliance and other internationalization-related bugs:

```
patch -Np1 -i ../coreutils-8.21-i18n-1.patch
```

> ### Замечание
>
> In the past, many bugs were found in this patch. When reporting new bugs to Coreutils maintainers, please check first if they are reproducible without this patch.

Now prepare Coreutils for compilation:

```
FORCE_UNSAFE_CONFIGURE=1 ./configure \
        --prefix=/usr          \
        --libexecdir=/usr/lib \
        --enable-no-install-program=kill,uptime
```

The meaning of the configure options:

--enable-no-install-program=kill,uptime
  The purpose of this switch is to prevent Coreutils from installing binaries that will be installed by other packages later.

Скомпилируем пакет:

```
make
```

Skip down to «Install the package» if not running the test suite.

Now the test suite is ready to be run. First, run the tests that are meant to be run as user root:

```
make NON_ROOT_USERNAME=nobody check-root
```

We're going to run the remainder of the tests as the nobody user. Certain tests, however, require that the user be a member of more than one group. So that все же запустить тестированиеse tests are not skipped we'll add a temporary group and make the user nobody a part of it:

```
echo "dummy:x:1000:nobody" >> /etc/group
```

Fix some of the permissions so that the non-root user can compile and run the tests:

```
chown -Rv nobody .
```

Now run the tests. Make sure the PATH in the **su** environment includes /tools/bin.

```
su nobody -s /bin/bash \
          -c "PATH=$PATH make RUN_EXPENSIVE_TESTS=yes check"
```

Remove the temporary group:

```
sed -i '/dummy/d' /etc/group
```

Установим пакет:

```
make install
```

Move programs to the locations specified by the FHS:

```
mv -v /usr/bin/{cat,chgrp,chmod,chown,cp,date,dd,df,echo} /bin
mv -v /usr/bin/{false,ln,ls,mkdir,mknod,mv,pwd,rm} /bin
mv -v /usr/bin/{rmdir,stty,sync,true,uname,test,[} /bin
mv -v /usr/bin/chroot /usr/sbin
mv -v /usr/share/man/man1/chroot.1 /usr/share/man/man8/chroot.8
sed -i s/\"1\"/\"8\"/1 /usr/share/man/man8/chroot.8
```

Some of the scripts in the LFS-Bootscripts package depend on **head**, **sleep**, and **nice**. As /usr may not be available during the early stages of booting, those binaries need to be on the root partition:

```
mv -v /usr/bin/{head,sleep,nice} /bin
```

6.27.2. Содержимое Coreutils

Установленные программы:	[, base64, basename, cat, chcon, chgrp, chmod, chown, chroot, cksum, comm, cp, csplit, cut, date, dd, df, dir, dircolors, dirname, du, echo, env, expand, expr, factor, false, fmt, fold, groups, head, hostid, id, install, join, link, ln, logname, ls, md5sum, mkdir, mkfifo, mknod, mktemp, mv, nice, nl, nohup, nproc, od, paste, pathchk, pinky, pr, printenv, printf, ptx, pwd, readlink, realpath, rm, rmdir, runcon, seq, sha1sum, sha224sum, sha256sum, sha384sum, sha512sum, shred, shuf, sleep, sort, split, stat, stdbuf, stty, sum, sync, tac, tail, tee, test, timeout, touch, tr, true, truncate, tsort, tty, uname, unexpand, uniq, unlink, users, vdir, wc, who, whoami, and yes
Установленная библиотека:	libstdbuf.so
Установленный каталог:	/usr/libexec/coreutils

Краткое описание

base64   Encodes and decodes data according to the base64 (RFC 3548) specification

basename Strips any path and a given suffix from a file name

cat	Concatenates files to standard output
chcon	Changes security context for files and directories
chgrp	Changes the group ownership of files and directories
chmod	Changes the permissions of each file to the given mode; the mode can be either a symbolic representation of the changes to make or an octal number representing the new permissions
chown	Changes the user and/or group ownership of files and directories
chroot	Runs a command with the specified directory as the / directory
cksum	Prints the Cyclic Redundancy Check (CRC) checksum and the byte counts of each specified file
comm	Compares two sorted files, outputting in three columns the lines that are unique and the lines that are common
cp	Copies files
csplit	Splits a given file into several new files, separating them according to given patterns or line numbers and outputting the byte count of each new file
cut	Prints sections of lines, selecting the parts according to given fields or positions
date	Displays the current time in the given format, or sets the system date
dd	Copies a file using the given block size and count, while optionally performing conversions on it
df	Reports the amount of disk space available (and used) on all mounted file systems, or only on the file systems holding the selected files
dir	Lists the contents of each given directory (the same as все же запустить тестирование **ls** command)
dircolors	Outputs commands to set the LS_COLOR environment variable to change the color scheme used by **ls**
dirname	Strips the non-directory suffix from a file name
du	Reports the amount of disk space used by the current directory, by each of the given directories (including all subdirectories) or by each of the given files
echo	Displays the given strings
env	Runs a command in a modified environment
expand	Converts tabs to spaces
expr	Evaluates expressions
factor	Prints the prime factors of all specified integer numbers
false	Does nothing, unsuccessfully; it always exits with a status code indicating failure
fmt	Reformats the paragraphs in the given files
fold	Wraps the lines in the given files
groups	Reports a user's group memberships
head	Prints the first ten lines (or the given number of lines) of each given file

hostid	Reports the numeric identifier (in hexadecimal) of the host
id	Reports the effective user ID, group ID, and group memberships of the current user or specified user
install	Copies files while setting their permission modes and, if possible, their owner and group
join	Joins the lines that have identical join fields from two separate files
link	Creates a hard link with the given name to a file
ln	Makes hard links or soft (symbolic) links between files
logname	Reports the current user's login name
ls	Lists the contents of each given directory
md5sum	Reports or checks Message Digest 5 (MD5) checksums
mkdir	Creates directories with the given names
mkfifo	Creates First-In, First-Outs (FIFOs), a «named pipe» in UNIX parlance, with the given names
mknod	Creates device nodes with the given names; a device node is a character special file, a block special file, or a FIFO
mktemp	Creates temporary files in a secure manner; it is used in scripts
mv	Moves or renames files or directories
nice	Runs a program with modified scheduling priority
nl	Numbers the lines from the given files
nohup	Runs a command immune to hangups, with its output redirected to a log file
nproc	Prints the number of processing units available to a process
od	Dumps files in octal and other formats
paste	Merges the given files, joining sequentially corresponding lines side by side, separated by tab characters
pathchk	Checks if file names are valid or portable
pinky	Is a lightweight finger client; it reports some information about the given users
pr	Paginates and columnates files for printing
printenv	Prints the environment
printf	Prints the given arguments according to the given format, much like the C printf function
ptx	Produces a permuted index from the contents of the given files, with each keyword in its context
pwd	Reports the name of the current working directory
readlink	Reports the value of the given symbolic link
realpath	Prints the resolved path
rm	Removes files or directories
rmdir	Removes directories if they are empty
runcon	Runs a command with specified security context

seq	Prints a sequence of numbers within a given range and with a given increment
sha1sum	Prints or checks 160-bit Secure Hash Algorithm 1 (SHA1) checksums
sha224sum	Prints or checks 224-bit Secure Hash Algorithm checksums
sha256sum	Prints or checks 256-bit Secure Hash Algorithm checksums
sha384sum	Prints or checks 384-bit Secure Hash Algorithm checksums
sha512sum	Prints or checks 512-bit Secure Hash Algorithm checksums
shred	Overwrites the given files repeatedly with complex patterns, making it difficult to recover the data
shuf	Shuffles lines of text
sleep	Pauses for the given amount of time
sort	Sorts the lines from the given files
split	Splits the given file into pieces, by size or by number of lines
stat	Displays file or filesystem status
stdbuf	Runs commands with altered buffering operations for its standard streams
stty	Sets or reports terminal line settings
sum	Prints checksum and block counts for each given file
sync	Flushes file system buffers; it forces changed blocks to disk and updates the super block
tac	Concatenates the given files in reverse
tail	Prints the last ten lines (or the given number of lines) of each given file
tee	Reads from standard input while writing both to standard output and to the given files
test	Compares values and checks file types
timeout	Runs a command with a time limit
touch	Changes file timestamps, setting the access and modification times of the given files to the current time; files that do not exist are created with zero length
tr	Translates, squeezes, and deletes the given characters from standard input
true	Does nothing, successfully; it always exits with a status code indicating success
truncate	Shrinks or expands a file to the specified size
tsort	Performs a topological sort; it writes a completely ordered list according to the partial ordering in a given file
tty	Reports the file name of the terminal connected to standard input
uname	Reports system information
unexpand	Converts spaces to tabs
uniq	Discards all but one of successive identical lines
unlink	Removes the given file

users	Reports the names of the users currently logged on
vdir	Is the same as **ls -l**
wc	Reports the number of lines, words, and bytes for each given file, as well as a total line when more than one file is given
who	Reports who is logged on
whoami	Reports the user name associated with the current effective user ID
yes	Repeatedly outputs «y» or a given string until killed
libstdbuf.so	Library used by **stdbuf**

6.28. Iana-Etc-2.30

The Iana-Etc package provides data for network services and protocols.

Приблизительное время сборки:	менее 0.1 SBU
Требует свободного места на диске:	2.2 MB

6.28.1. Установка Iana-Etc

The following command converts the raw data provided by IANA into the correct formats for the /etc/protocols and /etc/services data files:

```
make
```

This package does not come with a test suite.

Установим пакет:

```
make install
```

6.28.2. Содержимое Iana-Etc

Installed files:	/etc/protocols and /etc/services

Краткое описание

/etc/protocols	Describes the various DARPA Internet protocols that are available from the TCP/IP subsystem
/etc/services	Provides a mapping between friendly textual names for internet services, and their underlying assigned port numbers and protocol types

6.29. M4-1.4.16

The M4 package contains a macro processor.

Приблизительное время сборки:	0.4 SBU
Требует свободного места на диске:	26.6 MB

6.29.1. Installation of M4

Fix an incompatibility between this package and Glibc-2.17:

```
sed -i -e '/gets is a/d' lib/stdio.in.h
```

Prepare M4 for compilation:

```
./configure --prefix=/usr
```

Compile the package:

```
make
```

To test the results, first fix a test program and then run the test programs:

```
sed -i -e '41s/ENOENT/& || errno == EINVAL/' tests/test-readlink.h
make check
```

Install the package:

```
make install
```

6.29.2. Содержимое M4

Установленная программа:	m4

Краткое описание

m4 copies the given files while expanding the macros that they contain. These macros are either built-in or user-defined and can take any number of arguments. Besides performing macro expansion, **m4** has built-in functions for including named files, running Unix commands, performing integer arithmetic, manipulating text, recursion, etc. The **m4** program can be used either as a front-end to a compiler or as a macro processor in its own right.

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6.30. Bison-2.7

The Bison package contains a parser generator.

Приблизительное время сборки:	1.3 SBU
Требует свободного места на диске:	34 MB

6.30.1. Установка Bison

Подготовим Bison к компиляции:

```
./configure --prefix=/usr
```

The configure system causes Bison to be built without support for internationalization of error messages if a **bison** program is not already in $PATH. The following addition will correct this:

```
echo '#define YYENABLE_NLS 1' >> lib/config.h
```

Скомпилируем пакет:

```
make
```

To test the results (about 0.5 SBU), issue:

```
make check
```

Установим пакет:

```
make install
```

6.30.2. Содержимое Bison

Установленные программы:	bison and yacc
Установленная библиотека:	liby.a
Установленный каталог:	/usr/share/bison

Краткое описание

bison	Generates, from a series of rules, a program for analyzing the structure of text files; Bison is a replacement for Yacc (Yet Another Compiler Compiler)
yacc	A wrapper for **bison**, meant for programs that still call **yacc** instead of **bison**; it calls **bison** with the –y option
liby.a	The Yacc library containing implementations of Yacc-compatible yyerror and main functions; this library is normally not very useful, but POSIX requires it

6.31. Grep-2.14

The Grep package contains programs for searching through files.

Приблизительное время сборки:	0.4 SBU
Требует свободного места на диске:	30 MB

6.31.1. Installation of Grep

Prepare Grep for compilation:

```
./configure --prefix=/usr --bindir=/bin
```

Compile the package:

```
make
```

To test the results, issue:

```
make check
```

Install the package:

```
make install
```

6.31.2. Contents of Grep

Installed programs:	egrep, fgrep, and grep

Краткое описание

egrep	Prints lines matching an extended regular expression
fgrep	Prints lines matching a list of fixed strings
grep	Prints lines matching a basic regular expression

6.32. Readline-6.2

The Readline package is a set of libraries that offers command-line editing and history capabilities.

Приблизительное время сборки:	0.1 SBU
Требует свободного места на диске:	17.2 MB

6.32.1. Установка Readline

Reinstalling Readline will cause the old libraries to be moved to <libraryname>.old. While this is normally not a problem, in some cases it can trigger a linking bug in **ldconfig**. This can be avoided by issuing the following two seds:

```
sed -i '/MV.*old/d' Makefile.in
sed -i '/{OLDSUFF}/c:' support/shlib-install
```

Применим патч to fix a known bug that has been fixed upstream:

```
patch -Np1 -i ../readline-6.2-fixes-1.patch
```

Подготовим Readline к компиляции:

```
./configure --prefix=/usr --libdir=/lib
```

Скомпилируем пакет:

```
make SHLIB_LIBS=-lncurses
```

Значение параметра make:

SHLIB_LIBS=-lncurses
    This option forces Readline to link against the libncurses (really, libncursesw) library.

This package does not come with a test suite.

Установим пакет:

```
make install
```

Now move the static libraries to a more appropriate location:

```
mv -v /lib/lib{readline,history}.a /usr/lib
```

Next, remove the .so files in /lib and relink them into /usr/lib:

```
rm -v /lib/lib{readline,history}.so
ln -sfv ../../lib/libreadline.so.6 /usr/lib/libreadline.so
ln -sfv ../../lib/libhistory.so.6 /usr/lib/libhistory.so
```

If desired, install the documentation:

```
mkdir   -v      /usr/share/doc/readline-6.2
install -v -m644 doc/*.{ps,pdf,html,dvi} \
                /usr/share/doc/readline-6.2
```

6.32.2. Содержимое Readline

Установленные библиотеки:	libhistory.{a,so}, and libreadline.{a,so}
Установленные каталоги:	/usr/include/readline, /usr/share/readline, /usr/share/doc/readline-6.2

Краткое описание

`libhistory`	Provides a consistent user interface for recalling lines of history
`libreadline`	Aids in the consistency of user interface across discrete programs that need to provide a command line interface

6.33. Bash-4.2

The Bash package contains the Bourne-Again SHell.

Приблизительное время сборки:	1.7 SBU
Требует свободного места на диске:	45 MB

6.33.1. Installation of Bash

First, apply the following patch to fix various bugs that have been addressed upstream:

```
patch -Np1 -i ../bash-4.2-fixes-11.patch
```

Prepare Bash for compilation:

```
./configure --prefix=/usr                      \
            --bindir=/bin                      \
            --htmldir=/usr/share/doc/bash-4.2 \
            --without-bash-malloc             \
            --with-installed-readline
```

The meaning of the configure options:

--htmldir
> This option designates the directory into which HTML formatted documentation will be installed.

--with-installed-readline
> This option tells Bash to use the readline library that is already installed on the system rather than using its own readline version.

Скомпилируем пакет:

```
make
```

Skip down to «Install the package» if not running the test suite.

To prepare the tests, ensure that the nobody user can write to the sources tree:

```
chown -Rv nobody .
```

Now, run the tests as the nobody user:

```
su nobody -s /bin/bash -c "PATH=$PATH make tests"
```

Установим пакет:

```
make install
```

Run the newly compiled **bash** program (replacing the one that is currently being executed):

```
exec /bin/bash --login +h
```

> **Замечание**
>
> The parameters used make the **bash** process an interactive login shell and continue to disable hashing so that new programs are found as they become available.

6.33.2. Содержимое Bash

Установленные программы: bash, bashbug, and sh (link to bash)

Установленный каталог: /usr/share/doc/bash-4.2

Краткое описание

bash   A widely-used command interpreter; it performs many types of expansions and substitutions on a given command line before executing it, thus making this interpreter a powerful tool

bashbug   A shell script to help the user compose and mail standard formatted bug reports concerning **bash**

sh   A symlink to the **bash** program; when invoked as **sh**, **bash** tries to mimic the startup behavior of historical versions of **sh** as closely as possible, while conforming to the POSIX standard as well

6.34. Libtool-2.4.2

The Libtool package contains the GNU generic library support script. It wraps the complexity of using shared libraries in a consistent, portable interface.

Приблизительное время сборки:	3.0 SBU
Требует свободного места на диске:	37 MB

6.34.1. Установка Libtool

Подготовим Libtool к компиляции:

```
./configure --prefix=/usr
```

Скомпилируем пакет:

```
make
```

To test the results (about 3.0 SBU), issue:

```
make check
```

Установим пакет:

```
make install
```

6.34.2. Содержимое Libtool

Установленные программы:	libtool and libtoolize
Установленные библиотеки:	libltdl.{a,so}
Установленные каталоги:	/usr/include/libltdl, /usr/share/libtool

Краткое описание

libtool	Provides generalized library-building support services
libtoolize	Provides a standard way to add **libtool** support to a package
libltdl	Hides the various difficulties of dlopening libraries

6.35. GDBM-1.10

The GDBM package contains the GNU Database Manager. This is a disk file format database which stores key/data-pairs in single files. The actual data of any record being stored is indexed by a unique key, which can be retrieved in less time than if it was stored in a text file.

Приблизительное время сборки:	0.1 SBU
Требует свободного места на диске:	8.5 MB

6.35.1. Установка GDBM

Подготовим GDBM к компиляции:

```
./configure --prefix=/usr --enable-libgdbm-compat
```

Значение параметра configure:

--enable-libgdbm-compat
This switch enables the libgdbm compatibility library to be built, as some packages outside of LFS may require the older DBM routines it provides.

Compile the package:

```
make
```

To test the results, issue:

```
make check
```

Install the package:

```
make install
```

6.35.2. Contents of GDBM

Installed program: testgdbm
Installed libraries: libgdbm.{so,a} and libgdbm_compat.{so,a}

Краткое описание

testgdbm Tests and modifies a GDBM database

libgdbm Contains functions to manipulate a hashed database

6.36. Inetutils-1.9.1

The Inetutils package contains programs for basic networking.

Приблизительное время сборки:	0.4 SBU
Требует свободного места на диске:	27 MB

6.36.1. Установка Inetutils

Fix an incompatibility between this package and Glibc-2.17

```
sed -i -e '/gets is a/d' lib/stdio.in.h
```

Prepare Inetutils for compilation:

```
./configure --prefix=/usr  \
    --libexecdir=/usr/sbin \
    --localstatedir=/var   \
    --disable-ifconfig     \
    --disable-logger       \
    --disable-syslogd      \
    --disable-whois        \
    --disable-servers
```

Значение параметров configure:

--disable-ifconfig

This option prevents Inetutils from installing the **ifconfig** program, which can be used to configure network interfaces. LFS uses **ip** from IPRoute2 to perform this task.

--disable-logger

This option prevents Inetutils from installing the **logger** program, which is used by scripts to pass messages to the System Log Daemon. Do not install it because Util-linux installed a version earlier.

--disable-syslogd

This option prevents Inetutils from installing the System Log Daemon, which is installed with the Sysklogd package.

--disable-whois

This option disables the building of the Inetutils **whois** client, which is out of date. Instructions for a better **whois** client are in the BLFS book.

--disable-servers

This disables the installation of the various network servers included as part of the Inetutils package. These servers are deemed not appropriate in a basic LFS system. Some are insecure by nature and are only considered safe on trusted networks. More information can be found at *http://www.linuxfromscratch.org/blfs/view/svn/basicnet/ inetutils.html*. Note that better replacements are available for many of these servers.

Скомпилируем пакет:

```
make
```

Чтобы запустить тестирование пакета, выполните:

```
make check
```

Установим пакет:

```
make install
```

Move some programs so they are available if /usr is not accessible:

```
mv -v /usr/bin/{hostname,ping,ping6,traceroute} /bin
```

6.36.2. Содержимое Inetutils

**Установленные
программы:**   ftp, hostname, ping, ping6, rcp, rexec, rlogin, rsh, talk, telnet, tftp, and traceroute

Краткое описание

ftp	Is the file transfer protocol program
hostname	Reports or sets the name of the host
ping	Sends echo-request packets and reports how long the replies take
ping6	A version of **ping** for IPv6 networks
rcp	Performs remote file copy
rexec	executes commands on a remote host
rlogin	Performs remote login
rsh	Runs a remote shell
talk	Is used to chat with another user
telnet	An interface to the TELNET protocol
tftp	A trivial file transfer program
traceroute	Traces the route your packets take from the host you are working on to another host on a network, showing all the intermediate hops (gateways) along the way

6.37. Perl-5.16.2

The Perl package contains the Practical Extraction and Report Language.

Приблизительное время сборки:	7.5 SBU
Требует свободного места на диске:	247 MB

6.37.1. Установка Perl

First create a basic /etc/hosts file to be referenced in one of Perl's configuration files as well as the optional test suite:

```
echo "127.0.0.1 localhost $(hostname)" > /etc/hosts
```

This version of Perl now builds the Compress::Raw::Zlib module. By default Perl will use an internal copy of the Zlib source for the build. Issue the following command so that Perl will use the Zlib library installed on the system:

```
sed -i -e "s|BUILD_ZLIB\s*= True|BUILD_ZLIB = False|"          \
       -e "s|INCLUDE\s*= ./zlib-src|INCLUDE    = /usr/include|" \
       -e "s|LIB\s*= ./zlib-src|LIB         = /usr/lib|"        \
    cpan/Compress-Raw-Zlib/config.in
```

To have full control over the way Perl is set up, you can remove the «-des» options from the following command and hand-pick the way this package is built. Alternatively, use the command exactly as below to use the defaults that Perl auto-detects:

```
sh Configure -des -Dprefix=/usr                    \
                  -Dvendorprefix=/usr              \
                  -Dman1dir=/usr/share/man/man1 \
                  -Dman3dir=/usr/share/man/man3 \
                  -Dpager="/usr/bin/less -isR"  \
                  -Duseshrplib
```

Значение параметров configure:

-Dvendorprefix=/usr
　　This ensures **perl** knows how to tell packages where they should install their perl modules.

-Dpager="/usr/bin/less -isR"
　　This corrects an error in the way that **perldoc** invokes the **less** program.

-Dman1dir=/usr/share/man/man1 -Dman3dir=/usr/share/man/man3
　　Since Groff is not installed yet, **Configure** thinks that we do not want man pages for Perl. Issuing these parameters overrides this decision.

-Duseshrplib
　　Build a shared libperl needed by some perl modules.

Скомпилируем пакет:

```
make
```

To test the results (approximately 2.5 SBU), issue:

```
make -k test
```

Установим пакет:

```
make install
```

6.37.2. Содержимое Perl

Установленные программы:	a2p, c2ph, config_data, corelist, cpan, cpan2dist, cpanp, cpanp-run-perl, enc2xs, find2perl, h2ph, h2xs, instmodsh, json_pp, libnetcfg, perl, perl5.16.2 (link to perl), perlbug, perldoc, perlivp, perlthanks (link to perlbug), piconv, pl2pm, pod2html, pod2latex, pod2man, pod2text, pod2usage, podchecker, podselect, prove, psed (link to s2p), pstruct (link to c2ph), ptar, ptardiff, ptargrep, s2p, shasum, splain, xsubpp, and zipdetails
Установленные библиотеки:	Several hundred which cannot all be listed here
Установленный каталог:	/usr/lib/perl5

Краткое описание

a2p	Translates awk to Perl
c2ph	Dumps C structures as generated from **cc -g -S**
config_data	Queries or changes configuration of Perl modules
corelist	A commandline frontend to Module::CoreList
cpan	Interact with the Comprehensive Perl Archive Network (CPAN) from the command line
cpan2dist	The CPANPLUS distribution creator
cpanp	The CPANPLUS launcher
cpanp-run-perl	Perl script that is used to enable flushing of the output buffer after each write in spawned processes
enc2xs	Builds a Perl extension for the Encode module from either Unicode Character Mappings or Tcl Encoding Files
find2perl	Translates **find** commands to Perl
h2ph	Converts .h C header files to .ph Perl header files
h2xs	Converts .h C header files to Perl extensions
instmodsh	Shell script for examining installed Perl modules, and can even create a tarball from an installed module
json_pp	Converts data between certain input and output formats
libnetcfg	Can be used to configure the libnet Perl module
perl	Combines some of the best features of C, **sed**, **awk** and **sh** into a single swiss-army language
perl5.16.2	A hard link to **perl**
perlbug	Used to generate bug reports about Perl, or the modules that come with it, and mail them

perldoc	Displays a piece of documentation in pod format that is embedded in the Perl installation tree or in a Perl script
perlivp	The Perl Installation Verification Procedure; it can be used to verify that Perl and its libraries have been installed correctly
perlthanks	Used to generate thank you messages to mail to the Perl developers
piconv	A Perl version of the character encoding converter **iconv**
pl2pm	A rough tool for converting Perl4 `.pl` files to Perl5 `.pm` modules
pod2html	Converts files from pod format to HTML format
pod2latex	Converts files from pod format to LaTeX format
pod2man	Converts pod data to formatted *roff input
pod2text	Converts pod data to formatted ASCII text
pod2usage	Prints usage messages from embedded pod docs in files
podchecker	Checks the syntax of pod format documentation files
podselect	Displays selected sections of pod documentation
prove	Command line tool for running tests against the Test::Harness module.
psed	A Perl version of the stream editor **sed**
pstruct	Dumps C structures as generated from **cc -g -S** stabs
ptar	A **tar**-like program written in Perl
ptardiff	A Perl program that compares an extracted archive with an unextracted one
ptargrep	A Perl program that applies pattern matching to the contents of files in a tar archive
s2p	Translates **sed** scripts to Perl
shasum	Prints or checks SHA checksums
splain	Is used to force verbose warning diagnostics in Perl
xsubpp	Converts Perl XS code into C code
zipdetails	Displays details about the internal structure of a Zip file

6.38. Autoconf-2.69

The Autoconf package contains programs for producing shell scripts that can automatically configure source code.

Приблизительное время сборки:	4.5 SBU
Требует свободного места на диске:	17.1 MB

6.38.1. Установка Autoconf

Подготовим Autoconf к компиляции:

```
./configure --prefix=/usr
```

Скомпилируем пакет:

```
make
```

Чтобы запустить тестирование пакета, выполните:

```
make check
```

This takes a long time, about 4.7 SBUs. In addition, 6 tests are skipped that use Automake. For full test coverage, Autoconf can be re-tested after Automake has been installed.

Установим пакет:

```
make install
```

6.38.2. Содержимое Autoconf

Установленные программы:	autoconf, autoheader, autom4te, autoreconf, autoscan, autoupdate, and ifnames
Установленный каталог:	/usr/share/autoconf

Краткое описание

autoconf   Produces shell scripts that automatically configure software source code packages to adapt to many kinds of Unix-like systems. The configuration scripts it produces are independent—running все же запустить тестированием does not require the **autoconf** program.

autoheader   A tool for creating template files of C *#define* statements for configure to use

autom4te   A wrapper for the M4 macro processor

autoreconf   Automatically runs **autoconf**, **autoheader**, **aclocal**, **automake**, **gettextize**, and **libtoolize** in the correct order to save time when changes are made to **autoconf** and **automake** template files

autoscan   Helps to create a `configure.in` file for a software package; it examines the source files in a directory tree, searching them for common portability issues, and creates a `configure.scan` file that serves as as a preliminary `configure.in` file for the package

autoupdate   Modifies a `configure.in` file that still calls **autoconf** macros by their old names to use the current macro names

ifnames   Helps when writing `configure.in` files for a software package; it prints the identifiers that the package uses in C preprocessor conditionals. If a package has already been set up to have some portability, this program can help determine what **configure** needs to check for. It can also fill in gaps in a `configure.in` file generated by **autoscan**

6.39. Automake-1.13.1

The Automake package contains programs for generating Makefiles for use with Autoconf.

Приблизительное время сборки:	менее 0.1 SBU (34.1 SBU with tests)
Требует свободного места на диске:	100 MB

6.39.1. Installation of Automake

Prepare Automake for compilation:

```
./configure --prefix=/usr --docdir=/usr/share/doc/automake-1.13.1
```

Compile the package:

```
make
```

> **Замечание**
>
> The tests take a very long time: over 30 SBUs. Running the tests is not recommended.

To test the results, issue:

```
make check
```

Install the package:

```
make install
```

6.39.2. Содержимое Automake

Установленные программы:	acinstall, aclocal, aclocal-1.13, automake, automake-1.13, compile, config.guess, config.sub, depcomp, elisp-comp, install-sh, mdate-sh, missing, mkinstalldirs, py-compile, symlink-tree, and ylwrap
Установленные каталоги:	/usr/share/aclocal-1.13, /usr/share/automake-1.13, /usr/share/doc/automake-1.13.1

Краткое описание

acinstall	A script that installs aclocal-style M4 files
aclocal	Generates `aclocal.m4` files based on the contents of `configure.in` files
aclocal-1.13	A hard link to **aclocal**
automake	A tool for automatically generating `Makefile.in` files from `Makefile.am` files. To create all the `Makefile.in` files for a package, run this program in the top-level directory. By scanning the `configure.in` file, it automatically finds each appropriate `Makefile.am` file and generates the corresponding `Makefile.in` file
automake-1.13	A hard link to **automake**
compile	A wrapper for compilers

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config.guess   A script that attempts to guess the canonical triplet for все же запустить тестирование given build, host, or target architecture

config.sub   A configuration validation subroutine script

depcomp   A script for compiling a program so that dependency information is generated in addition to the desired output

elisp-comp   Byte-compiles Emacs Lisp code

install-sh   A script that installs a program, script, or data file

mdate-sh   A script that prints the modification time of a file or directory

missing   A script acting as a common stub for missing GNU programs during an installation

mkinstalldirs   A script that creates a directory tree

py-compile   Compiles a Python program

symlink-tree   A script to create a symlink tree of a directory tree

ylwrap   A wrapper for **lex** and **yacc**

6.40. Diffutils-3.2

The Diffutils package contains programs that show the differences between files or directories.

Приблизительное время сборки:	0.5 SBU
Требует свободного места на диске:	25 MB

6.40.1. Installation of Diffutils

Fix an incompatibility between this package and Glibc-2.17

```
sed -i -e '/gets is a/d' lib/stdio.in.h
```

Prepare Diffutils for compilation:

```
./configure --prefix=/usr
```

Compile the package:

```
make
```

To test the results, issue:

```
make check
```

Install the package:

```
make install
```

6.40.2. Содержимое Diffutils

Установленные программы:	cmp, diff, diff3, and sdiff

Краткое описание

cmp	Compares two files and reports whether or in which bytes they differ
diff	Compares two files or directories and reports which lines in все же запустить тестирование files differ
diff3	Compares three files line by line
sdiff	Merges two files and interactively outputs the results

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6.41. Gawk-4.0.2

The Gawk package contains programs for manipulating text files.

Приблизительное время сборки:	0.2 SBU
Требует свободного места на диске:	30 MB

6.41.1. Установка Gawk

Подготовим Gawk к компиляции:

```
./configure --prefix=/usr --libexecdir=/usr/lib
```

Скомпилируем пакет:

```
make
```

Чтобы запустить тестирование пакета, выполните:

```
make check
```

Установим пакет:

```
make install
```

If desired, install the documentation:

```
mkdir -v /usr/share/doc/gawk-4.0.2
cp    -v doc/{awkforai.txt,*.{eps,pdf,jpg}} /usr/share/doc/gawk-4.0.2
```

6.41.2. Содержимое Gawk

Установленные программы:	awk (link to gawk), dgawk, gawk, gawk-4.0.2, grcat, igawk, pgawk, pgawk-4.0.2, and pwcat
Установленные каталоги:	/usr/lib/awk, /usr/share/awk

Краткое описание

awk	A link to **gawk**
dgawk	An awk debugger
gawk	A program for manipulating text files; it is the GNU implementation of **awk**
gawk-4.0.2	A hard link to **gawk**
grcat	Dumps the group database /etc/group
igawk	Gives **gawk** the ability to include files
pgawk	The profiling version of **gawk**
pgawk-4.0.2	Hard link to **pgawk**
pwcat	Dumps the password database /etc/passwd

6.42. Findutils-4.4.2

The Findutils package contains programs to find files. These programs are provided to recursively search through a directory tree and to create, maintain, and search a database (often faster than the recursive find, but unreliable if the database has not been recently updated).

Приблизительное время сборки:	0.4 SBU
Требует свободного места на диске:	29 MB

6.42.1. Installation of Findutils

Prepare Findutils for compilation:

```
./configure --prefix=/usr                  \
            --libexecdir=/usr/lib/findutils \
            --localstatedir=/var/lib/locate
```

The meaning of the configure options:

--localstatedir
> This option changes the location of the **locate** database to be in /var/lib/locate, which is FHS-compliant.

Скомпилируем пакет:

```
make
```

Чтобы запустить тестирование пакета, выполните:

```
make check
```

Установим пакет:

```
make install
```

Some of the scripts in the LFS-Bootscripts package depend on **find**. As /usr may not be available during the early stages of booting, this program needs to be on the root partition. The **updatedb** script also needs to be modified to correct an explicit path:

```
mv -v /usr/bin/find /bin
sed -i 's/find:=${BINDIR}/find:=\/bin/' /usr/bin/updatedb
```

6.42.2. Содержимое Findutils

Установленные программы:	bigram, code, find, frcode, locate, oldfind, updatedb, and xargs
Установленный каталог:	/usr/lib/findutils

Краткое описание

bigram	Was formerly used to produce **locate** databases
code	Was formerly used to produce **locate** databases; it is the ancestor of **frcode**.

find Searches given directory trees for files matching the specified criteria

frcode Is called by **updatedb** to compress the list of file names; it uses front-compression, reducing the database size by a factor of four to five.

locate Searches through a database of file names and reports the names that contain a given string or match a given pattern

oldfind Older version of find, using a different algorithm

updatedb Updates the **locate** database; it scans the entire file system (including other file systems that are currently mounted, unless told not to) and puts every file name it finds into все же запустить тестирование database

xargs Can be used to apply a given command to a list of files

6.43. Flex-2.5.37

The Flex package contains a utility for generating programs that recognize patterns in text.

Приблизительное время сборки:	0.4 SBU
Требует свободного места на диске:	39 MB

6.43.1. Installation of Flex

First, fix some regression tests:

```
patch -Np1 -i ../flex-2.5.37-bison-2.6.1-1.patch
```

Prepare Flex for compilation:

```
./configure --prefix=/usr            \
            --docdir=/usr/share/doc/flex-2.5.37
```

Compile the package:

```
make
```

To test the results (about 0.5 SBU), issue:

```
make check
```

Установим пакет:

```
make install
```

There are some packages that expect to find the lex library in /usr/lib. Create a symlink to account for this:

```
ln -sv libfl.a /usr/lib/libl.a
```

A few programs do not know about **flex** yet and try to run its predecessor, **lex**. To support those programs, create a wrapper script named lex that calls flex in **lex** emulation mode:

```
cat > /usr/bin/lex << "EOF"
#!/bin/sh
# Begin /usr/bin/lex

exec /usr/bin/flex -l "$@"

# End /usr/bin/lex
EOF
chmod -v 755 /usr/bin/lex
```

6.43.2. Contents of Flex

Installed programs:	flex, flex++ (link to flex), and lex
Installed libraries:	libfl.a and libfl_pic.a
Installed directories:	/usr/share/doc/flex-2.5.37

Краткое описание

flex   A tool for generating programs that recognize patterns in text; it allows for the versatility to specify the rules for pattern-finding, eradicating the need to develop a specialized program

flex++   An extension of flex, is used for generating C++ code and classes. It is a symbolic link to **flex**

lex   A script that runs **flex** in **lex** emulation mode

`libfl.a`   The `flex` library

6.44. Gettext-0.18.2

The Gettext package contains utilities for internationalization and localization. These allow programs to be compiled with NLS (Native Language Support), enabling them to output messages in the user's native language.

Приблизительное время сборки:	2.3 SBU
Требует свободного места на диске:	180 MB

6.44.1. Установка Gettext

Подготовим Gettext к компиляции:

```
./configure --prefix=/usr \
            --docdir=/usr/share/doc/gettext-0.18.2
```

Скомпилируем пакет:

```
make
```

To test the results (this takes a long time, around 3 SBUs), issue:

```
make check
```

Установим пакет:

```
make install
```

6.44.2. Содержимое Gettext

Установленные программы:	autopoint, config.charset, config.rpath, envsubst, gettext, gettext.sh, gettextize, hostname, msgattrib, msgcat, msgcmp, msgcomm, msgconv, msgen, msgexec, msgfilter, msgfmt, msggrep, msginit, msgmerge, msgunfmt, msguniq, ngettext, recode-sr-latin, and xgettext
Установленные библиотеки:	libasprintf.{a,so}, libgettextlib.so, libgettextpo.{a,so}, libgettextsrc.so, and preloadable_libintl.so
Установленные каталоги:	/usr/lib/gettext, /usr/share/doc/gettext-0.18.2, /usr/share/gettext

Краткое описание

autopoint	Copies standard Gettext infrastructure files into a source package
config.charset	Outputs a system-dependent table of character encoding aliases
config.rpath	Outputs a system-dependent set of variables, describing how to set the runtime search path of shared libraries in an executable
envsubst	Substitutes environment variables in shell format strings
gettext	Translates a natural language message into the user's language by looking up the translation in a message catalog
gettext.sh	Primarily serves as a shell function library for gettext

gettextize	Copies all standard Gettext files into the given top-level directory of a package to begin internationalizing it
hostname	Displays a network hostname in various forms
msgattrib	Filters the messages of a translation catalog according to their attributes and manipulates the attributes
msgcat	Concatenates and merges the given `.po` files
msgcmp	Compares two `.po` files to check that both contain the same set of msgid strings
msgcomm	Finds the messages that are common to to the given `.po` files
msgconv	Converts a translation catalog to a different character encoding
msgen	Creates an English translation catalog
msgexec	Applies a command to all translations of a translation catalog
msgfilter	Applies a filter to all translations of a translation catalog
msgfmt	Generates a binary message catalog from a translation catalog
msggrep	Extracts all messages of a translation catalog that match a given pattern or belong to some given source files
msginit	Creates a new `.po` file, initializing the meta information with values from the user's environment
msgmerge	Combines two raw translations into a single file
msgunfmt	Decompiles a binary message catalog into raw translation text
msguniq	Unifies duplicate translations in a translation catalog
ngettext	Displays native language translations of a textual message whose grammatical form depends on a number
recode-sr-latin	Recodes Serbian text from Cyrillic to Latin script
xgettext	Extracts the translatable message lines from the given source files to make the first translation template
`libasprintf`	defines the *autosprintf* class, which makes C formatted output routines usable in C++ programs, for use with the *<string>* strings and the *<iostream>* streams
`libgettextlib`	a private library containing common routines used by the various Gettext programs; these are not intended for general use
`libgettextpo`	Used to write specialized programs that process `.po` files; this library is used when the standard applications shipped with Gettext (such as **msgcomm**, **msgcmp**, **msgattrib**, and **msgen**) will not suffice
`libgettextsrc`	A private library containing common routines used by the various Gettext programs; these are not intended for general use
`preloadable_libintl`	A library, intended to be used by LD_PRELOAD that assists `libintl` in logging untranslated messages.

6.45. Groff-1.22.2

The Groff package contains programs for processing and formatting text.

Приблизительное время сборки:	0.5 SBU
Требует свободного места на диске:	83 MB

6.45.1. Установка Groff

Groff expects the environment variable PAGE to contain the default paper size. For users in the United States, *PAGE=letter* is appropriate. Elsewhere, *PAGE=A4* may be more suitable. While the default paper size is configured during compilation, it can be overridden later by echoing either «A4» or «letter» to the /etc/papersize file.

Подготовим Groff к компиляции:

```
PAGE=<paper_size> ./configure --prefix=/usr
```

Скомпилируем пакет:

```
make
```

This package does not come with a test suite.

Установим пакет:

```
mkdir -p /usr/share/doc/groff-1.22/pdf
make install
```

Some documentation programs, such as **xman**, will not work properly without the following symlinks:

```
ln -sv eqn /usr/bin/geqn
ln -sv tbl /usr/bin/gtbl
```

6.45.2. Содержимое Groff

Установленные программы:	addftinfo, afmtodit, chem, eqn, eqn2graph, gdiffmk, geqn (link to eqn), grap2graph, grn, grodvi, groff, groffer, grog, grolbp, grolj4, grops, grotty, gtbl (link to tbl), hpftodit, indxbib, lkbib, lookbib, mmroff, neqn, nroff, pdfroff, pfbtops, pic, pic2graph, post-grohtml, preconv, pre-grohtml, refer, roff2dvi, roff2html, roff2pdf, roff2ps, roff2text, roff2x, soelim, tbl, tfmtodit, and troff
Установленные каталоги:	/usr/lib/groff, /usr/share/doc/groff-1.22.2, /usr/share/groff

Краткое описание

addftinfo	Reads a troff font file and adds some additional font-metric information that is used by the **groff** system
afmtodit	Creates a font file for use with **groff** and **grops**
chem	Groff preprocessor for producing chemical structure diagrams

eqn	Compiles descriptions of equations embedded within troff input files into commands that are understood by **troff**
eqn2graph	Converts a troff EQN (equation) into a cropped image
gdiffmk	Marks differences between groff/nroff/troff files
geqn	A link to **eqn**
grap2graph	Converts a grap diagram into a cropped bitmap image
grn	A **groff** preprocessor for gremlin files
grodvi	A driver for **groff** that produces TeX dvi format
groff	A front-end to the groff document formatting system; normally, it runs the **troff** program and a post-processor appropriate for the selected device
groffer	Displays groff files and man pages on X and tty terminals
grog	Reads files and guesses which of the **groff** options -e, -man, -me, -mm, -ms, -p, -s, and -t are required for printing files, and reports the **groff** command including those options
grolbp	Is a **groff** driver for Canon CAPSL printers (LBP-4 and LBP-8 series laser printers)
grolj4	Is a driver for **groff** that produces output in PCL5 format suitable for an HP LaserJet 4 printer
grops	Translates the output of GNU **troff** to PostScript
grotty	Translates the output of GNU **troff** into a form suitable for typewriter-like devices
gtbl	A link to **tbl**
hpftodit	Creates a font file for use with **groff -Tlj4** from an HP-tagged font metric file
indxbib	Creates an inverted index for the bibliographic databases with a specified file for use with **refer**, **lookbib**, and **lkbib**
lkbib	Searches bibliographic databases for references that contain specified keys and reports any references found
lookbib	Prints a prompt on the standard error (unless the standard input is not a terminal), reads a line containing a set of keywords from the standard input, searches the bibliographic databases in a specified file for references containing those keywords, prints any references found on the standard output, and repeats this process until the end of input
mmroff	A simple preprocessor for **groff**
neqn	Formats equations for American Standard Code for Information Interchange (ASCII) output
nroff	A script that emulates the **nroff** command using **groff**
pdfroff	Creates pdf documents using groff
pfbtops	Translates a PostScript font in .pfb format to ASCII
pic	Compiles descriptions of pictures embedded within troff or TeX input files into commands understood by TeX or **troff**
pic2graph	Converts a PIC diagram into a cropped image

post-grohtml	Translates the output of GNU **troff** to HTML
preconv	Converts encoding of input files to something GNU **troff** understands
pre-grohtml	Translates the output of GNU **troff** to HTML
refer	Copies the contents of a file to the standard output, except that lines between *.[* and *.]* are interpreted as citations, and lines between *.R1* and *.R2* are interpreted as commands for how citations are to be processed
roff2dvi	Transforms roff files into DVI format
roff2html	Transforms roff files into HTML format
roff2pdf	Transforms roff files into PDFs
roff2ps	Transforms roff files into ps files
roff2text	Transforms roff files into text files
roff2x	Transforms roff files into other formats
soelim	Reads files and replaces lines of the form *.so file* by the contents of the mentioned *file*
tbl	Compiles descriptions of tables embedded within troff input files into commands that are understood by **troff**
tfmtodit	Creates a font file for use with **groff -Tdvi**
troff	Is highly compatible with Unix **troff**; it should usually be invoked using the **groff** command, which will also run preprocessors and post-processors in the appropriate order and with the appropriate options

6.46. Xz-5.0.4

The Xz package contains programs for compressing and decompressing files. It provides capabilities for the lzma and the newer xz compression formats. Compressing text files with **xz** yields a better compression percentage than with the traditional **gzip** or **bzip2** commands.

Приблизительное время сборки:	0.3 SBU
Требует свободного места на диске:	18 MB

6.46.1. Installation of Xz

Prepare Xz for compilation with:

```
./configure --prefix=/usr --libdir=/lib --docdir=/usr/share/doc/xz-5.0.4
```

Compile the package:

```
make
```

To test the results, issue:

```
make check
```

Install the package:

```
make pkgconfigdir=/usr/lib/pkgconfig install
```

6.46.2. Contents of Xz

Installed programs:	lzcat (link to xz), lzcmp (link to xzdiff), lzdiff (link to xzdiff), lzegrep (link to xzgrep), lzfgrep (link to xzgrep), lzgrep (link to xzgrep), lzless (link to xzless), lzma (link to xz), lzmadec, lzmainfo, lzmore (link to xzmore), unlzma (link to xz), unxz, (link to xz), xz, xzcat (link to xz), xzcmp (link to xzdiff), xzdec, xzdiff, xzegrep (link to xzgrep), xzfgrep (link to xzgrep), xzgrep, xzless, xzmore
Installed libraries:	liblzma.{a,so}
Installed directories:	/usr/include/lzma and /usr/share/doc/xz-5.0.4

Краткое описание

lzcat	Decompresses to standard output
lzcmp	Runs **cmp** on LZMA compressed files
lzdiff	Runs **diff** on LZMA compressed files
lzegrep	Runs **egrep** on LZMA compressed files files
lzfgrep	Runs **fgrep** on LZMA compressed files
lzgrep	Runs **grep** on LZMA compressed files
lzless	Runs **less** on LZMA compressed files
lzma	Compresses or decompresses files using the LZMA format

lzmadec   A small and fast decoder for LZMA compressed files

lzmainfo Shows information stored in the LZMA compressed file header

lzmore   Runs **more** on LZMA compressed files

unlzma   Decompresses files using the LZMA format

unxz   Decompresses files using the XZ format

xz   Compresses or decompresses files using the XZ format

xzcat   Decompresses to standard output

xzcmp   Runs **cmp** on XZ compressed files

xzdec   A small and fast decoder for XZ compressed files

xzdiff   Runs **diff** on XZ compressed files

xzegrep   Runs **egrep** on XZ compressed files files

xzfgrep   Runs **fgrep** on XZ compressed files

xzgrep   Runs **grep** on XZ compressed files

xzless   Runs **less** on XZ compressed files

xzmore   Runs **more** on XZ compressed files

liblzma*   The library implementing lossless, block-sorting data compression, using the Lempel-Ziv-Markov chain algorithm

6.47. GRUB-2.00

The GRUB package contains the GRand Unified Bootloader.

Приблизительное время сборки:	0.7 SBU
Требует свободного места на диске:	112 MB

6.47.1. Installation of GRUB

Fix an incompatibility between this package and Glibc-2.17:

```
sed -i -e '/gets is a/d' grub-core/gnulib/stdio.in.h
```

Prepare GRUB for compilation:

```
./configure --prefix=/usr          \
            --sysconfdir=/etc       \
            --disable-grub-emu-usb \
            --disable-efiemu        \
            --disable-werror
```

The --disable-werror option allows the build to complete with warnings introduced by more recent flex versions. The other --disable switches minimize what is built by disabling features and testing programs not needed for LFS.

Скомпилируем пакет:

```
make
```

This package does not come with a test suite.

Установим пакет:

```
make install
```

Using GRUB to make your LFS system bootable will be discussed in Раздел 8.4, «Using GRUB to Set Up the Boot Process».

6.47.2. Содержимое GRUB

Установленные программы:	grub-bios-setup, grub-editenv, grub-fstest, grub-install, grub-kbdcomp, grub-menulst2cfg, grub-mkconfig, grub-mkimage, grub-mklayout, grub-mknetdir, grub-mkpasswd-pbkdf2, grub-mkrelpath, grub-mkrescue, grub-mkstandalone, grub-ofpathname, grub-probe, grub-reboot, grub-script-check, grub-set-default, grub-sparc64-setup
Установленные каталоги:	/usr/lib/grub, /etc/grub.d, /usr/share/grub, /boot/grub

Краткое описание

grub-bios-setup	Is a helper program for grub-install
grub-editenv	A tool to edit the environment block

grub-fstest	Tool to debug the filesystem driver
grub-install	Install GRUB on your drive
grub-kbdcomp	Script that converts an xkb layout into one recognized by GRUB
grub-menulst2cfg	Converts a GRUB Legacy `menu.lst` into a `grub.cfg` for use with GRUB 2
grub-mkconfig	Generate a grub config file
grub-mkimage	Make a bootable image of GRUB
grub-mklayout	Generates a GRUB keyboard layout file
grub-mknetdir	Prepares a GRUB netboot directory
grub-mkpasswd-pbkdf2	Generates an encrypted PBKDF2 password for use in the boot menu
grub-mkrelpath	Makes a system pathname relative to its root
grub-mkrescue	Make a bootable image of GRUB suitable for a floppy disk or CDROM/DVD
grub-mkstandalone	Generates a standalone image
grub-ofpathname	Is a helper program that prints the path of a GRUB device
grub-probe	Probe device information for a given path or device
grub-reboot	Sets the default boot entry for GRUB for the next boot only
grub-script-check	Checks GRUB configuration script for syntax errors
grub-set-default	Sets the default boot entry for GRUB
grub-sparc64-setup	Is a helper program for grub-setup

6.48. Less-451

The Less package contains a text file viewer.

Приблизительное время сборки:	менее 0.1 SBU
Требует свободного места на диске:	3.8 MB

6.48.1. Установка Less

Подготовим Less к компиляции:

```
./configure --prefix=/usr --sysconfdir=/etc
```

Значение параметров configure:

--sysconfdir=/etc
    This option tells the programs created by the package to look in /etc for the configuration files.

Скомпилируем пакет:

```
make
```

This package does not come with a test suite.

Установим пакет:

```
make install
```

6.48.2. Содержимое Less

Установленные программы:	less, lessecho, and lesskey

Краткое описание

less   A file viewer or pager; it displays the contents of the given file, letting the user scroll, find strings, and jump to marks

lessecho   Needed to expand meta-characters, such as * and *?*, in filenames on Unix systems

lesskey   Used to specify the key bindings for **less**

6.49. Gzip-1.5

The Gzip package contains programs for compressing and decompressing files.

Приблизительное время сборки:	0.2 SBU
Требует свободного места на диске:	19.7 MB

6.49.1. Установка Gzip

Подготовим Gzip к компиляции:

```
./configure --prefix=/usr --bindir=/bin
```

Скомпилируем пакет:

```
make
```

Чтобы запустить тестирование пакета, выполните:

```
make check
```

Установим пакет:

```
make install
```

Move some programs that do not need to be on the root filesystem:

```
mv -v /bin/{gzexe,uncompress,zcmp,zdiff,zegrep} /usr/bin
mv -v /bin/{zfgrep,zforce,zgrep,zless,zmore,znew} /usr/bin
```

6.49.2. Содержимое Gzip

Установленные программы:	gunzip, gzexe, gzip, uncompress, zcat, zcmp, zdiff, zegrep, zfgrep, zforce, zgrep, zless, zmore, and znew

Краткое описание

gunzip	Decompresses gzipped files
gzexe	Creates self-decompressing executable files
gzip	Compresses the given files using Lempel-Ziv (LZ77) coding
uncompress	Decompresses compressed files
zcat	Decompresses the given gzipped files to standard output
zcmp	Runs **cmp** on gzipped files
zdiff	Runs **diff** on gzipped files
zegrep	Runs **egrep** on gzipped files
zfgrep	Runs **fgrep** on gzipped files
zforce	Forces a `.gz` extension on all given files that are gzipped files, so that **gzip** will not compress them again; this can be useful when file names were truncated during a file transfer
zgrep	Runs **grep** on gzipped files

zless   Runs **less** on gzipped files

zmore   Runs **more** on gzipped files

znew   Re-compresses files from **compress** format to **gzip** format—`.Z` to `.gz`

6.50. IPRoute2-3.8.0

The IPRoute2 package contains programs for basic and advanced IPV4-based networking.

Приблизительное время сборки:	0.1 SBU
Требует свободного места на диске:	7.3 MB

6.50.1. Установка IPRoute2

The **arpd** binary included in this package is dependent on Berkeley DB. Because **arpd** is not a very common requirement on a base Linux system, remove the dependency on Berkeley DB by applying the commands below. If the **arpd** binary is needed, instructions for compiling Berkeley DB can be found in the BLFS Book at *http://www.linuxfromscratch. org/blfs/view/svn/server/databases.html#db*.

```
sed -i '/^TARGETS/s@arpd@@g' misc/Makefile
sed -i /ARPD/d Makefile
sed -i 's/arpd.8//' man/man8/Makefile
```

Remove a compiler flag that causes the compilation to fail:

```
sed -i 's/-Werror//' Makefile
```

Скомпилируем пакет:

```
make DESTDIR=
```

Значение параметра make:

DESTDIR=
    This ensures that the IPRoute2 binaries will install into все же запустить тестирование correct directory. By default, *DESTDIR* is set to /usr.

This package comes with a test suite, but due to assumptions it makes, it is not possible to reliably run these tests from within the chroot environment. If you wish to run these tests after booting into your new LFS system, ensure you select /proc/config. gz CONFIG_IKCONFIG_PROC ("General setup" -> "Enable access to .config through / proc/config.gz") support into your kernel then run 'make alltests' from the testsuite/ subdirectory.

Установим пакет:

```
make DESTDIR=                  \
    MANDIR=/usr/share/man \
    DOCDIR=/usr/share/doc/iproute2-3.8.0 install
```

6.50.2. Содержимое IPRoute2

Установленные программы:	bridge, ctstat (link to lnstat), genl, ifcfg, ifstat, ip, lnstat, nstat, routef, routel, rtacct, rtmon, rtpr, rtstat (link to lnstat), ss, and tc
Установленные каталоги:	/etc/iproute2, /lib/tc, /usr/share/doc/iproute2-3.8.0, /usr/lib/tc

Краткое описание

bridge   Configures network bridges

ctstat   Connection status utility

genl

ifcfg   A shell script wrapper for the **ip** command. Note that it requires the **arping** and **rdisk** programs from the iputils package found at *http://www.skbuff.net/iputils/*.

ifstat   Shows the interface statistics, including the amount of transmitted and received packets by interface

ip   The main executable. It has several different functions:

    ip link *<device>* allows users to look at the state of devices and to make changes

    ip addr allows users to look at addresses and все же запустить тестированиеir properties, add new addresses, and delete old ones

    ip neighbor allows users to look at neighbor bindings and their properties, add new neighbor entries, and delete old ones

    ip rule allows users to look at the routing policies and change them

    ip route allows users to look at the routing table and change routing table rules

    ip tunnel allows users to look at the IP tunnels and their properties, and change them

    ip maddr allows users to look at the multicast addresses and their properties, and change them

    ip mroute allows users to set, change, or delete the multicast routing

    ip monitor allows users to continuously monitor the state of devices, addresses and routes

lnstat   Provides Linux network statistics. It is a generalized and more feature-complete replacement for the old **rtstat** program

nstat   Shows network statistics

routef   A component of **ip route**. This is for flushing все же запустить тестирование routing tables

routel   A component of **ip route**. This is for listing все же запустить тестирование routing tables

rtacct   Displays the contents of /proc/net/rt_acct

rtmon   Route monitoring utility

rtpr   Converts the output of **ip -o** back into a readable form

rtstat   Route status utility

ss   Similar to the **netstat** command; shows active connections

tc   Traffic Controlling Executable; this is for Quality Of Service (QOS) and Class Of Service (COS) implementations

    tc qdisc allows users to setup the queueing discipline

    tc class allows users to setup classes based on the queuing discipline scheduling

    tc estimator allows users to estimate the network flow into a network

    tc filter allows users to setup the QOS/COS packet filtering

    tc policy allows users to setup the QOS/COS policies

6.51. Kbd-1.15.5

The Kbd package contains key-table files, console fonts, and keyboard utilities.

Приблизительное время сборки:	0.1 SBU
Требует свободного места на диске:	20 MB

6.51.1. Установка Kbd

The behaviour of the Backspace and Delete keys is not consistent across the keymaps in the Kbd package. The following patch fixes this issue for i386 keymaps:

```
patch -Np1 -i ../kbd-1.15.5-backspace-1.patch
```

After patching, the Backspace key generates the character with code 127, and the Delete key generates a well-known escape sequence.

Fix a bug that causes some keymaps not to be loaded correctly:

```
sed -i -e '326 s/if/while/' src/loadkeys.analyze.l
```

Remove the redundant **resizecons** program (it requires the defunct svgalib to provide the video mode files - for normal use **setfont** sizes the console appropriately) together with its manpage.

```
sed -i 's/\(RESIZECONS_PROGS=\)yes/\1no/g' configure
sed -i 's/resizecons.8 //' man/man8/Makefile.in
```

Prepare Kbd for compilation:

```
./configure --prefix=/usr --datadir=/lib/kbd \
  --disable-vlock
```

The meaning of the configure options:

--datadir=/lib/kbd
This option puts keyboard layout data in a directory that will always be on the root partition instead of the default /usr/share/kbd.

--disable-vlock
This option prevents the vlock utility from being built, as it requires the PAM library, which isn't available in the chroot environment.

Скомпилируем пакет:

```
make
```

This package does not come with a test suite.

Установим пакет:

```
make install
```

> ### Замечание
>
> For some languages (e.g., Belarusian) the Kbd package doesn't provide a useful keymap where the stock «by» keymap assumes все же запустить тестирование ISO-8859-5 encoding, and the CP1251 keymap is normally used. Users of such languages have to download working keymaps separately.

Some of the scripts in the LFS-Bootscripts package depend on **kbd_mode**, **loadkeys**, **openvt**, and **setfont**. As /usr may not be available during the early stages of booting, those binaries need to be on the root partition:

```
mv -v /usr/bin/{kbd_mode,loadkeys,openvt,setfont} /bin
```

If desired, install the documentation:

```
mkdir -v /usr/share/doc/kbd-1.15.5
cp -R -v doc/* \
        /usr/share/doc/kbd-1.15.5
```

6.51.2. Содержимое Kbd

Установленные программы:	chvt, deallocvt, dumpkeys, fgconsole, getkeycodes, kbdinfo, kbd_mode, kbdrate, loadkeys, loadunimap, mapscrn, openvt, psfaddtable (link to psfxtable), psfgettable (link to psfxtable), psfstriptable (link to psfxtable), psfxtable, setfont, setkeycodes, setleds, setmetamode, showconsolefont, showkey, unicode_start, and unicode_stop
Установленный каталог:	/lib/kbd

Краткое описание

chvt	Changes the foreground virtual terminal
deallocvt	Deallocates unused virtual terminals
dumpkeys	Dumps the keyboard translation tables
fgconsole	Prints the number of the active virtual terminal
getkeycodes	Prints the kernel scancode-to-keycode mapping table
kbdinfo	Obtains information about the status of a console
kbd_mode	Reports or sets the keyboard mode
kbdrate	Sets the keyboard repeat and delay rates
loadkeys	Loads the keyboard translation tables
loadunimap	Loads the kernel unicode-to-font mapping table
mapscrn	An obsolete program that used to load a user-defined output character mapping table into the console driver; this is now done by **setfont**
openvt	Starts a program on a new virtual terminal (VT)
psfaddtable	A link to **psfxtable**
psfgettable	A link to **psfxtable**
psfstriptable	A link to **psfxtable**

psfxtable	Handle Unicode character tables for console fonts
setfont	Changes the Enhanced Graphic Adapter (EGA) and Video Graphics Array (VGA) fonts on the console
setkeycodes	Loads kernel scancode-to-keycode mapping table entries; this is useful if there are unusual keys on the keyboard
setleds	Sets the keyboard flags and Light Emitting Diodes (LEDs)
setmetamode	Defines the keyboard meta-key handling
showconsolefont	Shows the current EGA/VGA console screen font
showkey	Reports the scancodes, keycodes, and ASCII codes of the keys pressed on the keyboard
unicode_start	Puts the keyboard and console in UNICODE mode. Don't use this program unless your keymap file is in the UTF-8 encoding. For other encodings, this utility produces incorrect results.
unicode_stop	Reverts keyboard and console from UNICODE mode

6.52. Kmod-12

The Kmod package contains libraries and utilities for loading kernel modules

Приблизительное время сборки:	0.1 SBU
Требует свободного места на диске:	30 MB

6.52.1. Installation of Kmod

Prepare Kmod for compilation:

```
./configure --prefix=/usr         \
            --bindir=/bin         \
            --libdir=/lib         \
            --sysconfdir=/etc     \
            --disable-manpages    \
            --with-xz             \
            --with-zlib
```

The meaning of the configure options:

--with-*
These options enable Kmod to handle compressed kernel modules.

--disable-manpages
This option prevents the man pages from being built, as they rely on libxslt, which isn't available in the chroot environment.

Compile the package:

```
make
```

To test the results, issue:

```
make check
```

Install the package, and create symlinks for compatibility with Module-Init-Tools, the package that previously handled Linux kernel modules:

```
make pkgconfigdir=/usr/lib/pkgconfig install

for target in depmod insmod modinfo modprobe rmmod; do
  ln -sv ../bin/kmod /sbin/$target
done

ln -sv kmod /bin/lsmod
```

6.52.2. Contents of Kmod

Installed programs:	depmod (link to kmod), insmod (link to kmod), kmod, kmod-nolib, lsmod (link to kmod), modinfo (link to kmod), modprobe (link to kmod), and rmmod (link to kmod)
Installed libraries:	/lib/kmod.so

Short Descriptions

depmod	Creates a dependency file based on the symbols it finds in the existing set of modules; this dependency file is used by **modprobe** to automatically load the required modules
insmod	Installs a loadable module in the running kernel
kmod	Loads and unloads kernel modules
libkmod	This library is used by other programs to load and unload kernel modules
lsmod	Lists currently loaded modules
modinfo	Examines an object file associated with a kernel module and displays any information that it can glean
modprobe	Uses a dependency file, created by **depmod**, to automatically load relevant modules
rmmod	Unloads modules from the running kernel

6.53. Libpipeline-1.2.2

The Libpipeline package contains a library for manipulating pipelines of subprocesses in a flexible and convenient way.

Приблизительное время сборки:	0.2 SBU
Требует свободного места на диске:	7.4 MB

6.53.1. Installation of Libpipeline

Prepare Libpipeline for compilation:

```
PKG_CONFIG_PATH=/tools/lib/pkgconfig ./configure --prefix=/usr
```

The meaning of the configure options:

PKG_CONFIG_PATH
Use pkg-config to obtain the location of the test library metadata built in Раздел 5.13, «Check-0.9.9».

Скомпилируем пакет:

```
make
```

Чтобы запустить тестирование пакета, выполните:

```
make check
```

Установим пакет:

```
make install
```

6.53.2. Содержимое Libpipeline

Установленные библиотеки:	libpipeline.so

Краткое описание

libpipeline   This library is used to safely construct pipelines between subprocesses

6.54. Make-3.82

The Make package contains a program for compiling packages.

Приблизительное время сборки:	0.4 SBU
Требует свободного места на диске:	11.3 MB

6.54.1. Installation of Make

First apply some upstream patches:

```
patch -Np1 -i ../make-3.82-upstream_fixes-3.patch
```

Prepare Make for compilation:

```
./configure --prefix=/usr
```

Compile the package:

```
make
```

To test the results, issue:

```
make check
```

Install the package:

```
make install
```

6.54.2. Содержимое Make

Установленная программа:	make

Краткое описание

make Automatically determines which pieces of a package need to be (re)compiled and then issues the relevant commands

6.55. Man-DB-2.6.3

The Man-DB package contains programs for finding and viewing man pages.

Приблизительное время сборки:	0.5 SBU
Требует свободного места на диске:	27 MB

6.55.1. Установка Man-DB

Подготовим Man-DB к компиляции:

```
./configure --prefix=/usr                      \
            --libexecdir=/usr/lib              \
            --docdir=/usr/share/doc/man-db-2.6.3 \
            --sysconfdir=/etc                 \
            --disable-setuid                  \
            --with-browser=/usr/bin/lynx      \
            --with-vgrind=/usr/bin/vgrind     \
            --with-grap=/usr/bin/grap
```

Значение параметров configure:

--disable-setuid

This disables making the **man** program setuid to user man.

--with-...

These three parameters are used to set some default programs. **lynx** is a text-based web browser (see BLFS for installation instructions), **vgrind** converts program sources to Groff input, and **grap** is useful for typesetting graphs in Groff documents. The **vgrind** and **grap** programs are not normally needed for viewing manual pages. They are not part of LFS or BLFS, but you should be able to install them yourself after finishing LFS if you wish to do so.

Скомпилируем пакет:

```
make
```

Чтобы запустить тестирование пакета, выполните:

```
make check
```

Установим пакет:

```
make install
```

6.55.2. Non-English Manual Pages in LFS

The following table shows the character set that Man-DB assumes manual pages installed under /usr/share/man/<ll> will be encoded with. In addition to this, Man-DB correctly determines if manual pages installed in that directory are UTF-8 encoded.

Таблица 6.1. Expected character encoding of legacy 8-bit manual pages

Language (code)	Encoding	Language (code)	Encoding
Danish (da)	UTF-8	Croatian (hr)	ISO-8859-2
German (de)	UTF-8	Hungarian (hu)	ISO-8859-2
English (en)	UTF-8	Japanese (ja)	EUC-JP
Spanish (es)	UTF-8	Korean (ko)	EUC-KR
Estonian (et)	UTF-8	Lithuanian (lt)	UTF-83
Finnish (fi)	UTF-8	Latvian (lv)	UTF-83
French (fr)	UTF-8	Macedonian (mk)	ISO-8859-5
Irish (ga)	UTF-8	Polish (pl)	ISO-8859-2
Galician (gl)	UTF-8	Romanian (ro)	ISO-8859-2
Indonesian (id)	UTF-8	Russian (ru)	KOI8-R
Icelandic (is)	UTF-8	Slovak (sk)	ISO-8859-2
Italian (it)	UTF-8	Slovenian (sl)	ISO-8859-2
Norwegian Bokmal (nb)	UTF-8	Serbian Latin (sr@latin)	ISO-8859-2
Dutch (nl)	UTF-8	Serbian (sr)	ISO-8859-5
Norwegian Nynorsk (nn)	UTF-8	Turkish (tr)	ISO-8859-9
Norwegian (no)	UTF-8	Ukrainian (uk)	KOI8-U
Portuguese (pt)	UTF-8	Vietnamese (vi)	TCVN5712-1
Swedish (sv)	UTF-8	Simplified Chinese (zh_CN)	GBK
Belarusian (be)	CP1251	Simplified Chinese, Singapore (zh_SG)	GBK
Bulgarian (bg)	CP1251	Traditional Chinese, Hong Kong (zh_HK)	BIG5HKSCS
Czech (cs)	ISO-8859-2	Traditional Chinese (zh_TW)	BIG5
Greek (el)	ISO-8859-7		

> **Замечание**
>
> Manual pages in languages not in the list are not supported.

6.55.3. Contents of Man-DB

Installed programs:	accessdb, apropos (link to whatis), catman, lexgrog, man, mandb, manpath, whatis, and zsoelim
Installed libraries:	libman.so, libmandb.so
Installed directories:	/usr/lib/man-db, /usr/share/doc/man-db-2.6.3

Краткое описание

accessdb   Dumps the **whatis** database contents in human-readable form

apropos   Searches the **whatis** database and displays все же запустить тестирование short descriptions of system commands that contain a given string

catman   Creates or updates the pre-formatted manual pages

lexgrog   Displays one-line summary information about a given manual page

man   Formats and displays the requested manual page

mandb   Creates or updates the **whatis** database

manpath   Displays the contents of $MANPATH or (if $MANPATH is not set) a suitable search path based on the settings in man.conf and the user's environment

whatis   Searches the **whatis** database and displays все же запустить тестирование short descriptions of system commands that contain the given keyword as a separate word

zsoelim   Reads files and replaces lines of the form *.so file* by the contents of the mentioned *file*

`libman`   Contains run-time support for **man**

`libmandb` Contains run-time support for **man**

6.56. Patch-2.7.1

The Patch package contains a program for modifying or creating files by applying a «patch» file typically created by the **diff** program.

| **Приблизительное время сборки:** | менее 0.1 SBU |
| **Требует свободного места на диске:** | 3.4 MB |

6.56.1. Installation of Patch

Prepare Patch for compilation:

```
./configure --prefix=/usr
```

Compile the package:

```
make
```

To test the results, issue:

```
make check
```

Install the package:

```
make install
```

6.56.2. Contents of Patch

Installed program: patch

Краткое описание

patch   Modifies files according to a patch file. A patch file is normally a difference listing created with the **diff** program. By applying these differences to the original files, **patch** creates the patched versions.

6.57. Sysklogd-1.5

The Sysklogd package contains programs for logging system messages, such as those given by the kernel when unusual things happen.

Приблизительное время сборки:	менее 0.1 SBU
Требует свободного места на диске:	0.6 MB

6.57.1. Установка Sysklogd

Скомпилируем пакет:

```
make
```

This package does not come with a test suite.

Установим пакет:

```
make BINDIR=/sbin install
```

6.57.2. Configuring Sysklogd

Create a new /etc/syslog.conf file by running the following:

```
cat > /etc/syslog.conf << "EOF"
# Begin /etc/syslog.conf

auth,authpriv.* -/var/log/auth.log
*.*;auth,authpriv.none -/var/log/sys.log
daemon.* -/var/log/daemon.log
kern.* -/var/log/kern.log
mail.* -/var/log/mail.log
user.* -/var/log/user.log
*.emerg *

# End /etc/syslog.conf
EOF
```

6.57.3. Содержимое Sysklogd

Установленные программы:	klogd and syslogd

Краткое описание

klogd	A system daemon for intercepting and logging kernel messages
syslogd	Logs the messages that system programs offer for logging. Every logged message contains at least a date stamp and a hostname, and normally the program's name too, but that depends on how trusting the logging daemon is told to be

6.58. Sysvinit-2.88dsf

The Sysvinit package contains programs for controlling the startup, running, and shutdown of the system.

Приблизительное время сборки:	менее 0.1 SBU
Требует свободного места на диске:	1.4 MB

6.58.1. Установка Sysvinit

When run-levels are changed (for example, when halting the system), **init** sends termination signals to those processes that **init** itself started and that should not be running in the new run-level. While doing this, **init** outputs messages like «Sending processes все же запустить тестирование TERM signal» which seem to imply that it is sending these signals to all currently running processes. To avoid this misinterpretation, modify the source so that these messages read like «Sending processes configured via /etc/inittab the TERM signal» instead:

```
sed -i 's@Sending processes@& configured via /etc/inittab@g' src/init.c
```

Maintained versions of the **wall**, **mountpoint**, and **utmpdump** programs were installed earlier by Util-linux. Suppress the installation of Sysvinit's versions of these programs and their man pages:

```
sed -i -e '/utmpdump/d' \
       -e '/mountpoint/d' src/Makefile
```

Скомпилируем пакет:

```
make -C src
```

This package does not come with a test suite.

Установовим пакет:

```
make -C src install
```

6.58.2. Содержимое Sysvinit

Установленные программы:	bootlogd, fstab-decode, halt, init, killall5, last, lastb (link to last), mesg, pidof (link to killall5), poweroff (link to halt), reboot (link to halt), runlevel, shutdown, sulogin, and telinit (link to init)

Краткое описание

bootlogd	Logs boot messages to a log file
fstab-decode	Run a command with fstab-encoded arguments
halt	Normally invokes **shutdown** with the $-h$ option, except when already in run-level 0, все же запустить тестированиен it tells the kernel to halt the system; it notes in the file /var/log/wtmp that the system is being brought down

init   The first process to be started when the kernel has initialized все же запустить тестирование hardware which takes over the boot process and starts all the proceses it is instructed to

killall5   Sends a signal to all processes, except the processes in its own session so it will not kill the shell running the script that called it

last   Shows which users last logged in (and out), searching back through the /var/log/wtmp file; it also shows system boots, shutdowns, and run-level changes

lastb   Shows the failed login attempts, as logged in /var/log/btmp

mesg   Controls whether other users can send messages to the current user's terminal

pidof   Reports the PIDs of the given programs

poweroff   Tells the kernel to halt the system and switch off the computer (see **halt**)

reboot   Tells the kernel to reboot the system (see **halt**)

runlevel   Reports the previous and the current run-level, as noted in the last run-level record in /var/run/utmp

shutdown   Brings the system down in a secure way, signaling all processes and notifying all logged-in users

sulogin   Allows root to log in; it is normally invoked by **init** when the system goes into single user mode

telinit   Tells **init** which run-level to change to

6.59. Tar-1.26

The Tar package contains an archiving program.

Приблизительное время сборки:	2.4 SBU
Требует свободного места на диске:	34 MB

6.59.1. Installation of Tar

Fix an incompatibility between this package and Glibc-2.17:

```
sed -i -e '/gets is a/d' gnu/stdio.in.h
```

Prepare Tar for compilation:

```
FORCE_UNSAFE_CONFIGURE=1  \
./configure --prefix=/usr \
            --bindir=/bin \
            --libexecdir=/usr/sbin
```

The meaning of the configure options:

FORCE_UNSAFE_CONFIGURE=1
> This forces the test for mknod to be run as root. It is generally considered dangerous to run this test as the root user, but as it is being run on an only partially built system, overriding it is OK.

Compile the package:

```
make
```

To test the results (about 1 SBU), issue:

```
make check
```

Установим пакет:

```
make install
make -C doc install-html docdir=/usr/share/doc/tar-1.26
```

6.59.2. Contents of Tar

Installed programs:	rmt and tar
Installed directory:	/usr/share/doc/tar-1.26

Краткое описание

rmt   Remotely manipulates a magnetic tape drive through an interprocess communication connection

tar   Creates, extracts files from, and lists the contents of archives, also known as tarballs

6.60. Texinfo-5.0

The Texinfo package contains programs for reading, writing, and converting info pages.

Приблизительное время сборки:	0.6 SBU
Требует свободного места на диске:	101 MB

6.60.1. Установка Texinfo

Подготовим Texinfo к компиляции:

```
./configure --prefix=/usr
```

Скомпилируем пакет:

```
make
```

Чтобы запустить тестирование пакета, выполните:

```
make check
```

Установим пакет:

```
make install
```

Optionally, install the components belonging in a TeX installation:

```
make TEXMF=/usr/share/texmf install-tex
```

The meaning of the make parameter:

TEXMF=/usr/share/texmf
   The TEXMF makefile variable holds the location of the root of the TeX tree if, for example, a TeX package will be installed later.

The Info documentation system uses a plain text file to hold its list of menu entries. The file is located at /usr/share/info/dir. Unfortunately, due to occasional problems in the Makefiles of various packages, it can sometimes get out of sync with the info pages installed on the system. If the /usr/share/info/dir file ever needs to be recreated, the following optional commands will accomplish the task:

```
cd /usr/share/info
rm -v dir
for f in *
do install-info $f dir 2>/dev/null
done
```

6.60.2. Содержимое Texinfo

Установленные программы:	info, infokey, install-info, makeinfo, pdftexi2dvi, pod2texi, texi2any, texi2dvi, texi2pdf, and texindex
Установленный каталог:	/usr/share/texinfo

Краткое описание

info	Used to read info pages which are similar to man pages, but often go much deeper than just explaining all the available command line options. For example, compare **man bison** and **info bison**.
infokey	Compiles a source file containing Info customizations into a binary format
install-info	Used to install info pages; it updates entries in the **info** index file
makeinfo	Translates the given Texinfo source documents into info pages, plain text, or HTML
pdftexi2dvi	Used to format the given Texinfo document into a Portable Document Format (PDF) file
pod2texi	Converts Pod to Texinfo format
texi2any	Translate Texinfo source documentation to various other formats
texi2dvi	Used to format the given Texinfo document into a device-independent file that can be printed
texi2pdf	Used to format the given Texinfo document into a Portable Document Format (PDF) file
texindex	Used to sort Texinfo index files

6.61. Udev-197 (Extracted from systemd-197)

The Udev package contains programs for dynamic creation of device nodes. The development of udev has been merged with systemd, but most of systemd is incompatible with LFS. Here we build and install just the needed udev files.

Приблизительное время сборки:	0.1 SBU
Требует свободного места на диске:	23 MB

6.61.1. Installation of Udev

> **Замечание**
>
> This package is a little different from other packages. The initial package that is extracted is `systemd-197.tar.xz` even though the application we are installing is udev. After changing to the systemd directory, follow the instructions below.

The udev-lfs tarball contains LFS-specific files used to build Udev. Unpack it into the systemd source directory:

```
tar -xvf ../udev-lfs-197-2.tar.bz2
```

Compile the package:

```
make -f udev-lfs-197-2/Makefile.lfs
```

Install the package:

```
make -f udev-lfs-197-2/Makefile.lfs install
```

> **Предостережение**
>
> There are several places within the systemd source code that have explicit directory paths embedded. For instance, the binary version of the hardware database's path and file name used at run time, `/etc/udev/hwdb.bin`, cannot be changed without explicit changes to the source code.

Now initialize the hardware database:

```
build/udevadm hwdb --update
```

Finally set up the persistent network udev rules. This task will be explained in detail in Раздел 7.2.1, «Creating stable names for network interfaces». Note that the `/sys` and `/proc` filesystems must be mounted in the chroot environment as explained at the beginning of this chapter for the following script to work.

```
bash udev-lfs-197-2/init-net-rules.sh
```

6.61.2. Contents of Udev

Installed programs:	accelerometer, ata_id, cdrom_id, collect, mtd_probe, scsi_id, v4l_id, udevadm, and udevd
Installed libraries:	libudev.so
Installed directories:	/etc/udev, /lib/udev, /lib/firmware, /usr/share/doc/udev

Short Descriptions

ata_id	Provides Udev with a unique string and additional information (uuid, label) for an ATA drive
cdrom_id	Provides Udev with the capabilities of a CD-ROM or DVD-ROM drive
collect	Given an ID for the current uevent and a list of IDs (for all target uevents), registers the current ID and indicates whether all target IDs have been registered
scsi_id	Provides Udev with a unique SCSI identifier based on the data returned from sending a SCSI INQUIRY command to the specified device
udevadm	Generic udev administration tool: controls the udevd daemon, provides info from the Udev database, monitors uevents, waits for uevents to finish, tests Udev configuration, and triggers uevents for a given device
udevd	A daemon that listens for uevents on the netlink socket, creates devices and runs the configured external programs in response to these uevents
libudev	A library interface to udev device information
/etc/ udev	Contains Udev configuration files, device permissions, and rules for device naming

6.62. Vim-7.3

The Vim package contains a powerful text editor.

Приблизительное время сборки:	1.1 SBU
Требует свободного места на диске:	96 MB

> ⓘ **Alternatives to Vim**
>
> If you prefer another editor—such as Emacs, Joe, or Nano—please refer to *http://www.linuxfromscratch.org/blfs/view/svn/postlfs/editors.html* for suggested installation instructions.

6.62.1. Установка Vim

First, change the default location of the `vimrc` configuration file to `/etc`:

```
echo '#define SYS_VIMRC_FILE "/etc/vimrc"' >> src/feature.h
```

Now prepare Vim к компиляции:

```
./configure --prefix=/usr --enable-multibyte
```

Значение параметров configure:

--enable-multibyte
   This switch enables support for editing files in multibyte character encodings. This is needed if using a locale with a multibyte character set. This switch is also helpful to be able to edit text files initially created in Linux distributions like Fedora that use UTF-8 as a default character set.

Скомпилируем пакет:

```
make
```

Чтобы запустить тестирование пакета, выполните:

```
make test
```

However, this test suite outputs a lot of binary data to the screen, which can cause issues with the settings of the current terminal. This can be resolved by redirecting the output to a log file. A successful test will result in the words "ALL DONE" at completion.

Установим пакет:

```
make install
```

Many users are used to using **vi** instead of **vim**. To allow execution of **vim** when users habitually enter **vi**, create a symlink for both the binary and the man page in the provided languages:

```
ln -sv vim /usr/bin/vi
for L in  /usr/share/man/{,*/}man1/vim.1; do
    ln -sv vim.1 $(dirname $L)/vi.1
done
```

By default, Vim's documentation is installed in `/usr/share/vim`. The following symlink allows the documentation to be accessed via `/usr/share/doc/vim-7.3`, making it consistent with the location of documentation for other packages:

```
ln -sv ../vim/vim73/doc /usr/share/doc/vim-7.3
```

If an X Window System is going to be installed on the LFS system, it may be necessary to recompile Vim after installing X. Vim comes with a GUI version of the editor that requires X and some additional libraries to be installed. For more information on this process, refer to the Vim documentation and the Vim installation page in the BLFS book at *http://www.linuxfromscratch.org/blfs/view/svn/postlfs/editors.html#postlfs-editors-vim*.

6.62.2. Configuring Vim

By default, **vim** runs in vi-incompatible mode. This may be new to users who have used other editors in the past. The «nocompatible» setting is included below to highlight the fact that a new behavior is being used. It also reminds those who would change to «compatible» mode that it should be the first setting in the configuration file. This is necessary because it changes other settings, and overrides must come after this setting. Create a default **vim** configuration file by running the following:

```
cat > /etc/vimrc << "EOF"
" Begin /etc/vimrc

set nocompatible
set backspace=2
syntax on
if (&term == "iterm") || (&term == "putty")
  set background=dark
endif

" End /etc/vimrc
EOF
```

The `set nocompatible` setting makes **vim** behave in a more useful way (the default) than все же запустить тестирование vi-compatible manner. Remove the «no» to keep the old **vi** behavior. The `set backspace=2` setting allows backspacing over line breaks, autoindents, and the start of insert. The `syntax on` parameter enables vim's syntax highlighting. Finally, все же запустить тестирование *if* statement with the `set background=dark` setting corrects **vim**'s guess about the background color of some terminal emulators. This gives the highlighting a better color scheme for use on the black background of these programs.

Documentation for other available options can be obtained by running the following command:

```
vim -c ':options'
```

> **Замечание**
>
> By default, Vim only installs spell files for the English language. To install spell files for your preferred language, download the *.spl and optionally, the *.sug files for your language and character encoding from *ftp://ftp.vim.org/pub/vim/runtime/ spell/* and save them to /usr/share/vim/vim73/spell/.
>
> To use these spell files, some configuration in /etc/vimrc is needed, e.g.:
>
> ```
> set spelllang=en,ru
> set spell
> ```
>
> For more information, see the appropriate README file located at the URL above.

6.62.3. Содержимое Vim

Установленные программы:	ex (link to vim), rview (link to vim), rvim (link to vim), vi (link to vim), view (link to vim), vim, vimdiff (link to vim), vimtutor, and xxd
Установленный каталог:	/usr/share/vim

Краткое описание

ex	Starts **vim** in ex mode
rview	Is a restricted version of **view**; no shell commands can be started and **view** cannot be suspended
rvim	Is a restricted version of **vim**; no shell commands can be started and **vim** cannot be suspended
vi	Link to **vim**
view	Starts **vim** in read-only mode
vim	Is the editor
vimdiff	Edits two or three versions of a file with **vim** and show differences
vimtutor	Teaches the basic keys and commands of **vim**
xxd	Creates a hex dump of the given file; it can also do the reverse, so it can be used for binary patching

6.63. About Debugging Symbols

Most programs and libraries are, by default, compiled with debugging symbols included (with **gcc**'s *-g* option). This means that when debugging a program or library that was compiled with debugging information included, the debugger can provide not only memory addresses, but also the names of the routines and variables.

However, the inclusion of these debugging symbols enlarges a program or library significantly. The following is an example of the amount of space these symbols occupy:

- A **bash** binary with debugging symbols: 1200 KB
- A **bash** binary without debugging symbols: 480 KB
- Glibc and GCC files (`/lib` and `/usr/lib`) with debugging symbols: 87 MB
- Glibc and GCC files without debugging symbols: 16 MB

Sizes may vary depending on which compiler and C library were used, but when comparing programs with and without debugging symbols, the difference will usually be a factor between two and five.

Because most users will never use a debugger on their system software, a lot of disk space can be regained by removing these symbols. The next section shows how to strip all debugging symbols from the programs and libraries.

6.64. Stripping Again

If the intended user is not a programmer and does not plan to do any debugging on the system software, the system size can be decreased by about 90 MB by removing the debugging symbols from binaries and libraries. This causes no inconvenience other than not being able to debug the software fully anymore.

Most people who use the command mentioned below do not experience any difficulties. However, it is easy to make a typo and render the new system unusable, so before running the **strip** command, it is a good idea to make a backup of the LFS system in its current state.

Before performing the stripping, take special care to ensure that none of the binaries that are about to be stripped are running. If unsure whether the user entered chroot with the command given in Раздел 6.4, «Entering the Chroot Environment,» first exit from chroot:

```
logout
```

Then reenter it with:

```
chroot $LFS /tools/bin/env -i \
    HOME=/root TERM=$TERM PS1='\u:\w\$ ' \
    PATH=/bin:/usr/bin:/sbin:/usr/sbin \
    /tools/bin/bash --login
```

Now the binaries and libraries can be safely stripped:

```
/tools/bin/find /{,usr/}{bin,lib,sbin} -type f \
  -exec /tools/bin/strip --strip-debug '{}' ';'
```

A large number of files will be reported as having their file format not recognized. These warnings can be safely ignored. These warnings indicate that those files are scripts instead of binaries.

6.65. Cleaning Up

From now on, when reentering the chroot environment after exiting, use the following modified chroot command:

```
chroot "$LFS" /usr/bin/env -i \
    HOME=/root TERM="$TERM" PS1='\u:\w\$ ' \
    PATH=/bin:/usr/bin:/sbin:/usr/sbin \
    /bin/bash --login
```

The reason for this is that the programs in /tools are no longer needed. Since they are no longer needed you can delete the /tools directory if so desired.

> **Замечание**
>
> Removing /tools will also remove the temporary copies of Tcl, Expect, and DejaGNU which were used for running the toolchain tests. If you need these programs later on, все же запустить тестированиеy will need to be recompiled and re-installed. The BLFS book has instructions for this (see *http://www. linuxfromscratch.org/blfs/*).

If the virtual kernel file systems have been unmounted, either manually or through a reboot, ensure that the virtual kernel file systems are mounted when reentering the chroot. This process was explained in Раздел 6.2.2, «Mounting and Populating /dev» and Раздел 6.2.3, «Mounting Virtual Kernel File Systems».

Глава 7. Установка загрузочных скриптов

7.1. Introduction

This chapter discusses configuration files and boot scripts. First, the general configuration files needed to set up networking are presented.

- Раздел 7.2, «General Network Configuration.»
- Раздел 7.3, «Создание файла /etc/hosts.»

Second, issues that affect the proper setup of devices diescussed.

- Раздел 7.4, «Device and Module Handling on an LFS System.»
- Раздел 7.5, «Создание собственных ссылок на устройства.»

The next sections detail how to install and configure the LFS system scripts needed during the boot process. Most of these scripts will work without modification, but a few require additional configuration files because they deal with hardware-dependent information.

System-V style init scripts are employed in this book because they are widely used and relatively simple. For additional options, a hint detailing the BSD style init setup is available at *http://www.linuxfromscratch.org/hints/downloads/files/bsd-init.txt*. Searching the LFS mailing lists for «depinit», «upstart», or «systemd» will also offer additional information.

If using an alternative style of init scripts, skip these sections.

A listing of the boot scripts are found in Приложение D.

- Раздел 7.6, «LFS-Bootscripts-20130123.»
- Раздел 7.7, «How Do These Bootscripts Work?.»
- Раздел 7.8, «Настройка системного имени компьютера.»
- Раздел 7.9, «Configuring the setclock Script.»
- Раздел 7.10, «Настройка консоли Linux.»
- Раздел 7.11, «Настройка скрипта sysklogd.»

Finally, there is a brief introduction to the scripts and configuration files used when the user logs into the system.

- Раздел 7.13, «The Bash Shell Startup Files.»
- Раздел 7.14, «Создание файла /etc/inputrc.»

7.2. General Network Configuration

This section only applies if a network card is to be configured.

If a network card will not be used, there is likely no need to create any configuration files relating to network cards. If that is the case, you will need to remove the `network` symlinks from all run-level directories (`/etc/rc.d/rc*.d`) after the bootscripts are installed in Раздел 7.6, «LFS-Bootscripts-20130123».

7.2.1. Creating stable names for network interfaces

If there is only one network interface in the system to be configured, this section is optional, although it will never be wrong to do it. In many cases (e.g. a laptop with a wireless and a wired interface), accomplishing the configuration in this section is necessary.

With Udev and modular network drivers, the network interface numbering is not persistent across reboots by default, because the drivers are loaded in parallel and, thus, in random order. For example, on a computer having two network cards made by Intel and Realtek, the network card manufactured by Intel may become `eth0` and the Realtek card becomes `eth1`. In some cases, after a reboot the cards get renumbered the other way around. To avoid this, Udev comes with a script and some rules to assign stable names to network cards based on their MAC address.

The rules were pre-generated in the build instructions for udev (systemd) in the last chapter. Inspect the `/etc/udev/rules.d/70-persistent-net.rules` file, to find out which name was assigned to which network device:

```
cat /etc/udev/rules.d/70-persistent-net.rules
```

> **Замечание**
>
> In some cases such as when MAC addresess have been assigned to a network card manually or in a virtual environment such as Xen, the network rules file may not have been generated because addresses are not consistently assigned. In these cases, just continue to the next section.

The file begins with a comment block followed by two lines for each NIC. The first line for each NIC is a commented description showing its hardware IDs (e.g. its PCI vendor and device IDs, if it's a PCI card), along with its driver in parentheses, if the driver can be found. Neither the hardware ID nor the driver is used to determine which name to give an interface; this information is only for reference. The second line is the Udev rule that matches this NIC and actually assigns it a name.

All Udev rules are made up of several keys, separated by commas and optional whitespace. This rule's keys and an explanation of each of them are as follows:

- `SUBSYSTEM=="net"` - This tells Udev to ignore devices that are not network cards.
- `ACTION=="add"` - This tells Udev to ignore this rule for a uevent that isn't an add ("remove" and "change" uevents also happen, but don't need to rename network interfaces).
- `DRIVERS=="?*"` - This exists so that Udev will ignore VLAN or bridge sub-interfaces (because these sub-interfaces do not have drivers). These sub-interfaces are skipped because the name that would be assigned would collide with their parent devices.
- `ATTR{address}` - The value of this key is the NIC's MAC address.
- `ATTR{type}=="1"` - This ensures the rule only matches the primary interface in the case of certain wireless drivers, which create multiple virtual interfaces. The secondary interfaces are skipped for the same reason that VLAN and bridge sub-interfaces are skipped: there would be a name collision otherwise.
- `KERNEL=="eth*"` - This key was added to the Udev rule generator to handle machines that have multiple network interfaces, all with the same MAC address (the PS3 is one such machine). If the independent interfaces have different basenames, this key will allow Udev to tell them apart. This is generally not necessary for most Linux From Scratch users, but does not hurt.
- `NAME` - The value of this key is the name that Udev will assign to this interface.

The value of `NAME` is the important part. Make sure you know which name has been assigned to each of your network cards before proceeding, and be sure to use that `NAME` value when creating your configuration files below.

7.2.2. Создание файлов конфигурации сетевых интерфейсов

Which interfaces are brought up and down by the network script depends on the files in /etc/sysconfig/. This directory should contain a file for each interface to be configured, such as ifconfig.xyz, where «xyz» is meaningful to the administrator such as the device name (e.g. eth0). Inside this file are attributes to this interface, such as its IP address(es), subnet masks, and so forth. It is necessary that the stem of the filename be *ifconfig*.

The following command creates a sample file for the *eth0* device with a static IP address:

```
cd /etc/sysconfig/
cat > ifconfig.eth0 << "EOF"
ONBOOT=yes
IFACE=eth0
SERVICE=ipv4-static
IP=192.168.1.1
GATEWAY=192.168.1.2
PREFIX=24
BROADCAST=192.168.1.255
EOF
```

The values of these variables must be changed in every file to match the proper setup.

If the ONBOOT variable is set to «yes» the network script will bring up the Network Interface Card (NIC) during booting of the system. If set to anything but «yes» the NIC will be ignored by the network script and not be automatically brought up. The interface can be manually started or stopped with the **ifup** and **ifdown** commands.

The IFACE variable defines the interface name, for example, eth0. It is required for all network device configuration files.

The SERVICE variable defines the method used for obtaining the IP address. The LFS-Bootscripts package has a modular IP assignment format, and creating additional files in the /lib/services/ directory allows other IP assignment methods. This is commonly used for Dynamic Host Configuration Protocol (DHCP), which is addressed in the BLFS book.

The GATEWAY variable should contain the default gateway IP address, if one is present. If not, then comment out the variable entirely.

The PREFIX variable contains the number of bits used in the subnet. Each octet in an IP address is 8 bits. If the subnet's netmask is 255.255.255.0, then it is using the first three octets (24 bits) to specify the network number. If the netmask is 255.255.255.240, it would be using the first 28 bits. Prefixes longer than 24 bits are commonly used by DSL and cable-based Internet Service Providers (ISPs). In this example (PREFIX=24), the netmask is 255.255.255.0. Adjust the PREFIX variable according to your specific subnet.i If omitted, the PREFIX defaults to 24.

For more information see the **ifup** man page.

7.2.3. Создание файла /etc/resolv.conf

Если система будет подключена к сети Интернет, ей понадобится информация о DNS (Domain Name Service, службе доменных имен) для преобразования имен доменов Интернета в IP-адреса и наоборот. Лучшим способом предоставить ей эту информацию будет указать адреса DNS-серверов, которые Вам выдал провайдер или администратор сети, в файле /etc/resolv.conf. Создадим этот файл командой:

```
cat > /etc/resolv.conf << "EOF"
# Начало /etc/resolv.conf

domain <### ###### ######>
nameserver <IP-##### ########## ####### ####>
nameserver <IP-##### ########## ####### ####>

# Конец /etc/resolv.conf
EOF
```

Строка domain может быть опущена или заменена на search. Обратитесь к странице справки по resolv.conf за более подробной информацией.

Замените *<IP-адрес сервера имен>* IP-адресом самого подходящего на Ваш взгляд DNS-сервера. Зачастую стоит указать более одного сервера (вторичные сервера требуются для обеспечения надежности). Если Вы хотите указать только один DNS-сервер, удалите вторую строку *nameserver* из файла. IP-адрес может также принадлежать роутеру Вашей локальной сети.

> **Замечание**
>
> Адреса Google Public IPv4 DNS 8.8.8.8 и 8.8.4.4.

7.3. Создание файла /etc/hosts

Если Вы собираетесь настраивать сетевую карту, Вам необходимо решить, какие IP-адрес, полное доменное имя (FQDN) и возможные псевдонимы для него включить в файл /etc/hosts. Синтаксис файла такой:

```
IP_адрес myhost.example.org псевдонимы
```

Если компьютер не будет видим в Интернете (например, вдруг Вы имеете зарегистрированный домен и доступный выделенный блок IP-адресов—у большинства пользователей этого нет), убедитесь, что IP-адрес находится в диапазоне, выделенном для частных сетей. Верными диапазонами являются:

```
Частная сеть Диапазон адресов      Префикс
10.0.0.1 - 10.255.255.254          8
172.x.0.1 - 172.x.255.254          16
192.168.y.1 - 192.168.y.254        24
```

x может быть любым числом из диапазона 16-31. y может быть любым числом из диапазона 0-255.

Верным частным IP-адресом может быть 192.168.1.1. Верным FQDN для этого IP может быть lfs.example.org.

Даже если Вы не имеете сетевой карты, все равно необходимо указать FQDN. Это необходимо для корректной работы некоторых программ.

Создайте файл /etc/hosts командой:

```
cat > /etc/hosts << "EOF"
# Начало /etc/hosts (версия для сетевой карты)

127.0.0.1 localhost
<192.168.1.1> <HOSTNAME.example.org> [hostname1] [hostname2 ...]

# Конец /etc/hosts (версия для сетевой карты)
EOF
```

Необходимо заменить значения *<192.168.1.1>* и *<HOSTNAME.example.org>* на соответствующие Вашим условиям (если IP-адрес был присвоен сетевым/системным администратором и машина будет подключена к существующей сети). Необязательные имена псевдонимов могут быть опущены.

Если Вы не собираетесь настраивать сетевую карту или у Вас ее нет, создайте файл /etc/hosts командой:

```
cat > /etc/hosts << "EOF"
# Начало /etc/hosts (версия без сетевой карты)

127.0.0.1 <HOSTNAME.example.org> <HOSTNAME> localhost

# Конец /etc/hosts (версия без сетевой карты)
EOF
```

7.4. Device and Module Handling on an LFS System

In Глава 6, we installed the Udev package. Before we go into the details regarding how this works, a brief history of previous methods of handling devices is in order.

Linux systems in general traditionally use a static device creation method, whereby a great many device nodes are created under /dev (sometimes literally thousands of nodes), regardless of whether the corresponding hardware devices actually exist. This is typically done via a **MAKEDEV** script, which contains a number of calls to the **mknod** program with the relevant major and minor device numbers for every possible device that might exist in the world.

Using the Udev method, only those devices which are detected by the kernel get device nodes created for them. Because these device nodes will be created each time the system boots, they will be stored on a devtmpfs file system (a virtual file system that resides entirely in system memory). Device nodes do not require much space, so the memory that is used is negligible.

7.4.1. History

In February 2000, a new filesystem called devfs was merged into the 2.3.46 kernel and was made available during the 2.4 series of stable kernels. Although it was present in the kernel source itself, this method of creating devices dynamically never received overwhelming support from the core kernel developers.

The main problem with the approach adopted by `devfs` was the way it handled device detection, creation, and naming. The latter issue, that of device node naming, was perhaps the most critical. It is generally accepted that if device names are allowed to be configurable, then the device naming policy should be up to a system administrator, not imposed on them by any particular developer(s). The `devfs` file system also suffers from race conditions that are inherent in its design and cannot be fixed without a substantial revision to the kernel. It was marked as deprecated for a long period – due to a lack of maintenance – and was finally removed from the kernel in June, 2006.

With the development of the unstable 2.5 kernel tree, later released as the 2.6 series of stable kernels, a new virtual filesystem called `sysfs` came to be. The job of `sysfs` is to export a view of the system's hardware configuration to userspace processes. With this userspace-visible representation, the possibility of seeing a userspace replacement for `devfs` became much more realistic.

7.4.2. Udev Implementation

7.4.2.1. Sysfs

The `sysfs` filesystem was mentioned briefly above. One may wonder how `sysfs` knows about the devices present on a system and what device numbers should be used for them. Drivers that have been compiled into the kernel directly register their objects with a `sysfs` (devtmpfs internally) as they are detected by the kernel. For drivers compiled as modules, this registration will happen when the module is loaded. Once the `sysfs` filesystem is mounted (on /sys), data which the drivers register with `sysfs` are available to userspace processes and to udevd for processing (including modifications to device nodes).

7.4.2.2. Device Node Creation

Device files are created by the kernel by the `devtmpfs` filesystem. Any driver that wishes to register a device node will go through `devtmpfs` (via the driver core) to do it. When a `devtmpfs` instance is mounted on `/dev`, the device node will initially be created with a fixed name, permissions, and owner.

A short time later, the kernel will send a uevent to **udevd**. Based on the rules specified in the files within the `/etc/udev/rules.d`, `/lib/udev/rules.d`, and `/run/udev/rules.d` directories, **udevd** will create additional symlinks to the device node, or change its permissions, owner, or group, or modify the internal **udevd** database entry (name) for that object.

The rules in these three directories are numbered in a similar fashion to the LFS-Bootscripts package and all three directories are merged together. If **udevd** can't find a rule for the device it is creating, it will leave the permissions and ownership at whatever `devtmpfs` used initially.

7.4.2.3. Udev Bootscripts

The first LFS bootscript, `/etc/init.d/mountvirtfs` will copy any devices located in `/lib/udev/devices` to `/dev`. This is necessary because some devices, directories, and symlinks are needed before the dynamic device handling processes are available during the early stages of booting a system, or are required by **udevd** itself. Creating static device nodes in `/lib/udev/devices` also provides an easy workaround for devices that are not supported by the dynamic device handling infrastructure.

The /etc/rc.d/init.d/udev initscript starts **udevd**, triggers any "coldplug" devices that have already been created by the kernel and waits for any rules to complete. The script also unsets the uevent handler from the default of /sbin/hotplug . This is done because the kernel no longer needs to call out to an external binary. Instead **udevd** will listen on a netlink socket for uevents that the kernel raises.

The **/etc/rc.d/init.d/udev_retry** initscript takes care of re-triggering events for subsystems whose rules may rely on filesystems that are not mounted until the **mountfs** script is run (in particular, /usr and /var may cause this). This script runs after the **mountfs** script, so those rules (if re-triggered) should succeed the second time around. It is configured from the /etc/sysconfig/udev_retry file; any words in this file other than comments are considered subsystem names to trigger at retry time. To find the subsystem of a device, use **udevadm info --attribute-walk <device>** where <device> is a an absolure path in /dev or /sys such as /dev/sr0 or /sys/class/rtc.

7.4.2.4. Module Loading

Device drivers compiled as modules may have aliases built into them. Aliases are visible in the output of the **modinfo** program and are usually related to the bus-specific identifiers of devices supported by a module. For example, the *snd-fm801* driver supports PCI devices with vendor ID 0x1319 and device ID 0x0801, and has an alias of «pci:v00001319d00000801sv*sd*bc04sc01i*». For most devices, the bus driver exports the alias of the driver that would handle the device via sysfs. E.g., the /sys/bus/pci/devices/0000:00:0d.0/modalias file might contain the string «pci:v00001319d00000801sv00001319sd00001319bc04sc01i00». The default rules provided with Udev will cause **udevd** to call out to **/sbin/modprobe** with the contents of the MODALIAS uevent environment variable (which should be the same as the contents of the modalias file in sysfs), thus loading all modules whose aliases match this string after wildcard expansion.

In this example, this means that, in addition to *snd-fm801*, the obsolete (and unwanted) *forte* driver will be loaded if it is available. See below for ways in which the loading of unwanted drivers can be prevented.

The kernel itself is also able to load modules for network protocols, filesystems and NLS support on demand.

7.4.2.5. Handling Hotpluggable/Dynamic Devices

When you plug in a device, such as a Universal Serial Bus (USB) MP3 player, the kernel recognizes that the device is now connected and generates a uevent. This uevent is then handled by **udevd** as described above.

7.4.3. Problems with Loading Modules and Creating Devices

There are a few possible problems when it comes to automatically creating device nodes.

7.4.3.1. A kernel module is not loaded automatically

Udev will only load a module if it has a bus-specific alias and the bus driver properly exports the necessary aliases to sysfs. In other cases, one should arrange module loading by other means. With Linux-3.8.1, Udev is known to load properly-written drivers for INPUT, IDE, PCI, USB, SCSI, SERIO, and FireWire devices.

To determine if the device driver you require has the necessary support for Udev, run **modinfo** with the module name as the argument. Now try locating the device directory under `/sys/bus` and check whether there is a `modalias` file there.

If the `modalias` file exists in `sysfs`, the driver supports the device and can talk to it directly, but doesn't have the alias, it is a bug in the driver. Load the driver without the help from Udev and expect the issue to be fixed later.

If there is no `modalias` file in the relevant directory under `/sys/bus`, this means that the kernel developers have not yet added modalias support to this bus type. With Linux-3.8.1, this is the case with ISA busses. Expect this issue to be fixed in later kernel versions.

Udev is not intended to load «wrapper» drivers such as *snd-pcm-oss* and non-hardware drivers such as *loop* at all.

7.4.3.2. A kernel module is not loaded automatically, and Udev is not intended to load it

If the «wrapper» module only enhances the functionality provided by some other module (e.g., *snd-pcm-oss* enhances the functionality of *snd-pcm* by making the sound cards available to OSS applications), configure **modprobe** to load the wrapper after Udev loads the wrapped module. To do this, add a «softdep» line in any `/etc/modprobe.d/<filename>.conf` file. For example:

```
softdep snd-pcm post: snd-pcm-oss
```

Note that the «softdep» command also allows `pre:` dependencies, or a mixture of both `pre:` and `post:`. See the `modprobe.d(5)` manual page for more information on «softdep» syntax and capabilities.

If the module in question is not a wrapper and is useful by itself, configure the **modules** bootscript to load this module on system boot. To do this, add the module name to the `/etc/sysconfig/modules` file on a separate line. This works for wrapper modules too, but is suboptimal in that case.

7.4.3.3. Udev loads some unwanted module

Either don't build the module, or blacklist it in a `/etc/modprobe.d/blacklist.conf` file as done with the *forte* module in the example below:

```
blacklist forte
```

Blacklisted modules can still be loaded manually with the explicit **modprobe** command.

7.4.3.4. Udev creates a device incorrectly, or makes a wrong symlink

This usually happens if a rule unexpectedly matches a device. For example, a poorly-writen rule can match both a SCSI disk (as desired) and the corresponding SCSI generic device (incorrectly) by vendor. Find the offending rule and make it more specific, with the help of the **udevadm info** command.

7.4.3.5. Udev rule works unreliably

This may be another manifestation of the previous problem. If not, and your rule uses `sysfs` attributes, it may be a kernel timing issue, to be fixed in later kernels. For now, you can work around it by creating a rule that waits for the used `sysfs` attribute and appending it to the `/etc/udev/rules.d/10-wait_for_sysfs.rules` file (create this file if it does not exist). Please notify the LFS Development list if you do so and it helps.

7.4.3.6. Udev does not create a device

Further text assumes that the driver is built statically into the kernel or already loaded as a module, and that you have already checked that Udev doesn't create a misnamed device.

Udev has no information needed to create a device node if a kernel driver does not export its data to `sysfs`. This is most common with third party drivers from outside the kernel tree. Create a static device node in `/lib/udev/devices` with the appropriate major/minor numbers (see the file `devices.txt` inside the kernel documentation or the documentation provided by the third party driver vendor). The static device node will be copied to `/dev` by the **udev** bootscript.

7.4.3.7. Device naming order changes randomly after rebooting

This is due to the fact that Udev, by design, handles uevents and loads modules in parallel, and thus in an unpredictable order. This will never be «fixed». You should not rely upon the kernel device names being stable. Instead, create your own rules that make symlinks with stable names based on some stable attributes of the device, such as a serial number or the output of various *_id utilities installed by Udev. See Раздел 7.5, «Создание собственных ссылок на устройства» and Раздел 7.2, «General Network Configuration» for examples.

7.4.4. Useful Reading

Additional helpful documentation is available at the following sites:

- A Userspace Implementation of `devfs` *http://www.kroah.com/linux/talks/ols_2003_udev_paper/Reprint-Kroah-Hartman-OLS2003.pdf*
- The `sysfs` Filesystem *http://www.kernel.org/pub/linux/kernel/people/mochel/doc/papers/ols-2005/mochel.pdf*

7.5. Создание собственных ссылок на устройства

7.5.1. Ссылки на CD-ROM

Некоторые программы, которые Вы можете захотеть установить позже (например, разные медиаплееры), ожидают, что ссылки `/dev/cdrom` и `/dev/dvd` существуют и указывают на устройство CD-ROM или DVD-ROM. Кроме того, эти ссылки удобно использовать в файле `/etc/fstab`. Вместе с Udev поставляется скрипт, который сгенерирует файлы правил для создания этих символических ссылок основываясь на возможностях каждого устройства, однако Вам необходимо выбрать один из двух режимов работы скрипта.

Во-первых, скрипт может работать в режиме «by-path» (используется большинством устройств USB и FireWire), когда создаваемые им правила будут зависеть от физического пути к CD- или DVD-устройству. Во-вторых, он может работать в режиме «by-id» (применяется для большинства устройств IDE и SCSI), при котором правила будут зависеть от идентификатора, сохраненного в самом устройстве. Путь определяется скриптом **path_id** из поставки Udev, и идентификатор считывается при помощи его же программ **ata_id** или **scsi_id**, в зависимости от типа Вашего устройства.

У каждого подхода есть свои преимущества; выбор будет зависеть от того, какого типа изменения будут происходить с Вашим устройством наиболее часто. Если физический путь к устройству может смениться (например, потому что Вы

подключаете его в разные порты/слоты), то Вам следует использовать режим «by-id». С другой стороны, если измениться может идентификатор устройства, например, Вы ожидаете его скорой поломки и планируете заменить его другим таким же, подключив в тот же самый разъем, то Вам подойдет режим «by-path».

Если возможны изменения и того, и другого характера, Вам прийдется выбирать режим, основываясь на предположениях о том, какие же все-таки будут происходить чаще.

> ⚠️ **Важно**
>
> Внешние устройства (например, CD-привод, подключенный через USB) не должны использовать режим by-path, поскольку каждый раз при подключении устройства в новый внешний порт будет меняться его физический путь. Если Вы в правилах Udev попытаетесь распознавать внешние устройства по их физическому пути, Вы убедитесь, что проблема характерна для всех внешних устройств, а не только для CD- и DVD-приводов.

Если Вы хотите узнать значения, которые будут использовать скрипты Udev, тогда найдите каталог соответствующего CD-привода в `/sys` (например, это может быть `/sys/block/hdd`) и выполните команду типа:

```
udevadm test /sys/block/hdd
```

Look at the lines containing the output of various *_id programs. The «by-id» mode will use the ID_SERIAL value if it exists and is not empty, otherwise it will use a combination of ID_MODEL and ID_REVISION. The «by-path» mode will use the ID_PATH value.

If the default mode is not suitable for your situation, then the following modification can be made to the `/etc/udev/rules.d/83-cdrom-symlinks.rules` file, as follows (where *mode* is one of «by-id» or «by-path»):

```
sed -i -e 's/"write_cd_rules"/"write_cd_rules mode"/' \
    /etc/udev/rules.d/83-cdrom-symlinks.rules
```

Note that it is not necessary to create the rules files or symlinks at this time, because you have bind-mounted the host's `/dev` directory into the LFS system, and we assume the symlinks exist on the host. The rules and symlinks will be created the first time you boot your LFS system.

However, if you have multiple CD-ROM devices, then the symlinks generated at that time may point to different devices than they point to on your host, because devices are not discovered in a predictable order. The assignments created when you first boot the LFS system will be stable, so this is only an issue if you need the symlinks on both systems to point to the same device. If you need that, then inspect (and possibly edit) the generated `/etc/udev/rules.d/70-persistent-cd.rules` file after booting, to make sure the assigned symlinks match what you need.

7.5.2. Разбираемся с дублирующимися устройствами

As explained in Раздел 7.4, «Device and Module Handling on an LFS System», the order in which devices with the same function appear in `/dev` is essentially random. E.g., if you have a USB web camera and a TV tuner, sometimes `/dev/video0` refers to the camera and `/dev/video1` refers to the tuner, and sometimes after a reboot the order changes to the opposite one. For all classes of hardware except sound cards and network cards, this is

fixable by creating udev rules for custom persistent symlinks. The case of network cards is covered separately in Раздел 7.2, «General Network Configuration», and sound card configuration can be found in *BLFS*.

For each of your devices that is likely to have this problem (even if the problem doesn't exist in your current Linux distribution), find the corresponding directory under `/sys/class` or `/sys/block`. For video devices, this may be `/sys/class/video4linux/videoX`. Figure out the attributes that identify the device uniquely (usually, vendor and product IDs and/or serial numbers work):

```
udevadm info -a -p /sys/class/video4linux/video0
```

Затем впишите правила, которые будут создавать ссылки:

```
cat > /etc/udev/rules.d/83-duplicate_devs.rules << "EOF"

# Постоянные ссылки для веб-камеры и тюнера
KERNEL=="video*", ATTRS{idProduct}=="1910", ATTRS{idVendor}=="0d81", \
    SYMLINK+="webcam"
KERNEL=="video*", ATTRS{device}=="0x036f", ATTRS{vendor}=="0x109e", \
    SYMLINK+="tvtuner"

EOF
```

В результате устройства /dev/video0 и /dev/video1 все также будут продолжать случайным образом меняться местами при каждой загрузке (и поэтому не должны использоваться непосредственно), но теперь на помошь пришли символические ссылки /dev/tvtuner и /dev/webcam, которые всегда будут указывать на правильные устройства.

7.6. LFS-Bootscripts-20130123

Пакет LFS-Bootscripts содержит набор скриптов для запуска/остановки системных служб при загрузке или выключении LFS-системы.

Приблизительное время сборки:	менее 0.1 SBU
Требует свободного места на диске:	256 KB

7.6.1. Installation of LFS-Bootscripts

Install the package:

```
make install
```

7.6.2. Contents of LFS-Bootscripts

Installed scripts:	checkfs, cleanfs, console, functions, halt, ifdown, ifup, localnet, modules, mountfs, mountkernfs, network, rc, reboot, sendsignals, setclock, static, swap, sysctl, syslogd, template, udev, and udev_retry
Installed directories:	/etc/rc.d, /etc/init.d (symbolic link), /etc/sysconfig, /lib/services, /lib/lsb (symbolic link)

Short Descriptions

checkfs	Checks the integrity of the file systems before they are mounted (with the exception of journal and network based file systems)
cleanfs	Удаляет файлы, которые не должны сохраняться между перезагрузками, например файлы в директориях /var/run/ и /var/lock/; создает заново директорию /var/run/utmp и удаляет файлы /etc/nologin, /fastboot и /forcefsck, если они существуют
console	Загружает таблицу символов клавиатуры, соответствующую выбранной раскладке; также устанавливает шрифт для консоли
functions	Содержит общие для всех скриптов функции, такие как проверка статуса и ошибок
halt	Останавливает систему
ifdown	Останавливает сетевое устройство
ifup	Производит инициализацию сетевого устройства
localnet	Устанавливает имя системы и настраивает сетевое устройство "loopback"
modules	Загружает модули ядра, перечисленные в файле /etc/sysconfig/modules, используя аргументы, также задаваемые в нем
mountfs	Монтирует все файловые системы, за исключением сетевых и имеющих опцию *noauto*
mountkernfs	Монтирует виртуальные системы ядра, например proc
network	Задействует сетевые карты, поднимает сетевые интерфейсы и устанавливает шлюз по умолчанию (где возможно)

rc	Основной скрипт контроля уровня запуска; он отвечает за последовательный запуск всех остальных скриптов в порядке, определенном символическими ссылками
reboot	Перезагружает систему
sendsignals	Перед перезагрузкой или выключением системы сначала посылает всем процессам сигналы, требующие их завершения, а затем уничтожает оставшиеся процессы
setclock	Устанавливает на часах ядра локальное время, если на аппаратных часах время не в UTC
static	Предоставляет необходимую функциональность для присвоения статического IP-адреса сетевому интерфейсу
swap	Включает/отключает файлы и разделы подкачки
sysctl	Считывает конфигурацию системы из файла `/etc/sysctl.conf`, если он существует, и передает ее ядру
sysklogd	Запускает/останавливает демонов журналирования системы и ядра
template	Шаблон для создания своих скриптов
udev	Подготавливает директорию `/dev` и запускает Udev
udev_retry	Пытается заново выполнить неудавшиеся события udev и копирует созданные файлы правил из директории `/dev/.udev` в `/etc/udev/rules.d`, если необходимо

7.7. How Do These Bootscripts Work?

Linux uses a special booting facility named SysVinit that is based on a concept of *run-levels*. It can be quite different from one system to another, so it cannot be assumed that because things worked in one particular Linux distribution, they should work the same in LFS too. LFS has its own way of doing things, but it respects generally accepted standards.

SysVinit (which will be referred to as «init» from now on) works using a run-levels scheme. There are seven (numbered 0 to 6) run-levels (actually, there are more run-levels, but they are for special cases and are generally not used. See `init(8)` for more details), and each one of those corresponds to the actions the computer is supposed to perform when it starts up. The default run-level is 3. Here are the descriptions of the different run-levels as they are implemented:

```
0: halt the computer
1: single-user mode
2: multi-user mode without networking
3: multi-user mode with networking
4: reserved for customization, otherwise does the same as 3
5: same as 4, it is usually used for GUI login (like X's xdm or KDE's kdm)
6: reboot the computer
```

7.7.1. Configuring Sysvinit

During the kernel initialization, the first program that is run is either specified on the command line or, by default **init**. This program reads the initialization file /etc/inittab. Create this file with:

```
cat > /etc/inittab << "EOF"
# Begin /etc/inittab

id:3:initdefault:

si::sysinit:/etc/rc.d/init.d/rc S

l0:0:wait:/etc/rc.d/init.d/rc 0
l1:S1:wait:/etc/rc.d/init.d/rc 1
l2:2:wait:/etc/rc.d/init.d/rc 2
l3:3:wait:/etc/rc.d/init.d/rc 3
l4:4:wait:/etc/rc.d/init.d/rc 4
l5:5:wait:/etc/rc.d/init.d/rc 5
l6:6:wait:/etc/rc.d/init.d/rc 6

ca:12345:ctrlaltdel:/sbin/shutdown -t1 -a -r now

su:S016:once:/sbin/sulogin

1:2345:respawn:/sbin/agetty --noclear tty1 9600
2:2345:respawn:/sbin/agetty tty2 9600
3:2345:respawn:/sbin/agetty tty3 9600
4:2345:respawn:/sbin/agetty tty4 9600
5:2345:respawn:/sbin/agetty tty5 9600
6:2345:respawn:/sbin/agetty tty6 9600

# End /etc/inittab
EOF
```

An explanation of this initialization file is in the man page for *inittab*. For LFS, the key command that is run is **rc**. The intialization file above will instruct **rc** to run all the scripts starting with an S in the /etc/rc.d/rcsysinit.d directory followed by all the scripts starting with an S in the /etc/rc.d/rc?.d directory where the question mark is specified by the initdefault value.

As a convenience, the **rc** script reads a library of functions in /lib/lsb/init-functions. This library also reads an optional configuration file, /etc/sysconfig/rc.site. Any of the system configuration file parameters described in subsequent sections can be alternatively placed in this file allowing consolidation of all system parameters in this one file.

As a debugging convenience, the functions script also logs all output to /run/var/bootlog. Since the /run directory is a tmpfs, this file is not persistent across boots, however it is appended to the more permanent file /var/log/boot.log at the end of the boot process.

7.7.2. Changing Run Levels

Changing run-levels is done with **init _<runlevel>_**, where _<runlevel>_ is the target run-level. For example, to reboot the computer, a user could issue the **init 6** command, which is an alias for the **reboot** command. Likewise, **init 0** is an alias for the **halt** command.

There are a number of directories under `/etc/rc.d` that look like `rc?.d` (where ? is the number of the run-level) and `rcsysinit.d`, all containing a number of symbolic links. Some begin with a _K_, the others begin with an _S_, and all of them have two numbers following the initial letter. The K means to stop (kill) a service and the S means to start a service. The numbers determine the order in which the scripts are run, from 00 to 99—the lower the number the earlier it gets executed. When **init** switches to another run-level, the appropriate services are either started or stopped, depending on the runlevel chosen.

The real scripts are in `/etc/rc.d/init.d`. They do the actual work, and the symlinks all point to them. K links and S links point to the same script in `/etc/rc.d/init.d`. This is because the scripts can be called with different parameters like _start_, _stop_, _restart_, _reload_, and _status_. When a K link is encountered, the appropriate script is run with the _stop_ argument. When an S link is encountered, the appropriate script is run with the _start_ argument.

There is one exception to this explanation. Links that start with an _S_ in the `rc0.d` and `rc6.d` directories will not cause anything to be started. They will be called with the parameter _stop_ to stop something. The logic behind this is that when a user is going to reboot or halt the system, nothing needs to be started. The system only needs to be stopped.

These are descriptions of what the arguments make the scripts do:

start
   The service is started.

stop
   The service is stopped.

restart
   The service is stopped and then started again.

reload
   The configuration of the service is updated. This is used after the configuration file of a service was modified, when the service does not need to be restarted.

status
   Tells if the service is running and with which PIDs.

Feel free to modify the way the boot process works (after all, it is your own LFS system). The files given here are an example of how it can be done.

7.8. Настройка системного имени компьютера

Часть работы скрипта **localnet** заключается в установке имени системы, которое определяется в файле `/etc/sysconfig/network`.

Создадим файл `/etc/sysconfig/network` и зададим имя системы командой:

```
echo "HOSTNAME=<lfs>" > /etc/sysconfig/network
```

<lfs> нужно заменить на имя, которое Вы хотите дать компьютеру. Не вводите здесь полное доменное имя (Fully Qualified Domain Name, FQDN). Эту информацию мы поместим в файл `/etc/hosts`.

7.9. Configuring the setclock Script

The **setclock** script reads the time from the hardware clock, also known as the BIOS or the Complementary Metal Oxide Semiconductor (CMOS) clock. If the hardware clock is set to UTC, this script will convert the hardware clock's time to the local time using the `/etc/localtime` file (which tells the **hwclock** program which timezone the user is in). There is no way to detect whether or not the hardware clock is set to UTC, so this needs to be configured manually.

The **setclock** is run via udev when the kernel detects the hardware capability upon boot. It can also be run manually with the stop parameter to store the system time to the CMOS clock.

If you cannot remember whether or not the hardware clock is set to UTC, find out by running the **hwclock --localtime --show** command. This will display what the current time is according to the hardware clock. If this time matches whatever your watch says, then the hardware clock is set to local time. If the output from **hwclock** is not local time, chances are it is set to UTC time. Verify this by adding or subtracting the proper amount of hours for the timezone to the time shown by **hwclock**. For example, if you are currently in the MST timezone, which is also known as GMT -0700, add seven hours to the local time.

Change the value of the UTC variable below to a value of *0* (zero) if the hardware clock is *not* set to UTC time.

Create a new file `/etc/sysconfig/clock` by running the following:

```
cat > /etc/sysconfig/clock << "EOF"
# Begin /etc/sysconfig/clock

UTC=1

# Set this to any options you might need to give to hwclock,
# such as machine hardware clock type for Alphas.
CLOCKPARAMS=

# End /etc/sysconfig/clock
EOF
```

A good hint explaining how to deal with time on LFS is available at *http://www.linuxfromscratch.org/hints/downloads/files/time.txt*. It explains issues such as time zones, UTC, and the TZ environment variable.

> **Замечание**
>
> The CLOCKPARAMS and UTC paramaters may be alternatively set in the `/etc/sysconfig/rc.site` file.

7.10. Настройка консоли Linux

This section discusses how to configure the **console** bootscript that sets up the keyboard map, console font and console kernel log level. If non-ASCII characters (e.g., the copyright sign, the British pound sign and Euro symbol) will not be used and the keyboard is a U.S. one, much of this section can be skipped. Without the configuration file, (or equivalent settings in `rc.site`), the **console** bootscript will do nothing.

The **console** script reads the /etc/sysconfig/console file for configuration information. Decide which keymap and screen font will be used. Various language-specific HOWTOs can also help with this, see *http://www.tldp.org/HOWTO/HOWTO-INDEX/other-lang.html*. If still in doubt, look in the /lib/kbd directory for valid keymaps and screen fonts. Read loadkeys(1) and setfont(8) manual pages to determine the correct arguments for these programs.

The /etc/sysconfig/console file should contain lines of the form: VARIABLE="value". The following variables are recognized:

LOGLEVEL
> This variable specifies the log level for kernel messages sent to the console as set by **dmesg**. Valid levels are from "1" (no messages) to "8". The default level is "7".

KEYMAP
> This variable specifies the arguments for the **loadkeys** program, typically, the name of keymap to load, e.g., «es». If this variable is not set, the bootscript will not run the **loadkeys** program, and the default kernel keymap will be used.

KEYMAP_CORRECTIONS
> This (rarely used) variable specifies the arguments for the second call to the **loadkeys** program. This is useful if the stock keymap is not completely satisfactory and a small adjustment has to be made. E.g., to include the Euro sign into a keymap that normally doesn't have it, set this variable to «euro2».

FONT
> This variable specifies the arguments for the **setfont** program. Typically, this includes the font name, «-m», and the name of the application character map to load. E.g., in order to load the «lat1-16» font together with the «8859-1» application character map (as it is appropriate in the USA), set this variable to «lat1-16 -m 8859-1». In UTF-8 mode, the kernel uses the application character map for conversion of composed 8-bit key codes in the keymap to UTF-8, and thus the argument of the "-m" parameter should be set to the encoding of the composed key codes in the keymap.

UNICODE
> Присвойте этой переменной значение «1», «yes» или «true», чтобы переключить консоль в режим UTF-8. Это полезно при использовании локали, основанной на UTF-8, и не рекомендуется в иных случаях.

LEGACY_CHARSET
> Для многих раскладок клавиатуры в пакете Kbd не существует готового Unicode-варианта. Скрипт **console** будет на лету конвертировать имеющуюся раскладку в UTF-8, если привоить этой переменной имя доступной не-UTF-8 раскладки.

Несколько примеров:

- Для не-Unicode настройки необходимы только переменные KEYMAP и FONT. Например, для польских пользователей может подойти такой вариант:

```
cat > /etc/sysconfig/console << "EOF"
# Начало /etc/sysconfig/console

KEYMAP="pl2"
FONT="lat2a-16 -m 8859-2"

# Конец /etc/sysconfig/console
EOF
```

- Как упоминалось выше, иногда бывает необходимо подкорректировать раскладку. Следующий пример добавляет символ евро к немецкой раскладке:

```
cat > /etc/sysconfig/console << "EOF"
# Начало /etc/sysconfig/console

KEYMAP="de-latin1"
KEYMAP_CORRECTIONS="euro2"
FONT="lat0-16 -m 8859-15"


# Конец /etc/sysconfig/console
EOF
```

- Следующий пример - Болгарский язык в режиме Unicode, поскольку для этого языка существует UTF-8 раскладка:

```
cat > /etc/sysconfig/console << "EOF"
# Начало /etc/sysconfig/console

UNICODE="1"
KEYMAP="bg_bds-utf8"
FONT="LatArCyrHeb-16"


# Конец /etc/sysconfig/console
EOF
```

- Из-за использования 512-символьного шрифта LatArCyrHeb-16 в предыдущем примере, Вы не сможете использовать яркие цвета в консоли Linux без применения буфера кадров. Если Вы хотите использовать яркие цвета без буфера кадров и готовы прожить без символов, не относящихся к Вашему языку, Вы можете использовать специфичный для вашего языка 256-символьный шрифт, как показано ниже:

```
cat > /etc/sysconfig/console << "EOF"
# Начало /etc/sysconfig/console

UNICODE="1"
KEYMAP="bg_bds-utf8"
FONT="cyr-sun16"


# Конец /etc/sysconfig/console
EOF
```

- Следующий пример демонстрирует автоматическое преобразование раскладки из ISO-8859-15 в UTF-8 и включает "мертвые" клавиши в режиме Unicode:

```
cat > /etc/sysconfig/console << "EOF"
# Начало /etc/sysconfig/console

UNICODE="1"
KEYMAP="de-latin1"
KEYMAP_CORRECTIONS="euro2"
LEGACY_CHARSET="iso-8859-15"
FONT="LatArCyrHeb-16 -m 8859-15"


# Конец /etc/sysconfig/console
EOF
```

- Некоторые раскладки включают в себя "мертвые" клавиши (то есть клавиши, нажатие которых само по себе не приводит к появлению на экране символа, но которые влияют на символ, генерируемый следующей клавишей) или определяют слияние символов (например: «нажмите Ctrl+. A E, чтобы получить Æ» в раскладке по умолчанию). Linux-3.8.1 правильно интерпретирует "мертвые" клавиши и слияния, только когда исходные символы имеют 8-битные коды. Эта особенность не влияет на раскладки для европейских языков, поскольку в них "сливаются" два ASCII-символа или добавляются подчеркивания к неподчеркнутым ASCII-символам. Однако, в режиме UTF-8 могут быть проблемы, например, для греческого языка, когда необходимо подчеркнуть символ «alpha». Решением в этой ситуации будет отказ от использования UTF-8 или установка графической системы X Window, не имеющих подобных ограничений.

- Для китайского, японского, корейского и некоторых других языков невозможно насторить консоль Linux так, чтобы она отображала все необходимые символы. Пользователи, которым требуются эти языки, должны установить систему X Window, шрифты, покрывающие необходимый диапазон символов, и правильный метод ввода (например, SCIM, он поддерживает большое число разнообразных языков).

> **Замечание**
>
> Файл /etc/sysconfig/console управляет только локализацией текстовой консоли Linux. Он никак не влияет на настройки раскладки клавиатуры и шрифтов в системе X Window, в сессиях SSH или на последовательном терминале. В этих ситуациях ограничения, описанные в двух расположенных выше абзацах, не применяются.

7.11. Настройка скрипта sysklogd

Скрипт sysklogd запускает программу **syslogd** с опцией -m 0. Этот параметр отключает периодическую (по умолчанию - каждые 20 минут) запись временных меток в файлы журналов, производимую **syslogd**. Если Вам необходимо включить периодическую запись временных меток, отредактируйте файл /etc/sysconfig/rc.site и присвойте переменной SYSKLOGD_PARMS требуемое значение. Например, чтобы сбросить все параметры, присвойте переменной пустое значение:

```
SYSKLOGD_PARMS=
```

Обратитесь к **man syslogd** за дополнительной информацией.

7.12. The rc.site File

The optional /etc/sysconfig/rc.site file contains settings that are automatically set for each boot script. It can alternatively set the values specified in the hostname, console, and clock files in the /etc/sysconfig/ directory. If the associated variables are present in both these separate files and rc.site, the values in the script specific files have precedence.

```
#IPROMPT="yes"  # whether to display the interactive boot prompt
#itime="3"      # The amount of time (in seconds) to display the prompt

# The total length of the distro welcome string, without escape codes
#wlen=$(echo "Welcome to ${DISTRO}" | wc -c )
#welcome_message="Welcome to ${INFO}${DISTRO}${NORMAL}"

# The total length of the interactive string, without escape codes
#ilen=$(echo "Press 'I' to enter interactive startup" | wc -c )
#i_message="Press '${FAILURE}I${NORMAL}' to enter interactive startup"

# Set scripts to skip the file system check on reboot
#FASTBOOT=yes

# Skip reading from the console
#HEADLESS=yes

# Speed up boot without waiting for settle in udev_retry
#OMIT_UDEV_RETRY_SETTLE=yes

# Write out fsck progress if yes
#VERBOSE_FSCK=no

# Speed up boot without waiting for settle in udev
#OMIT_UDEV_SETTLE=y

# Speed up boot without waiting for settle in udev_retry
#OMIT_UDEV_RETRY_SETTLE=yes

# Skip cleaning /tmp if yes
#SKIPTMPCLEAN=no

# For setclock
#UTC=1
#CLOCKPARAMS=

# For consolelog
#LOGLEVEL=5

# For network
#HOSTNAME=mylfs

# Delay between TERM and KILL signals at shutdown
#KILLDELAY=3

# Optional sysklogd parameters
#SYSKLOGD_PARMS="-m 0"

# Console parameters
#UNICODE=1
#KEYMAP="de-latin1"
#KEYMAP_CORRECTIONS="euro2"
#FONT="lat0-16 -m 8859-15"
#LEGACY_CHARSET=
```

7.12.1. Customizing the Boot and Shutdown Scripts

The LFS boot scripts boot and shut down a system in a fairly efficient manner, but there are a few tweaks that you can make in the rc.site file to improve speed even more and to adjust messages according to your preferences. To do this, adjust the settings in the `/etc/sysconfig/rc.site` file above.

- During the boot script `udev`, there is a call to **udev settle** that requires some time to complete. This time may or may not be required depending on devices present in the system. If you only have simple partitions and a single ethernet card, the boot process will probably not need to wait for this command. To skip it, set the variable OMIT_UDEV_SETTLE=y.

- The boot script `udev_retry` also runs **udev settle** by default. This command is only needed by default if the `/var` directory is separately mounted. This is because the clock needs the file `/var/lib/hwclock/adjtime`. Other customizations may also need to wait for udev to complete, but in many installations it is not needed. Skip the command by setting the variable OMIT_UDEV_RETRY_SETTLE=y.

- By default, the file system checks are silent. This can appear to be a delay during the bootup process. To turn on the **fsck** output, set the variable VERBOSE_FSCK=y.

- When rebooting, you may want to skip the filesystem check, **fsck**, completely. To do this, either create the file `/fastboot` or reboot the system with the command **/sbin/shutdown -f -r now**. On the other hand, you can force all file systems to be checked by creating `/forcefsck` or running **shutdown** with the *–F* parameter instead of *–f*.

  Setting the variable FASTBOOT=y will disable **fsck** during the boot process until it is removed. This is not recommended on a permanent basis.

- Normally, all files in the `/tmp` directory are deleted at boot time. Depending on the number of files or directories present, this can cause a noticeable delay in the boot process. To skip removing these files set the variable SKIPTMPCLEAN=y.

- During shutdown, the **init** program sends a TERM signal to each program it has started (e.g. agetty), waits for a set time (default 3 seconds), and sends each process a KILL signal and waits again. This process is repeated in the **sendsignals** script for any processes that are not shut down by their own scripts. The delay for **init** can be set by passing a parameter. For example to remove the delay in **init**, pass the -t0 parameter when shutting down or rebooting (e.g. **/sbin/shutdown -t0 -r now**). The delay for the **sendsignals** script can be skipped by setting the parameter KILLDELAY=0.

7.13. The Bash Shell Startup Files

The shell program **/bin/bash** (hereafter referred to as «the shell») uses a collection of startup files to help create an environment to run in. Each file has a specific use and may affect login and interactive environments differently. The files in the `/etc` directory provide global settings. If an equivalent file exists in the home directory, it may override the global settings.

An interactive login shell is started after a successful login, using **/bin/login**, by reading the `/etc/passwd` file. An interactive non-login shell is started at the command-line (e.g., `[prompt]$`**/bin/bash**). A non-interactive shell is usually present when a shell script is running. It is non-interactive because it is processing a script and not waiting for user input between commands.

For more information, see **info bash** under the *Bash Startup Files and Interactive Shells* section.

The files `/etc/profile` and `~/.bash_profile` are read when the shell is invoked as an interactive login shell.

The base `/etc/profile` below sets some environment variables necessary for native language support. Setting them properly results in:

- The output of programs translated into the native language
- Correct classification of characters into letters, digits and other classes. This is necessary for **bash** to properly accept non-ASCII characters in command lines in non-English locales
- The correct alphabetical sorting order for the country
- Appropriate default paper size
- Correct formatting of monetary, time, and date values

Replace *<ll>* below with the two-letter code for the desired language (e.g., «en») and *<CC>* with the two-letter code for the appropriate country (e.g., «GB»). *<charmap>* should be replaced with the canonical charmap for your chosen locale. Optional modifiers such as «@euro» may also be present.

The list of all locales supported by Glibc can be obtained by running the following command:

```
locale -a
```

Charmaps can have a number of aliases, e.g., «ISO-8859-1» is also referred to as «iso8859-1» and «iso88591». Some applications cannot handle the various synonyms correctly (e.g., require that «UTF-8» is written as «UTF-8», not «utf8»), so it is safest in most cases to choose the canonical name for a particular locale. To determine the canonical name, run the following command, where *<locale name>* is the output given by **locale -a** for your preferred locale («en_GB.iso88591» in our example).

```
LC_ALL=<locale name> locale charmap
```

For the «en_GB.iso88591» locale, the above command will print:

```
ISO-8859-1
```

This results in a final locale setting of «en_GB.ISO-8859-1». It is important that the locale found using the heuristic above is tested prior to it being added to the Bash startup files:

```
LC_ALL=<locale name> locale language
LC_ALL=<locale name> locale charmap
LC_ALL=<locale name> locale int_curr_symbol
LC_ALL=<locale name> locale int_prefix
```

The above commands should print the language name, the character encoding used by the locale, the local currency, and the prefix to dial before the telephone number in order to get into the country. If any of the commands above fail with a message similar to the one shown below, this means that your locale was either not installed in Chapter 6 or is not supported by the default installation of Glibc.

```
locale: Cannot set LC_* to default locale: No such file or directory
```

If this happens, you should either install the desired locale using the **localedef** command, or consider choosing a different locale. Further instructions assume that there are no such error messages from Glibc.

Some packages beyond LFS may also lack support for your chosen locale. One example is the X library (part of the X Window System), which outputs the following error message if the locale does not exactly match one of the character map names in its internal files:

```
Warning: locale not supported by Xlib, locale set to C
```

In several cases Xlib expects that the character map will be listed in uppercase notation with canonical dashes. For instance, "ISO-8859-1" rather than "iso88591". It is also possible to find an appropriate specification by removing the charmap part of the locale specification. This can be checked by running the **locale charmap** command in both locales. For example, one would have to change "de_DE.ISO-8859-15@euro" to "de_DE@euro" in order to get this locale recognized by Xlib.

Other packages can also function incorrectly (but may not necessarily display any error messages) if the locale name does not meet their expectations. In those cases, investigating how other Linux distributions support your locale might provide some useful information.

Once the proper locale settings have been determined, create the /etc/profile file:

```
cat > /etc/profile << "EOF"
# Begin /etc/profile

export LANG=<ll>_<CC>.<charmap><@modifiers>

# End /etc/profile
EOF
```

The «C» (default) and «en_US» (the recommended one for United States English users) locales are different. «C» uses the US-ASCII 7-bit character set, and treats bytes with the high bit set as invalid characters. That's why, e.g., the **ls** command substitutes them with question marks in that locale. Also, an attempt to send mail with such characters from Mutt or Pine results in non-RFC-conforming messages being sent (the charset in the outgoing mail is indicated as «unknown 8-bit»). So you can use the «C» locale only if you are sure that you will never need 8-bit characters.

UTF-8 based locales are not supported well by many programs. Work is in progress to document and, if possible, fix such problems, see *http://www.linuxfromscratch.org/blfs/view/svn/introduction/locale-issues.html*.

7.14. Создание файла /etc/inputrc

В файле inputrc можно настроить параметры клавиатуры для специфических случаев. Этот файл используется Readline — библиотекой ввода — и считывается при запуске Bash и большей частью других оболочек.

Большинство людей не нуждаются в специальных настройках клавиатуры для каждого пользователя, поэтому команда ниже создаст общесистемный /etc/inputrc, используемый всеми. Если позже Вы решите переназначить для одного из пользователей умолчания, Вы можете создать файл .inputrc в домашней папке пользователя и указать в нем измененные настройки.

За более подробной информацией по редактированию файла inputrc , прочтите секцию *Readline Init File* на странице **info bash**. Также хорошим источником информации является **info readline**.

Ниже - обобщенный пример файла inputrc с комментариями к каждой опции. Заметьте, что комментарии не могут быть на одной строке с командами. Создайте файл следующей командой:

```
cat > /etc/inputrc << "EOF"
# Начало /etc/inputrc
# Изменен Chris Lynn <roryo@roryo.dynup.net>

# Разрешить перенос приглашения оболочки на следующую строку
set horizontal-scroll-mode Off

# Разрешить 8-битный ввод
set meta-flag On
set input-meta On

# Отключить обрезание восьмого бита в вводимых символах
set convert-meta Off

# Выводить на экран все восемь бит, не обрезая
set output-meta On

# Звуковой сигнал - none, visible или audible, соответственно никакого, видимы
set bell-style none

# Нижеследующие команды привязывают escape-последовательности (первый аргумент
# к специфичным для Readline функциям (второй аргумент)
"\eOd": backward-word
"\eOc": forward-word

# для консоли linux
"\e[1~": beginning-of-line
"\e[4~": end-of-line
"\e[5~": beginning-of-history
"\e[6~": end-of-history
"\e[3~": delete-char
"\e[2~": quoted-insert

# для xterm
"\eOH": beginning-of-line
"\eOF": end-of-line

# для Konsole
"\e[H": beginning-of-line
"\e[F": end-of-line

# Конец /etc/inputrc
EOF
```

Глава 8. Делаем LFS-систему загружаемой

8.1. Вступление

Пришло время сделать LFS-систему способной к загрузке. Эта глава описывает создание файла `fstab`, сборку ядра для новой LFS-системы и установку загрузчика GRUB, который позволит Вам выбирать для запуска Вашу LFS-систему при включении компьютера.

8.2. Creating the /etc/fstab File

The `/etc/fstab` file is used by some programs to determine where file systems are to be mounted by default, in which order, and which must be checked (for integrity errors) prior to mounting. Create a new file systems table like this:

```
cat > /etc/fstab << "EOF"
# Begin /etc/fstab

# file system  mount-point  type      options             dump  fsck
#                                                                order

/dev/<xxx>     /            <fff>     defaults            1     1
/dev/<yyy>     swap         swap      pri=1               0     0
proc           /proc        proc      nosuid,noexec,nodev 0     0
sysfs          /sys         sysfs     nosuid,noexec,nodev 0     0
devpts         /dev/pts     devpts    gid=5,mode=620      0     0
tmpfs          /run         tmpfs     defaults            0     0
devtmpfs       /dev         devtmpfs  mode=0755,nosuid    0     0

# End /etc/fstab
EOF
```

Replace *<xxx>*, *<yyy>*, and *<fff>* with the values appropriate for the system, for example, `hda2`, `hda5`, and `ext3`. For details on the six fields in this file, see **man 5 fstab**.

Filesystems with MS-DOS or Windows origin (i.e.: vfat, ntfs, smbfs, cifs, iso9660, udf) need the «iocharset» mount option in order for non-ASCII characters in file names to be interpreted properly. The value of this option should be the same as the character set of your locale, adjusted in such a way that the kernel understands it. This works if the relevant character set definition (found under File systems -> Native Language Support) has been compiled into the kernel or built as a module. The «codepage» option is also needed for vfat and smbfs filesystems. It should be set to the codepage number used under MS-DOS in your country. E.g., in order to mount USB flash drives, a ru_RU.KOI8-R user would need the following in the options portion of its mount line in `/etc/fstab`:

```
noauto,user,quiet,showexec,iocharset=koi8r,codepage=866
```

The corresponding options fragment for ru_RU.UTF-8 users is:

```
noauto,user,quiet,showexec,iocharset=utf8,codepage=866
```

> **Замечание**
>
> In the latter case, the kernel emits the following message:
>
> ```
> FAT: utf8 is not a recommended IO charset for FAT filesystems,
>     filesystem will be case sensitive!
> ```
>
> This negative recommendation should be ignored, since all other values of the «iocharset» option result in wrong display of filenames in UTF-8 locales.

It is also possible to specify default codepage and iocharset values for some filesystems during kernel configuration. The relevant parameters are named «Default NLS Option» (CONFIG_NLS_DEFAULT), «Default Remote NLS Option» (CONFIG_SMB_NLS_DEFAULT), «Default codepage for FAT» (CONFIG_FAT_DEFAULT_CODEPAGE), and «Default iocharset for FAT» (CONFIG_FAT_DEFAULT_IOCHARSET). There is no way to specify these settings for the ntfs filesystem at kernel compilation time.

It is possible to make the ext3 filesystem reliable across power failures for some hard disk types. To do this, add the `barrier=1` mount option to the appropriate entry in `/etc/fstab`. To check if the disk drive supports this option, run *hdparm* on the applicable disk drive. For example, if:

```
hdparm -I /dev/sda | grep NCQ
```

returns non-empty output, the option is supported.

Note: Logical Volume Management (LVM) based partitions cannot use the `barrier` option.

8.3. Linux-3.8.1

Пакет Linux содержит ядро Linux.

Приблизительное время сборки:	1.0 - 5.0 SBU
Требует свободного места на диске:	540 - 800 MB

8.3.1. Installation of the kernel

Building the kernel involves a few steps—configuration, compilation, and installation. Read the README file in the kernel source tree for alternative methods to the way this book configures the kernel.

Prepare for compilation by running the following command:

```
make mrproper
```

This ensures that the kernel tree is absolutely clean. The kernel team recommends that this command be issued prior to each kernel compilation. Do not rely on the source tree being clean after un-tarring.

Configure the kernel via a menu-driven interface. For general information on kernel configuration see *http://www.linuxfromscratch.org/hints/downloads/files/kernel-configuration.txt*. BLFS has some information regarding particular kernel configuration requirements of packages outside of LFS at *http://www.linuxfromscratch.org/blfs/view/svn/longindex.html#kernel-config-index*.

> **Замечание**
>
> Due to recent changes in udev, be sure to select:
>
> ```
> Device Drivers  --->
>   Generic Driver Options  --->
>     Maintain a devtmpfs filesystem to mount at /dev
> ```

```
make LANG=<host_LANG_value> LC_ALL= menuconfig
```

The meaning of the make parameters:

LANG=<host_LANG_value> LC_ALL=
> This establishes the locale setting to the one used on the host. This is needed for a proper menuconfig ncurses interface line drawing on UTF-8 linux text console.
> Be sure to replace *<host_LANG_value>* by the value of the $LANG variable from your host. If not set, you could use instead the host's value of $LC_ALL or $LC_CTYPE.

Alternatively, **make oldconfig** may be more appropriate in some situations. See the README file for more information.

If desired, skip kernel configuration by copying the kernel config file, `.config`, from the host system (assuming it is available) to the unpacked `linux-3.8.1` directory. However, we do not recommend this option. It is often better to explore all the configuration menus and create the kernel configuration from scratch.

Compile the kernel image and modules:

```
make
```

If using kernel modules, module configuration in `/etc/modprobe.d` may be required. Information pertaining to modules and kernel configuration is located in Раздел 7.4, «Device and Module Handling on an LFS System» and in the kernel documentation in the `linux-3.8.1/Documentation` directory. Also, `modprobe.conf(5)` may be of interest.

Install the modules, if the kernel configuration uses them:

```
make modules_install
```

After kernel compilation is complete, additional steps are required to complete the installation. Some files need to be copied to the `/boot` directory.

The path to the kernel image may vary depending on the platform being used. The filename below can be changed to suit your taste, but the stem of the filename should be *vmlinuz* to be compatible with the automatic setup of the boot process described in the next section. The following command assumes an x86 architecture:

```
cp -v arch/x86/boot/bzImage /boot/vmlinuz-3.8.1-lfs-7.3
```

`System.map` is a symbol file for the kernel. It maps the function entry points of every function in the kernel API, as well as the addresses of the kernel data structures for the running kernel. It is used as a resource when investigating kernel problems. Issue the following command to install the map file:

```
cp -v System.map /boot/System.map-3.8.1
```

The kernel configuration file `.config` produced by the **make menuconfig** step above contains all the configuration selections for the kernel that was just compiled. It is a good idea to keep this file for future reference:

```
cp -v .config /boot/config-3.8.1
```

Install the documentation for the Linux kernel:

```
install -d /usr/share/doc/linux-3.8.1
cp -r Documentation/* /usr/share/doc/linux-3.8.1
```

It is important to note that the files in the kernel source directory are not owned by *root*. Whenever a package is unpacked as user *root* (like we did inside chroot), the files have the user and group IDs of whatever they were on the packager's computer. This is usually not a problem for any other package to be installed because the source tree is removed after the installation. However, the Linux source tree is often retained for a long time. Because of this, there is a chance that whatever user ID the packager used will be assigned to somebody on the machine. That person would then have write access to the kernel source.

If the kernel source tree is going to be retained, run **chown -R 0:0** on the `linux-3.8.1` directory to ensure all files are owned by user *root*.

> **⚠ Внимание**
>
> Some kernel documentation recommends creating a symlink from `/usr/src/linux` pointing to the kernel source directory. This is specific to kernels prior to the 2.6 series and *must not* be created on an LFS system as it can cause problems for packages you may wish to build once your base LFS system is complete.

> ### ⚠ Внимание
>
> The headers in the system's `include` directory should *always* be the ones against which Glibc was compiled, that is, the sanitised headers from this Linux kernel tarball. Therefore, they should *never* be replaced by either the raw kernel headers or any other kernel sanitized headers.

8.3.2. Configuring Linux Module Load Order

Most of the time Linux modules are loaded automatically, but sometimes it needs some specific direction. The program that loads modules, **modprobe** or **insmod**, uses /etc/modprobe.d/usb.conf for this purpose. This file needs to be created so that if the USB drivers (ehci_hcd, ohci_hcd and uhci_hcd) have been built as modules, they will be loaded in the correct order; ehci_hcd needs to be loaded prior to ohci_hcd and uhci_hcd in order to avoid a warning being output at boot time.

Create a new file /etc/modprobe.d/usb.conf by running the following:

```
install -v -m755 -d /etc/modprobe.d
cat > /etc/modprobe.d/usb.conf << "EOF"
# Begin /etc/modprobe.d/usb.conf

install ohci_hcd /sbin/modprobe ehci_hcd ; /sbin/modprobe -i ohci_hcd ; true
install uhci_hcd /sbin/modprobe ehci_hcd ; /sbin/modprobe -i uhci_hcd ; true

# End /etc/modprobe.d/usb.conf
EOF
```

8.3.3. Contents of Linux

Installed files:	config-3.8.1, vmlinux-3.8.1-lfs-7.3-3.8.1, and System.map-3.8.1
Installed directories:	/lib/modules, /usr/share/doc/linux-3.8.1

Short Descriptions

config-3.8.1	Contains all the configuration selections for the kernel
vmlinux-3.8.1-lfs-7.3	Ядро системы Linux. Оно является самой первой частью операционной системы, загружаемой в оперативную память после включения компьютера. Ядро определяет и настраивает все компоненты аппаратного обеспечения компьютера, а затем делает их доступными для программ в виде дерева файлов, превращая процессор в многозадачную машину, способную выполнять множество программ "одновременно" с точки зрения пользователя
System.map-3.8.1	Список адресов и символов; из него можно узнать точки входа и адреса всех функций и структур данных ядра.

8.4. Using GRUB to Set Up the Boot Process

8.4.1. Introduction

> **! Внимание**
>
> Configuring GRUB incorrectly can render your system inoperable without an alternate boot device such as a CD-ROM. This section is not required to boot your LFS system. You may just want to modify your current boot loader, e.g. Grub-Legacy, GRUB2, or LILO.

Ensure that an emergency boot disk is ready to «rescue» the computer if the computer becomes unusable (un-bootable). If you do not already have a boot device, you can create one. In order for the procedure below to work, you need to jump ahead to BLFS and install **xorriso** from the *libisoburn* package.

```
cd /tmp &&
grub-mkrescue --output=grub-img.iso &&
xorriso -as cdrecord -v dev=/dev/cdrw blank=as_needed grub-img.iso
```

8.4.2. GRUB Naming Conventions

GRUB uses its own naming structure for drives and partitions in the form of *(hdn,m)*, where *n* is the hard drive number and *m* is the partition number. The hard drive number starts from zero, but the partition number starts from one for normal partitions and five for extended partitions. Note that this is different from earlier versions where both numbers started from zero. For example, partition sda1 is *(hd0,1)* to GRUB and sdb3 is *(hd1,3)*. In contrast to Linux, GRUB does not consider CD-ROM drives to be hard drives. For example, if using a CD on hdb and a second hard drive on hdc, that second hard drive would still be *(hd1)*.

8.4.3. Setting Up the Configuration

GRUB works by writing data to the first physical track of the hard disk. This area is not part of any file system. The programs there access GRUB modules in the boot partition. The default location is /boot/grub/.

The location of the boot partition is a choice of the user that affects the configuration. One recommendation is to have a separate small (suggested size is 100 MB) partition just for boot information. That way each build, whether LFS or some commercial distro, can access the same boot files and access can be made from any booted system. If you choose to do this, you will need to mount the separate partition, move all files in the current /boot directory (e.g. the linux kernel you just built in the previous section) to the new partition. You will then need to unmount the partition and remount it as /boot. If you do this, be sure to update /etc/fstab.

Using the current lfs partition will also work, but configuration for multiple systems is more difficult.

Using the above information, determine the appropriate designator for the root partition (or boot partition, if a separate one is used). For the following example, it is assumed that the root (or separate boot) partition is sda2.

Install the GRUB files into /boot/grub and set up the boot track:

> ### Внимание
>
> The following command will overwrite the current boot loader. Do not run the command if this is not desired, for example, if using a third party boot manager to manage the Master Boot Record (MBR).

```
grub-install /dev/sda
```

8.4.4. Creating the Configuration File

Generate /boot/grub/grub.cfg:

```
cat > /boot/grub/grub.cfg << "EOF"
# Begin /boot/grub/grub.cfg
set default=0
set timeout=5

insmod ext2
set root=(hd0,2)

menuentry "GNU/Linux, Linux 3.8.1-lfs-7.3" {
        linux   /boot/vmlinuz-3.8.1-lfs-7.3 root=/dev/sda2 ro
}
EOF
```

> ### Замечание
>
> From GRUB's perspective, the kernel files are relative to the partition used. If you used a separate /boot partition, remove /boot from the above *linux* line. You will also need to change the *set root* line to point to the boot partition.

GRUB is an extremely powerful program and it provides a tremendous number of options for booting from a wide variety of devices, operating systems, and partition types. There are also many options for customization such as graphical splash screens, playing sounds, mouse input, etc. The details of these options are beyond the scope of this introduction.

> ### Предостережение
>
> There is a command, grub-mkconfig, that can write a configuration file automatically. It uses a set of scripts in /etc/grub.d/ and will destroy any customizations that you make. These scripts are designed primarily for non-source distributions and are not recommended for LFS. If you install a commercial Linux distribution, there is a good chance that this program will be run. Be sure to back up your grub.cfg file.

Глава 9. Конец

9.1. Конец

Хорошо сработано! Новая LFS-система установлена! Мы хотим пожелать Вам удачи с Вашей новой блестящей самосборной Linux-системой.

Хорошей идеей будет создать файл /etc/lfs-release. Имея этот файл, Вам (и нам тоже, если Вам понадобится помощь), будет легко определить, какая версия LFS установлена. Создайте этот файл следующей командой:

```
echo 7.3 > /etc/lfs-release
```

It is also a good idea to create a file to show the status of your new system with resopect to the Linux Standards Base (LSB). To create this file, run:

```
cat > /etc/lsb-release << "EOF"
DISTRIB_ID="Linux From Scratch"
DISTRIB_RELEASE="7.3"
DISTRIB_CODENAME="<your name here>"
DISTRIB_DESCRIPTION="Linux From Scratch"
EOF
```

Be sure to put some sort of customization for the field 'DISTRIB_CODENAME' to make the system uniquely yours.

9.2. Регистрация

Теперь, когда Вы закончили сборку собственной системы, не хотели бы Вы зарегистрироваться как пользователь LFS? Зайдите на *http://www.linuxfromscratch. org/cgi-bin/lfscounter.php* и зарегистрируйтесь как пользователь LFS, введя Ваше имя и первую версию LFS, которую Вы использовали.

Пришло время перезагрузиться в LFS.

9.3. Перезагрузка системы

Теперь, когда все программное обеспечение установлено, пришло время перезагрузить Ваш компьютер. Однако, помните несколько вещей. Система, которую Вы создали по этой книге, минимальна, и скорее всего не имеет необходимых возможностей для продолжения движения вперед. Установив несколько дополнительных пакетов из книги BLFS, находясь пока в нашем временном окружении, Вы можете оказаться в лучшем положении, когда перезагруизтесь в Вашу свежеустановленную LFS-систему. Вот пара предложений:

- Текстовый веб-браузер, например, *Lynx*, Вы сможете просматривать книгу BLFS в одном виртуальном терминале, параллельно собирая пакеты в другом.

- Пакет *GPM* позволит переносить текст путем копирования/вставки между виртуальными терминалами.

- Наконец, если Вы не имеете статического IP-адреса, установка *dhcpcd* или клиентской части *dhcp* может быть полезной.

- Installing *sudo* may be useful for building packages as a non-root user and easily installing the resulting packages in your new system.

- If you want to access your new system from a remote system within a comfortable GUI environment, install *openssh* and it's prerequsite, *openssl*.
- To make fetching files over the internet easier, install *wget*.
- If one or more of your disk drives have a GUID partition table (GPT), either *gptfdisk* or *parted* will be useful.
- Finally, a review of the following configuration files is also appropriate at this point.
    - /etc/bashrc
    - /etc/dircolors
    - /etc/fstab
    - /etc/hosts
    - /etc/inputrc
    - /etc/profile
    - /etc/resolv.conf
    - /etc/vimrc
    - /root/.bash_profile
    - /root/.bashrc
    - /etc/sysconfig/network
    - /etc/sysconfig/ifconfig.eth0

После всего вышесказанного, приступим к первой загрузке нашей блестящей установленной LFS! Сначала покинем временное окружение:

```
logout
```

Затем отмонтируем виртуальные файловые системы:

```
umount -v $LFS/dev/pts

if [ -h $LFS/dev/shm ]; then
  link=$(readlink $LFS/dev/shm)
  umount -v $LFS/$link
  unset link
else
  umount -v $LFS/dev/shm
fi

umount -v $LFS/dev
umount -v $LFS/proc
umount -v $LFS/sys
```

Отмонтируем саму файловую систему LFS:

```
umount -v $LFS
```

Если было создано несколько разделов, отключите их перед отмонтированием основного, примерно так:

```
umount -v $LFS/usr
umount -v $LFS/home
umount -v $LFS
```

Наконец, перезагрузите систему:

```
shutdown -r now
```

Если загрузчик GRUB был установлен в соответствии с инструкциями выше, в меню автоматически будет выбрана опция загрузки *LFS 7.3*.

Когда перезагрузка завершится, система LFS будет готова к использованию и установке дополнительного программного обеспечения.

9.4. Что дальше?

Спасибо Вам за прочтение книги LFS. Мы надеемся, что Вы нашли эту книгу полезной и узнали много нового о процессе построения системы Linux.

Теперь, когда LFS-система установлена, Вы можете задаться вопросом «А что же дальше?» Чтобы ответить на этот вопрос, мы собрали для Вас список ресурсов.

• Поддержка

Отчеты об ошибках и угрозах безопасности регулярно появляются для любого программного обеспечения. Поскольку LFS-система компилируется из исходников, Вы можете не отставать от этих сообщений. Существуют несколько онлайн-ресурсов, которые следят за такими отчетами, ссылки на некоторые из них приведены ниже:

  • Freecode (*http://freecode.com/*)

    Freecode может сообщать Вам (по E-mail) о выходе новых версий пакетов, установленных в Вашей системе.

  • *CERT* (Computer Emergency Response Team)

    CERT имеет список рассылки, в котором публикуются предупреждения об уязвимостях в различных операционных системах и приложениях. Информация о подписке доступна на *http://www.us-cert.gov/cas/signup.html*.

  • Bugtraq

    Bugtraq - полностью открытый список рассылки, посвященный вопросам компьютерной безопасности. Он публикует свежевыявленные проблемы безопасности и иногда возможные способы их решения. Информация о подписке доступна на *http://www.securityfocus.com/archive*.

• Beyond Linux From Scratch

  Книга Beyond Linux From Scratch описывает установку широкого спектра программного обеспечения, не входящего в круг рассмотрения книги LFS. Проект BLFS расположен по адресу *http://www.linuxfromscratch.org/blfs/*.

• LFS Hints

  LFS Hints - это коллекция образовательных документов, созданных добровольцами из сообщества LFS. Советы доступны здесь: *http://www. linuxfromscratch.org/hints/list.html*.

• Списки рассылки

  Существуют несколько списков рассылки LFS, на которые Вы бы могли подписаться, если Вам нужна помощь, Вы хотите оставаться в курсе последних разработок или желаете помочь проекту. Подробнее здесь: Глава 1 - Списки рассылки.

- The Linux Documentation Project

  Цель The Linux Documentation Project (TLDP) - собрать документацию по всем аспектам использования и настройки Linux. Сайт TLDP содержит большую коллекцию HOWTO, руководств и справочных страниц. Он расположен по адресу *http://www.tldp.org/*.

Часть IV. Приложения

Приложение A. Сокращения и термины

ABI	Application Binary Interface, бинарный интерфейс приложения
ALFS	Automated Linux From Scratch, автоматизированный Linux From Scratch
API	Application Programming Interface, программный интерфейс приложения
ASCII	American Standard Code for Information Interchange, американский стандартный код для обмена информацией
BIOS	Basic Input/Output System, базовая система ввода-вывода
BLFS	Beyond Linux From Scratch, за пределами Linux From Scratch
BSD	Berkeley Software Distribution, дистрибутив программного обеспечения Беркли
chroot	change root, сменить корень
CMOS	Complementary Metal Oxide Semiconductor
COS	Class Of Service
CPU	Central Processing Unit, центральный процессор
CRC	Cyclic Redundancy Check, циклическая проверка целостности
CVS	Concurrent Versions System
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name Service
EGA	Enhanced Graphics Adapter
ELF	Executable and Linkable Format
EOF	End of File
EQN	equation
ext2	second extended file system
ext3	third extended file system
ext4	fourth extended file system
FAQ	Frequently Asked Questions
FHS	Filesystem Hierarchy Standard
FIFO	First-In, First Out
FQDN	Fully Qualified Domain Name
FTP	File Transfer Protocol
GB	Gigabytes
GCC	GNU Compiler Collection
GID	Group Identifier
GMT	Greenwich Mean Time
HTML	Hypertext Markup Language
IDE	Integrated Drive Electronics

IEEE	Institute of Electrical and Electronic Engineers
IO	Input/Output
IP	Internet Protocol
IPC	Inter-Process Communication
IRC	Internet Relay Chat
ISO	International Organization for Standardization
ISP	Internet Service Provider
KB	Kilobytes
LED	Light Emitting Diode
LFS	Linux From Scratch
LSB	Linux Standard Base
MB	Megabytes
MBR	Master Boot Record
MD5	Message Digest 5
NIC	Network Interface Card
NLS	Native Language Support
NNTP	Network News Transport Protocol
NPTL	Native POSIX Threading Library
OSS	Open Sound System
PCH	Pre-Compiled Headers
PCRE	Perl Compatible Regular Expression
PID	Process Identifier
PTY	pseudo terminal
QOS	Quality Of Service
RAM	Random Access Memory
RPC	Remote Procedure Call
RTC	Real Time Clock
SBU	Standard Build Unit
SCO	The Santa Cruz Operation
SHA1	Secure-Hash Algorithm 1
TLDP	The Linux Documentation Project
TFTP	Trivial File Transfer Protocol
TLS	Thread-Local Storage
UID	User Identifier
umask	user file-creation mask
USB	Universal Serial Bus
UTC	Coordinated Universal Time
UUID	Universally Unique Identifier

VC   Virtual Console

VGA   Video Graphics Array

VT   Virtual Terminal

Приложение B. Благодарности

Мы хотели бы поблагодарить следующих людей и организации за их вклад в проект Linux From Scratch.

- *Gerard Beekmans* <gerard@linuxfromscratch.org> – Создатель LFS, лидер проекта LFS

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- Бесчетное количество других людей в различных списках рассылки LFS и BLFS, которые помогали воплотить эту книгу в жизнь своими предложениями, проверкой книги и отправлением сообщений об ошибках, инструкциями и просто делясь своим опытом по установке различных пакетов.

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Приложение C. Зависимости

Every package built in LFS relies on one or more other packages in order to build and install properly. Some packages even participate in circular dependencies, that is, the first package depends on the second which in turn depends on the first. Because of these dependencies, the order in which packages are built in LFS is very important. The purpose of this page is to document the dependencies of each package built in LFS.

For each package we build, we have listed three, and sometimes four, types of dependencies. The first lists what other packages need to be available in order to compile and install the package in question. The second lists what packages, in addition to those on the first list, need to be available in order to run the test suites. The third list of dependencies are packages that require this package to be built and installed in its final location before they are built and installed. In most cases, this is because these packages will hardcode paths to binaries within their scripts. If not built in a certain order, this could result in paths of /tools/bin/[binary] being placed inside scripts installed to the final system. This is obviously not desirable.

The last list of dependencies are optional packages that are not addressed in LFS, but could be useful to the user. These packages may have additional mandatory or optional dependencies of their own. For these dependencies, the recommeded practice is to install them after completion of the LFS book and then go back an rebuild the LFS package. In several cases, reinstallation is addressed in BLFS.

Autoconf

Для установки необходимы:	Bash, Coreutils, Grep, M4, Make, Perl, Sed, and Texinfo
Для тестов необходимы:	Automake, Diffutils, Findutils, GCC, and Libtool
Необходимо установить перед:	Automake
Необязательные зависимости:	Emacs

Automake

Для установки необходимы:	Autoconf, Bash, Coreutils, Gettext, Grep, M4, Make, Perl, Sed, and Texinfo
Для тестов необходимы:	Binutils, Bison, Bzip2, DejaGNU, Diffutils, Expect, Findutils, Flex, GCC, Gettext, Gzip, Libtool, and Tar.
Необходимо установить перед:	None
Необязательные зависимости:	None

Bash

Для установки необходимы:	Bash, Binutils, Bison, Coreutils, Diffutils, Gawk, GCC, Glibc, Grep, Make, Ncurses, Patch, Readline, Sed, and Texinfo
Для тестов необходимы:	Shadow
Необходимо установить перед:	None
Необязательные зависимости:	Xorg

Binutils

Для установки необходимы:	Bash, Binutils, Coreutils, Diffutils, File, Gawk, GCC, Glibc, Grep, Make, Perl, Sed, Texinfo and Zlib
Для тестов необходимы:	DejaGNU and Expect
Необходимо установить перед:	None
Необязательные зависимости:	None

Bison

Для установки необходимы:	Bash, Binutils, Coreutils, GCC, Gettext, Glibc, Grep, M4, Make, and Sed
Для тестов необходимы:	Diffutils and Findutils
Необходимо установить перед:	Flex, Kbd, and Tar
Необязательные зависимости:	Doxygen (test suite)

Bzip2

Для установки необходимы:	Bash, Binutils, Coreutils, Diffutils, GCC, Glibc, Make, and Patch
Для тестов необходимы:	None
Необходимо установить перед:	None
Необязательные зависимости:	None

Coreutils

Для установки необходимы:	Bash, Binutils, Coreutils, GCC, Gettext, Glibc, GMP, Grep, Make, Patch, Perl, Sed, and Texinfo
Для тестов необходимы:	Diffutils, E2fsprogs, Findutils, Shadow, and Util-linux
Необходимо установить перед:	Bash, Diffutils, Findutils, Man-DB, and Udev
Необязательные зависимости:	Perl Expect and IO:Tty modules (for test suite)

DejaGNU

Для установки необходимы:	Bash, Coreutils, Diffutils, GCC, Grep, Make, and Sed
Для тестов необходимы:	No test suite available
Необходимо установить перед:	None
Необязательные зависимости:	None

Diffutils

Для установки необходимы:	Bash, Binutils, Coreutils, Gawk, GCC, Gettext, Glibc, Grep, Make, Sed, and Texinfo
Для тестов необходимы:	Diffutils, Perl
Необходимо установить перед:	None
Необязательные зависимости:	None

Expect

Для установки необходимы:	Bash, Binutils, Coreutils, Diffutils, GCC, Glibc, Grep, Make, Patch, Sed, and Tcl
Для тестов необходимы:	None
Необходимо установить перед:	None
Необязательные зависимости:	None

E2fsprogs

Для установки необходимы:	Bash, Binutils, Coreutils, Diffutils, Gawk, GCC, Glibc, Grep, Gzip, Make, Sed, Texinfo, and Util-linux
Для тестов необходимы:	Procps-ng,Psmisc
Необходимо установить перед:	None
Необязательные зависимости:	None

File

Для установки необходимы:	Bash, Binutils, Coreutils, Diffutils, Gawk, GCC, Glibc, Grep, Make, Sed, and Zlib
Для тестов необходимы:	None
Необходимо установить перед:	None
Необязательные зависимости:	None

Findutils

Для установки необходимы:	Bash, Binutils, Coreutils, GCC, Gettext, Glibc, Grep, Make, Sed, and Texinfo
Для тестов необходимы:	DejaGNU, Diffutils, and Expect
Необходимо установить перед:	None
Необязательные зависимости:	None

Flex

Для установки необходимы:	Bash, Binutils, Coreutils, GCC, Gettext, Glibc, Grep, M4, Make, Patch, Sed, and Texinfo
Для тестов необходимы:	Bison and Gawk
Необходимо установить перед:	IPRoute2, Kbd, and Man-DB
Необязательные зависимости:	None

Gawk

Для установки необходимы:	Bash, Binutils, Coreutils, GCC, Gettext, Glibc, Grep, Make, Patch, Sed and, Texinfo
Для тестов необходимы:	Diffutils
Необходимо установить перед:	None
Необязательные зависимости:	None

Gcc

Для установки необходимы:	Bash, Binutils, Coreutils, Diffutils, Findutils, Gawk, GCC, Gettext, Glibc, GMP, Grep, M4, Make, MPC, MPFR, Patch, Perl, Sed, Tar, and Texinfo
Для тестов необходимы:	DejaGNU and Expect
Необходимо установить перед:	None
Необязательные зависимости:	*CLooG-PPL*, *GNAT* and *PPL*

GDBM

Для установки необходимы:	Bash, Binutils, Coreutils, Diffutils, GCC, Grep, Make, and Sed
Для тестов необходимы:	None
Необходимо установить перед:	None
Необязательные зависимости:	None

Gettext

Для установки необходимы:	Bash, Binutils, Coreutils, Gawk, GCC, Glibc, Grep, Make, Sed, and Texinfo
Для тестов необходимы:	Diffutils, Perl, and Tcl
Необходимо установить перед:	Automake
Необязательные зависимости:	None

Glibc

Для установки необходимы:	Bash, Binutils, Coreutils, Diffutils, Gawk, GCC, Gettext, Grep, Gzip, Linux API Headers, Make, Perl, Sed, and Texinfo
Для тестов необходимы:	File
Необходимо установить перед:	None
Необязательные зависимости:	None

GMP

Для установки необходимы:	Bash, Binutils, Coreutils, Diffutils, Gawk, GCC, Glibc, Grep, M4, Make, Sed and Texinfo
Для тестов необходимы:	None
Необходимо установить перед:	MPFR, GCC
Необязательные зависимости:	None

Grep

Для установки необходимы:	Bash, Binutils, Coreutils, Diffutils, GCC, Gettext, Glibc, Grep, Make, Patch, Sed, and Texinfo
Для тестов необходимы:	Gawk
Необходимо установить перед:	Man-DB
Необязательные зависимости:	Pcre, Xorg, and CUPS

Groff

Для установки необходимы:	Bash, Binutils, Bison, Coreutils, Gawk, GCC, Glibc, Grep, Make, Patch, Sed, and Texinfo
Для тестов необходимы:	No test suite available
Необходимо установить перед:	Man-DB and Perl
Необязательные зависимости:	GPL Ghostscript

GRUB

Для установки необходимы:	Bash, Binutils, Bison, Coreutils, Diffutils, GCC, Gettext, Glibc, Grep, Make, Ncurses, Sed, Texinfo, and Xz
Для тестов необходимы:	None
Необходимо установить перед:	None
Необязательные зависимости:	None

Gzip

Для установки необходимы:	Bash, Binutils, Coreutils, GCC, Glibc, Grep, Make, Sed, and Texinfo
Для тестов необходимы:	Diffutils. Less
Необходимо установить перед:	Man-DB
Необязательные зависимости:	None

Iana-Etc

Для установки необходимы:	Coreutils, Gawk, and Make
Для тестов необходимы:	No test suite available
Необходимо установить перед:	Perl
Необязательные зависимости:	None

Inetutils

Для установки необходимы:	Bash, Binutils, Coreutils, GCC, Glibc, Grep, Make, Ncurses, Patch, Sed, Texinfo, and Zlib
Для тестов необходимы:	No test suite available
Необходимо установить перед:	Tar
Необязательные зависимости:	None

IProute2

Для установки необходимы:	Bash, Bison, Coreutils, Flex, GCC, Glibc, Make, and Linux API Headers
Для тестов необходимы:	No test suite available
Необходимо установить перед:	None
Необязательные зависимости:	None

Kbd

Для установки необходимы:	Bash, Binutils, Bison, Coreutils, Flex, GCC, Gettext, Glibc, Gzip, Make, Patch, and Sed
Для тестов необходимы:	No test suite available
Необходимо установить перед:	None
Необязательные зависимости:	None

Kmod

Для установки необходимы:	Bash, Binutils, Bison, Coreutils, Flex, GCC, Gettext, Glibc, Gzip, Make, Sed, Xz-Utils, Zlib
Для тестов необходимы:	No test suite available
Необходимо установить перед:	Udev
Необязательные зависимости:	None

Less

Для установки необходимы:	Bash, Binutils, Coreutils, Diffutils, GCC, Glibc, Grep, Make, Ncurses, and Sed
Для тестов необходимы:	No test suite available
Необходимо установить перед:	Gzip
Необязательные зависимости:	Pcre

Libpipeline

Для установки необходимы:	Bash, Binutils, Coreutils, Diffutils, Gawk, GCC, Glibc, Grep, Make, Sed, and Texinfo
Для тестов необходимы:	No test suite available
Необходимо установить перед:	Man-DB
Необязательные зависимости:	None

Libtool

Для установки необходимы:	Bash, Binutils, Coreutils, Diffutils, Gawk, GCC, Glibc, Grep, Make, Sed, and Texinfo
Для тестов необходимы:	Findutils
Необходимо установить перед:	None
Необязательные зависимости:	None

Linux Kernel

Для установки необходимы:	Bash, Binutils, Coreutils, Diffutils, Findutils, GCC, Glibc, Grep, Gzip, Kmod, Make, Ncurses, Perl, and Sed
Для тестов необходимы:	No test suite available
Необходимо установить перед:	None
Необязательные зависимости:	None

M4

Для установки необходимы:	Bash, Binutils, Coreutils, GCC, Glibc, Grep, Make, Sed, and Texinfo
Для тестов необходимы:	Diffutils
Необходимо установить перед:	Autoconf and Bison
Необязательные зависимости:	libsigsegv

Make

Для установки необходимы:	Bash, Binutils, Coreutils, GCC, Gettext, Glibc, Grep, Make, Sed, and Texinfo
Для тестов необходимы:	Perl and Procps-ng
Необходимо установить перед:	None
Необязательные зависимости:	None

Man-DB

Для установки необходимы:	Bash, Binutils, Bzip2, Coreutils, Flex, GCC, GDBM, Gettext, Glibc, Grep, Groff, Gzip, Less, Libpipeline, Make, Sed, and Xz
Для тестов необходимы:	Not run. Requires Man-DB test suite package
Необходимо установить перед:	None
Необязательные зависимости:	None

Man-Pages

Для установки необходимы:	Bash, Coreutils, and Make
Для тестов необходимы:	No test suite available
Необходимо установить перед:	None
Необязательные зависимости:	None

MPC

Для установки необходимы:	Bash, Binutils, Coreutils, Diffutils, Gawk, GCC, Glibc, Grep, GMP, Make, MPFR, Sed and Texinfo
Для тестов необходимы:	None
Необходимо установить перед:	GCC
Необязательные зависимости:	None

MPFR

Для установки необходимы:	Bash, Binutils, Coreutils, Diffutils, Gawk, GCC, Glibc, Grep, GMP, Make, Sed and Texinfo
Для тестов необходимы:	None
Необходимо установить перед:	GCC
Необязательные зависимости:	None

Ncurses

Для установки необходимы:	Bash, Binutils, Coreutils, Diffutils, Gawk, GCC, Glibc, Grep, Make, Patch, and Sed
Для тестов необходимы:	No test suite available
Необходимо установить перед:	Bash, GRUB, Inetutils, Less, Procps-ng, Psmisc, Readline, Texinfo, Util-linux, and Vim
Необязательные зависимости:	None

Patch

Для установки необходимы:	Bash, Binutils, Coreutils, GCC, Glibc, Grep, Make, and Sed
Для тестов необходимы:	No test suite available
Необходимо установить перед:	None
Необязательные зависимости:	Ed

Perl

Для установки необходимы:	Bash, Binutils, Coreutils, Gawk, GCC, GDBM, Glibc, Grep, Groff, Make, Sed, and Zlib
Для тестов необходимы:	Iana-Etc and Procps-ng
Необходимо установить перед:	Autoconf
Необязательные зависимости:	None

Pkg-config

Для установки необходимы:	Bash, Binutils, Coreutils, Gawk, GCC, Glibc, Grep, Make, Popt, and Sed
Для тестов необходимы:	None
Необходимо установить перед:	Kmod
Необязательные зависимости:	None

Popt

Для установки необходимы:	Bash, Binutils, Coreutils, Gawk, GCC, Glibc, Grep, Make
Для тестов необходимы:	Diffutils and Sed
Необходимо установить перед:	Pkg-config
Необязательные зависимости:	None

Procps-ng

Для установки необходимы:	Bash, Binutils, Coreutils, GCC, Glibc, Make, and Ncurses
Для тестов необходимы:	DejaGNU
Необходимо установить перед:	None
Необязательные зависимости:	None

Psmisc

Для установки необходимы:	Bash, Binutils, Coreutils, GCC, Gettext, Glibc, Grep, Make, Ncurses, and Sed
Для тестов необходимы:	No test suite available
Необходимо установить перед:	None
Необязательные зависимости:	None

Readline

Для установки необходимы:	Bash, Binutils, Coreutils, Gawk, GCC, Glibc, Grep, Make, Ncurses, Patch, Sed, and Texinfo
Для тестов необходимы:	No test suite available
Необходимо установить перед:	Bash
Необязательные зависимости:	None

Sed

Для установки необходимы:	Bash, Binutils, Coreutils, GCC, Gettext, Glibc, Grep, Make, Sed, and Texinfo
Для тестов необходимы:	Diffutils and Gawk
Необходимо установить перед:	E2fsprogs, File, Libtool, and Shadow
Необязательные зависимости:	Cracklib

Shadow

Для установки необходимы:	Bash, Binutils, Coreutils, Diffutils, Findutils, Gawk, GCC, Gettext, Glibc, Grep, Make, and Sed
Для тестов необходимы:	No test suite available
Необходимо установить перед:	Coreutils
Необязательные зависимости:	Acl, Attr, Cracklib, PAM

Sysklogd

Для установки необходимы:	Binutils, Coreutils, GCC, Glibc, Make, and Patch
Для тестов необходимы:	No test suite available
Необходимо установить перед:	None
Необязательные зависимости:	None

Sysvinit

Для установки необходимы:	Binutils, Coreutils, GCC, Glibc, Make, and Sed
Для тестов необходимы:	No test suite available
Необходимо установить перед:	None
Необязательные зависимости:	None

Tar

Для установки необходимы:	Bash, Binutils, Bison, Coreutils, GCC, Gettext, Glibc, Grep, Inetutils, Make, Sed, and Texinfo
Для тестов необходимы:	Autoconf, Diffutils, Findutils, Gawk, and Gzip
Необходимо установить перед:	None
Необязательные зависимости:	None

Tcl

Для установки необходимы:	Bash, Binutils, Coreutils, Diffutils, GCC, Glibc, Grep, Make, and Sed
Для тестов необходимы:	None
Необходимо установить перед:	None
Необязательные зависимости:	None

Texinfo

Для установки необходимы:	Bash, Binutils, Coreutils, GCC, Gettext, Glibc, Grep, Make, Ncurses, Patch, and Sed
Для тестов необходимы:	None
Необходимо установить перед:	None
Необязательные зависимости:	None

Udev

Для установки необходимы:	Bash, Binutils, Coreutils, Diffutils, Gawk, GCC, Glibc, Grep, Kmod, Make, and Sed
Для тестов необходимы:	No test suite available
Необходимо установить перед:	None
Необязательные зависимости:	Glib, Pci-Utils, Python, Systemd, USB-Utils

Util-linux

Для установки необходимы:	Bash, Binutils, Coreutils, Diffutils, Findutils, Gawk, GCC, Gettext, Glibc, Grep, Make, Ncurses, Sed, and Zlib
Для тестов необходимы:	No test suite available
Необходимо установить перед:	None
Необязательные зависимости:	None

Vim

Для установки необходимы:	Bash, Binutils, Coreutils, Diffutils, GCC, Glibc, Grep, Make, Ncurses, and Sed
Для тестов необходимы:	None
Необходимо установить перед:	None
Необязательные зависимости:	Xorg, GTK+2, LessTif, Python, Tcl, Ruby, and GPM

Xz

Для установки необходимы:	Bash, Binutils, Coreutils, Diffutils, GCC, Glibc, and Make.
Для тестов необходимы:	None
Необходимо установить перед:	GRUB, Kmod, Man-DB, Udev
Необязательные зависимости:	None

Zlib

Для установки необходимы:	Bash, Binutils, Coreutils, GCC, Glibc, Make, and Sed
Для тестов необходимы:	None
Необходимо установить перед:	File, Kmod, Perl, and Util-linux
Необязательные зависимости:	None

Приложение D. Загрузочные и конфигурационные скрипты версии 20130123

Скрипты в этом приложении сгруппированы по каталогам, в которых они располагаются. Порядок каталогов такой: /etc/rc.d/init.d, /etc/sysconfig, /etc/sysconfig/network-devices и /etc/sysconfig/network-devices/services. Внутри каждой секции скрипты перечисляются в том же порядке, в котором они обычно выполняются.

D.1. /etc/rc.d/init.d/rc

Скрипт rc – самый первый скрипт, который вызывается init и начинает процесс инициализации системы.

```
#!/bin/bash
########################################################################
# Begin rc
#
# Description : Main Run Level Control Script
#
# Authors     : Gerard Beekmans  - gerard@linuxfromscratch.org
#             : DJ Lucas - dj@linuxfromscratch.org
# Update      : Bruce Dubbs - bdubbs@linuxfromscratch.org
#
# Version     : LFS 7.0
#
########################################################################

. /lib/lsb/init-functions

print_error_msg()
{
   log_failure_msg
   # $i is set when called
   MSG="FAILURE:\n\nYou should not be reading this error message.\n\n"
   MSG="${MSG}It means that an unforeseen error took place in\n"
   MSG="${MSG}${i},\n"
   MSG="${MSG}which exited with a return value of ${error_value}.\n"

   MSG="${MSG}If you're able to track this error down to a bug in one of\n"
   MSG="${MSG}the files provided by the files provided by\n"
   MSG="${MSG}the ${DISTRO_MINI} book, please be so kind to inform us at\n"
   MSG="${MSG}${DISTRO_CONTACT}.\n"
   log_failure_msg "${MSG}"

   log_info_msg "Press Enter to continue..."
   wait_for_user
}

check_script_status()
{
   # $i is set when called
   if [ ! -f ${i} ]; then
      log_warning_msg "${i} is not a valid symlink."
      continue
```

```
    fi

    if [ ! -x ${i} ]; then
        log_warning_msg "${i} is not executable, skipping."
        continue
    fi
}

run()
{
    if [ -z $interactive ]; then
        ${1} ${2}
        return $?
    fi

    while true; do
        read -p "Run ${1} ${2} (Yes/no/continue)? " -n 1 runit
        echo

        case ${runit} in
            c | C)
                interactive=""
                ${i} ${2}
                ret=${?}
                break;
                ;;

            n | N)
                return 0
                ;;

            y | Y)
                ${i} ${2}
                ret=${?}
                break
                ;;
        esac
    done

    return $ret
}

# Read any local settings/overrides
[ -r /etc/sysconfig/rc.site ] && source /etc/sysconfig/rc.site

DISTRO=${DISTRO:-"Linux From Scratch"}
DISTRO_CONTACT=${DISTRO_CONTACT:-"lfs-dev@linuxfromscratch.org (Registration required)"}
DISTRO_MINI=${DISTRO_MINI:-"LFS"}
IPROMPT=${IPROMPT:-"no"}

# These 3 signals will not cause our script to exit
trap "" INT QUIT TSTP

[ "${1}" != "" ] && runlevel=${1}

if [ "${runlevel}" == "" ]; then
    echo "Usage: ${0} <runlevel>" >&2
    exit 1
fi

previous=${PREVLEVEL}
```

```
[ "${previous}" == "" ] && previous=N

if [ ! -d /etc/rc.d/rc${runlevel}.d ]; then
    log_info_msg "/etc/rc.d/rc${runlevel}.d does not exist.\n"
    exit 1
fi

if [ "$runlevel" == "6" -o "$runlevel" == "0" ]; then IPROMPT="no"; fi

# Note: In ${LOGLEVEL:-7}, it is ':' 'dash' '7', not minus 7
if [ "$runlevel" == "S" ]; then
    [ -r /etc/sysconfig/console ] && source /etc/sysconfig/console
    dmesg -n "${LOGLEVEL:-7}"
fi

if [ "${IPROMPT}" == "yes" -a "${runlevel}" == "S" ]; then
    # The total length of the distro welcome string, without escape codes
    wlen=${wlen:-$(echo "Welcome to ${DISTRO}" | wc -c )}
    welcome_message=${welcome_message:-"Welcome to ${INFO}${DISTRO}${NORMAL}"}

    # The total length of the interactive string, without escape codes
    ilen=${ilen:-$(echo "Press 'I' to enter interactive startup" | wc -c )}
    i_message=${i_message:-"Press '${FAILURE}I${NORMAL}' to enter interactive startup"}


    # dcol and icol are spaces before the message to center the message
    # on screen. itime is the amount of wait time for the user to press a key
    wcol=$(( ( ${COLUMNS} - ${wlen} ) / 2 ))
    icol=$(( ( ${COLUMNS} - ${ilen} ) / 2 ))
    itime=${itime:-"3"}

    echo -e "\n\n"
    echo -e "\\033[${wcol}G${welcome_message}"
    echo -e "\\033[${icol}G${i_message}${NORMAL}"
    echo ""
    read -t "${itime}" -n 1 interactive 2>&1 > /dev/null
fi

# Make lower case
[ "${interactive}" == "I" ] && interactive="i"
[ "${interactive}" != "i" ] && interactive=""

# Read the state file if it exists from runlevel S
[ -r /var/run/interactive ] && source /var/run/interactive

# Attempt to stop all services started by the previous runlevel,
# and killed in this runlevel
if [ "${previous}" != "N" ]; then
    for i in $(ls -v /etc/rc.d/rc${runlevel}.d/K* 2> /dev/null)
    do
        check_script_status

        suffix=${i#/etc/rc.d/rc$runlevel.d/K[0-9][0-9]}
        prev_start=/etc/rc.d/rc$previous.d/S[0-9][0-9]$suffix
        sysinit_start=/etc/rc.d/rcS.d/S[0-9][0-9]$suffix

        if [ "${runlevel}" != "0" -a "${runlevel}" != "6" ]; then
            if [ ! -f ${prev_start} -a  ! -f ${sysinit_start} ]; then
                MSG="WARNING:\n\n${i} can't be "
                MSG="${MSG}executed because it was not "
                MSG="${MSG}not started in the previous "
```

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```
                MSG="${MSG}runlevel (${previous})."
                log_warning_msg "$MSG"
                continue
            fi
        fi

        run ${i} stop
        error_value=${?}

        if [ "${error_value}" != "0" ]; then print_error_msg; fi
    done
fi

if [ "${previous}" == "N" ]; then export IN_BOOT=1; fi

if [ "$runlevel" == "6" -a -n "${FASTBOOT}" ]; then
    touch /fastboot
fi


# Start all functions in this runlevel
for i in $( ls -v /etc/rc.d/rc${runlevel}.d/S* 2> /dev/null)
do
    if [ "${previous}" != "N" ]; then
        suffix=${i#/etc/rc.d/rc$runlevel.d/S[0-9][0-9]}
        stop=/etc/rc.d/rc$runlevel.d/K[0-9][0-9]$suffix
        prev_start=/etc/rc.d/rc$previous.d/S[0-9][0-9]$suffix

        [ -f ${prev_start} -a ! -f ${stop} ] && continue
    fi

    check_script_status

    case ${runlevel} in
        0|6)
            run ${i} stop
            ;;
        *)
            run ${i} start
            ;;
    esac

    error_value=${?}

    if [ "${error_value}" != "0" ]; then print_error_msg; fi
done

# Store interactive variable on switch from runlevel S and remove if not
if [ "${runlevel}" == "S" -a "${interactive}" == "i" ]; then
    echo "interactive=\"i\"" > /var/run/interactive
else
    rm -f /var/run/interactive 2> /dev/null
fi

# Copy the boot log on initial boot only
if [ "${previous}" == "N" -a  "${runlevel}" != "S" ]; then
    cat /run/var/bootlog >> /var/log/boot.log

    # Mark the end of boot
    echo "--------" >> /var/log/boot.log
```

```
    # Remove the temporary file
    rm -f /run/var/bootlog 2> /dev/null
fi

# End rc
```

D.2. /lib/lsb/init-functions

```
#!/bin/sh
########################################################################
#
# Begin /lib/lsb/init-funtions
#
# Description : Run Level Control Functions
#
# Authors     : Gerard Beekmans - gerard@linuxfromscratch.org
#             : DJ Lucas - dj@linuxfromscratch.org
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#
# Version     : LFS 7.0
#
# Notes       : With code based on Matthias Benkmann's simpleinit-msb
#               http://winterdrache.de/linux/newboot/index.html
#
#               The file should be located in /lib/lsb
#
########################################################################

## Environmental setup
# Setup default values for environment
umask 022
export PATH="/bin:/usr/bin:/sbin:/usr/sbin"

## Screen Dimensions
# Find current screen size
if [ -z "${COLUMNS}" ]; then
    COLUMNS=$(stty size)
    COLUMNS=${COLUMNS##* }
fi

# When using remote connections, such as a serial port, stty size returns 0
if [ "${COLUMNS}" = "0" ]; then
    COLUMNS=80
fi

## Measurements for positioning result messages
COL=$((${COLUMNS} - 8))
WCOL=$((${COL} - 2))

## Set Cursor Position Commands, used via echo
SET_COL="\\033[${COL}G"      # at the $COL char
SET_WCOL="\\033[${WCOL}G"    # at the $WCOL char
CURS_UP="\\033[1A\\033[0G"   # Up one line, at the 0'th char
CURS_ZERO="\\033[0G"

## Set color commands, used via echo
# Please consult `man console_codes for more information
# under the "ECMA-48 Set Graphics Rendition" section
#
# Warning: when switching from a 8bit to a 9bit font,
```

```
# the linux console will reinterpret the bold (1;) to
# the top 256 glyphs of the 9bit font.  This does
# not affect framebuffer consoles

NORMAL="\\033[0;39m"          # Standard console grey
SUCCESS="\\033[1;32m"         # Success is green
WARNING="\\033[1;33m"         # Warnings are yellow
FAILURE="\\033[1;31m"         # Failures are red
INFO="\\033[1;36m"            # Information is light cyan
BRACKET="\\033[1;34m"         # Brackets are blue


# Use a colored prefix
BMPREFIX="        "
SUCCESS_PREFIX="${SUCCESS}  *  ${NORMAL}"
FAILURE_PREFIX="${FAILURE}*****${NORMAL}"
WARNING_PREFIX="${WARNING} *** ${NORMAL}"


SUCCESS_SUFFIX="${BRACKET}[${SUCCESS}  OK  ${BRACKET}]${NORMAL}"
FAILURE_SUFFIX="${BRACKET}[${FAILURE} FAIL ${BRACKET}]${NORMAL}"
WARNING_SUFFIX="${BRACKET}[${WARNING} WARN ${BRACKET}]${NORMAL}"


BOOTLOG=/run/var/bootlog
KILLDELAY=3

# Set any user specified environment variables e.g. HEADLESS
[ -r /etc/sysconfig/rc.site ]  && . /etc/sysconfig/rc.site


################################################################################
# start_daemon()                                                               #
# Usage: start_daemon [-f] [-n nicelevel] [-p pidfile] pathname [args...]      #
#                                                                              #
# Purpose: This runs the specified program as a daemon                         #
#                                                                              #
# Inputs: -f: (force) run the program even if it is already running.           #
#         -n nicelevel: specify a nice level. See 'man nice(1)'.               #
#         -p pidfile: use the specified file to determine PIDs.                #
#         pathname: the complete path to the specified program                 #
#         args: additional arguments passed to the program (pathname)          #
#                                                                              #
# Return values (as defined by LSB exit codes):                                #
#       0 - program is running or service is OK                                #
#       1 - generic or unspecified error                                       #
#       2 - invalid or excessive argument(s)                                   #
#       5 - program is not installed                                           #
################################################################################
start_daemon()
{
    local force=""
    local nice="0"
    local pidfile=""
    local pidlist=""
    local retval=""


    # Process arguments
    while true
    do
        case "${1}" in

            -f)
                force="1"
                shift 1
```

```
                        ;;

            -n)
                nice="${2}"
                shift 2
                ;;

            -p)
                pidfile="${2}"
                shift 2
                ;;

            -*)
                return 2
                ;;

            *)
                program="${1}"
                break
                ;;
        esac
    done

    # Check for a valid program
    if [ ! -e "${program}" ]; then return 5; fi

    # Execute
    if [ -z "${force}" ]; then
        if [ -z "${pidfile}" ]; then
            # Determine the pid by discovery
            pidlist=`pidofproc "${1}"`
            retval="${?}"
        else
            # The PID file contains the needed PIDs
            # Note that by LSB requirement, the path must be given to pidofproc,
            # however, it is not used by the current implementation or standard.
            pidlist=`pidofproc -p "${pidfile}" "${1}"`
            retval="${?}"
        fi

        # Return a value ONLY
        # It is the init script's (or distribution's functions) responsibilty
        # to log messages!
        case "${retval}" in

            0)
                # Program is already running correctly, this is a
                # successful start.
                return 0
                ;;

            1)
                # Program is not running, but an invalid pid file exists
                # remove the pid file and continue
                rm -f "${pidfile}"
                ;;

            3)
                # Program is not running and no pidfile exists
                # do nothing here, let start_deamon continue.
                ;;
```

```
            *)
                    # Others as returned by status values shall not be interpreted
                    # and returned as an unspecified error.
                    return 1
                    ;;
        esac
    fi

    # Do the start!
    nice -n "${nice}" "${@}"
}


################################################################################
# killproc()                                                                   #
# Usage: killproc [-p pidfile] pathname [signal]                               #
#                                                                              #
# Purpose: Send control signals to running processes                           #
#                                                                              #
# Inputs: -p pidfile, uses the specified pidfile                               #
#         pathname, pathname to the specified program                          #
#         signal, send this signal to pathname                                 #
#                                                                              #
# Return values (as defined by LSB exit codes):                                #
#       0 - program (pathname) has stopped/is already stopped or a             #
#           running program has been sent specified signal and stopped         #
#           successfully                                                       #
#       1 - generic or unspecified error                                       #
#       2 - invalid or excessive argument(s)                                   #
#       5 - program is not installed                                           #
#       7 - program is not running and a signal was supplied                   #
################################################################################
killproc()
{
    local pidfile
    local program
    local prefix
    local progname
    local signal="-TERM"
    local fallback="-KILL"
    local nosig
    local pidlist
    local retval
    local pid
    local delay="30"
    local piddead
    local dtime

    # Process arguments
    while true; do
        case "${1}" in
            -p)
                    pidfile="${2}"
                    shift 2
                    ;;

             *)
                    program="${1}"
                    if [ -n "${2}" ]; then
                        signal="${2}"
                        fallback=""
```

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```
                else
                    nosig=1
                fi

                # Error on additional arguments
                if [ -n "${3}" ]; then
                    return 2
                else
                    break
                fi
                ;;
    esac
done

# Check for a valid program
if [ ! -e "${program}" ]; then return 5; fi

# Check for a valid signal
check_signal "${signal}"
if [ "${?}" -ne "0" ]; then return 2; fi

# Get a list of pids
if [ -z "${pidfile}" ]; then
    # determine the pid by discovery
    pidlist=`pidofproc "${1}"`
    retval="${?}"
else
    # The PID file contains the needed PIDs
    # Note that by LSB requirement, the path must be given to pidofproc,
    # however, it is not used by the current implementation or standard.
    pidlist=`pidofproc -p "${pidfile}" "${1}"`
    retval="${?}"
fi

# Return a value ONLY
# It is the init script's (or distribution's functions) responsibilty
# to log messages!
case "${retval}" in

    0)
        # Program is running correctly
        # Do nothing here, let killproc continue.
        ;;

    1)
        # Program is not running, but an invalid pid file exists
        # Remove the pid file.
        rm -f "${pidfile}"

        # This is only a success if no signal was passed.
        if [ -n "${nosig}" ]; then
            return 0
        else
            return 7
        fi
        ;;

    3)
        # Program is not running and no pidfile exists
        # This is only a success if no signal was passed.
        if [ -n "${nosig}" ]; then
```

```
                return 0
            else
                return 7
            fi
            ;;

    *)
            # Others as returned by status values shall not be interpreted
            # and returned as an unspecified error.
            return 1
            ;;
esac

# Perform different actions for exit signals and control signals
check_sig_type "${signal}"

if [ "${?}" -eq "0" ]; then # Signal is used to terminate the program

    # Account for empty pidlist (pid file still exists and no
    # signal was given)
    if [ "${pidlist}" != "" ]; then

        # Kill the list of pids
        for pid in ${pidlist}; do

            kill -0 "${pid}" 2> /dev/null

            if [ "${?}" -ne "0" ]; then
                # Process is dead, continue to next and assume all is well
                continue
            else
                kill "${signal}" "${pid}" 2> /dev/null

                # Wait up to ${delay}/10 seconds to for "${pid}" to
                # terminate in 10ths of a second

                while [ "${delay}" -ne "0" ]; do
                    kill -0 "${pid}" 2> /dev/null || piddead="1"
                    if [ "${piddead}" = "1" ]; then break; fi
                    sleep 0.1
                    delay="$(( ${delay} - 1 ))"
                done

                # If a fallback is set, and program is still running, then
                # use the fallback
                if [ -n "${fallback}" -a "${piddead}" != "1" ]; then
                    kill "${fallback}" "${pid}" 2> /dev/null
                    sleep 1
                    # Check again, and fail if still running
                    kill -0 "${pid}" 2> /dev/null && return 1
                fi
            fi
        done
    fi

    # Check for and remove stale PID files.
    if [ -z "${pidfile}" ]; then
        # Find the basename of $program
        prefix=`echo "${program}" | sed 's/[^/]*$//'`
        progname=`echo "${program}" | sed "s@${prefix}@@"`
```

```
                if [ -e "/var/run/${progname}.pid" ]; then
                    rm -f "/var/run/${progname}.pid" 2> /dev/null
                fi
            else
                if [ -e "${pidfile}" ]; then rm -f "${pidfile}" 2> /dev/null; fi
            fi

        # For signals that do not expect a program to exit, simply
        # let kill do it's job, and evaluate kills return for value

        else # check_sig_type - signal is not used to terminate program
            for pid in ${pidlist}; do
                kill "${signal}" "${pid}"
                if [ "${?}" -ne "0" ]; then return 1; fi
            done
        fi
}

################################################################################
# pidofproc()                                                                  #
# Usage: pidofproc [-p pidfile] pathname                                       #
#                                                                              #
# Purpose: This function returns one or more pid(s) for a particular daemon    #
#                                                                              #
# Inputs: -p pidfile, use the specified pidfile instead of pidof              #
#         pathname, path to the specified program                             #
#                                                                              #
# Return values (as defined by LSB status codes):                             #
#       0 - Success (PIDs to stdout)                                           #
#       1 - Program is dead, PID file still exists (remaining PIDs output)    #
#       3 - Program is not running (no output)                                #
################################################################################
pidofproc()
{
    local pidfile
    local program
    local prefix
    local progname
    local pidlist
    local lpids
    local exitstatus="0"

    # Process arguments
    while true; do
        case "${1}" in

            -p)
                pidfile="${2}"
                shift 2
                ;;

            *)
                program="${1}"
                if [ -n "${2}" ]; then
                    # Too many arguments
                    # Since this is status, return unknown
                    return 4
                else
                    break
                fi
                ;;
```

```
            esac
    done

    # If a PID file is not specified, try and find one.
    if [ -z "${pidfile}" ]; then
        # Get the program's basename
        prefix=`echo "${program}" | sed 's/[^/]*$//'`

        if [ -z "${prefix}" ]; then
            progname="${program}"
        else
            progname=`echo "${program}" | sed "s@${prefix}@@"`
        fi

        # If a PID file exists with that name, assume that is it.
        if [ -e "/var/run/${progname}.pid" ]; then
            pidfile="/var/run/${progname}.pid"
        fi
    fi

    # If a PID file is set and exists, use it.
    if [ -n "${pidfile}" -a -e "${pidfile}" ]; then

        # Use the value in the first line of the pidfile
        pidlist=`/bin/head -n1 "${pidfile}"`
        # This can optionally be written as 'sed 1q' to repalce 'head -n1'
        # should LFS move /bin/head to /usr/bin/head
    else
        # Use pidof
        pidlist=`pidof "${program}"`
    fi

    # Figure out if all listed PIDs are running.
    for pid in ${pidlist}; do
        kill -0 ${pid} 2> /dev/null

        if [ "${?}" -eq "0" ]; then
            lpids="${lpids}${pid} "
        else
            exitstatus="1"
        fi
    done

    if [ -z "${lpids}" -a ! -f "${pidfile}" ]; then
        return 3
    else
        echo "${lpids}"
        return "${exitstatus}"
    fi
}

################################################################################
# statusproc()                                                                 #
# Usage: statusproc [-p pidfile] pathname                                      #
#                                                                              #
# Purpose: This function prints the status of a particular daemon to stdout    #
#                                                                              #
# Inputs: -p pidfile, use the specified pidfile instead of pidof               #
#         pathname, path to the specified program                             #
#                                                                              #
# Return values:                                                               #
```

```
#         0 - Status printed                                                  #
#         1 - Input error. The daemon to check was not specified.             #
###############################################################################
statusproc()
{
    local pidfile
    local pidlist

    if [ "${#}" = "0" ]; then
        echo "Usage: statusproc [-p pidfle] {program}"
        exit 1
    fi

    # Process arguments
    while true; do
        case "${1}" in

            -p)
                pidfile="${2}"
                shift 2
                ;;

            *)
                if [ -n "${2}" ]; then
                    echo "Too many arguments"
                    return 1
                else
                    break
                fi
                ;;
        esac
    done

    if [ -n "${pidfile}" ]; then
        pidlist=`pidofproc -p "${pidfile}" $@`
    else
        pidlist=`pidofproc $@`
    fi

    # Trim trailing blanks
    pidlist=`echo "${pidlist}" | sed -r 's/ +$//'`

    base="${1##*/}"

    if [ -n "${pidlist}" ]; then
        /bin/echo -e "${INFO}${base} is running with Process" \
            "ID(s) ${pidlist}.${NORMAL}"
    else
        if [ -n "${base}" -a -e "/var/run/${base}.pid" ]; then
            /bin/echo -e "${WARNING}${1} is not running but" \
                "/var/run/${base}.pid exists.${NORMAL}"
        else
            if [ -n "${pidfile}" -a -e "${pidfile}" ]; then
                /bin/echo -e "${WARNING}${1} is not running" \
                    "but ${pidfile} exists.${NORMAL}"
            else
                /bin/echo -e "${INFO}${1} is not running.${NORMAL}"
            fi
        fi
    fi
}
```

```
################################################################################
# timespec()                                                                   #
#                                                                              #
# Purpose: An internal utility function to format a timestamp                  #
#          a boot log file.  Sets the STAMP variable.                          #
#                                                                              #
# Return value: Not used                                                       #
################################################################################
timespec()
{
   STAMP="$(echo `date +"%b %d %T %:z"` `hostname`) "
   return 0
}


################################################################################
# log_success_msg()                                                            #
# Usage: log_success_msg ["message"]                                           #
#                                                                              #
# Purpose: Print a successful status message to the screen and                 #
#          a boot log file.                                                    #
#                                                                              #
# Inputs: $@ - Message                                                         #
#                                                                              #
# Return values: Not used                                                      #
################################################################################
log_success_msg()
{
    /bin/echo -n -e "${BMPREFIX}${@}"
    /bin/echo -e "${CURS_ZERO}${SUCCESS_PREFIX}${SET_COL}${SUCCESS_SUFFIX}"

    # Strip non-printable characters from log file
    logmessage=`echo "${@}" | sed 's/\\\033[^a-zA-Z]*.//g'`

    timespec
    /bin/echo -e "${STAMP} ${logmessage} OK" >> ${BOOTLOG}

    return 0
}

log_success_msg2()
{
    /bin/echo -n -e "${BMPREFIX}${@}"
    /bin/echo -e "${CURS_ZERO}${SUCCESS_PREFIX}${SET_COL}${SUCCESS_SUFFIX}"

    echo " OK" >> ${BOOTLOG}

    return 0
}


################################################################################
# log_failure_msg()                                                            #
# Usage: log_failure_msg ["message"]                                           #
#                                                                              #
# Purpose: Print a failure status message to the screen and                    #
#          a boot log file.                                                    #
#                                                                              #
# Inputs: $@ - Message                                                         #
#                                                                              #
# Return values: Not used                                                      #
################################################################################
```

```
log_failure_msg()
{
    /bin/echo -n -e "${BMPREFIX}${@}"
    /bin/echo -e "${CURS_ZERO}${FAILURE_PREFIX}${SET_COL}${FAILURE_SUFFIX}"

    # Strip non-printable characters from log file

    timespec
    logmessage=`echo "${@}" | sed 's/\\\033[^a-zA-Z]*.//g'`
    /bin/echo -e "${STAMP} ${logmessage} FAIL" >> ${BOOTLOG}

    return 0
}

log_failure_msg2()
{
    /bin/echo -n -e "${BMPREFIX}${@}"
    /bin/echo -e "${CURS_ZERO}${FAILURE_PREFIX}${SET_COL}${FAILURE_SUFFIX}"

    echo "FAIL" >> ${BOOTLOG}

    return 0
}

################################################################################
# log_warning_msg()                                                            #
# Usage: log_warning_msg ["message"]                                           #
#                                                                              #
# Purpose: Print a warning status message to the screen and                    #
#          a boot log file.                                                     #
#                                                                              #
# Return values: Not used                                                      #
################################################################################
log_warning_msg()
{
    /bin/echo -n -e "${BMPREFIX}${@}"
    /bin/echo -e "${CURS_ZERO}${WARNING_PREFIX}${SET_COL}${WARNING_SUFFIX}"

    # Strip non-printable characters from log file
    logmessage=`echo "${@}" | sed 's/\\\033[^a-zA-Z]*.//g'`
    timespec
    /bin/echo -e "${STAMP} ${logmessage} WARN" >> ${BOOTLOG}

    return 0
}

################################################################################
# log_info_msg()                                                               #
# Usage: log_info_msg message                                                  #
#                                                                              #
# Purpose: Print an information message to the screen and                      #
#          a boot log file.  Does not print a trailing newline character.      #
#                                                                              #
# Return values: Not used                                                      #
################################################################################
log_info_msg()
{
    /bin/echo -n -e "${BMPREFIX}${@}"

    # Strip non-printable characters from log file
    logmessage=`echo "${@}" | sed 's/\\\033[^a-zA-Z]*.//g'`
```

```
        timespec
        /bin/echo -n -e "${STAMP} ${logmessage}" >> ${BOOTLOG}

        return 0
}

log_info_msg2()
{
        /bin/echo -n -e "${@}"

        # Strip non-printable characters from log file
        logmessage=`echo "${@}" | sed 's/\\\033[^a-zA-Z]*.//g'`
        /bin/echo -n -e "${logmessage}" >> ${BOOTLOG}

        return 0
}

################################################################################
# evaluate_retval()                                                            #
# Usage: Evaluate a return value and print success or failyure as appropriate  #
#                                                                              #
# Purpose: Convenience function to terminate an info message                   #
#                                                                              #
# Return values: Not used                                                      #
################################################################################
evaluate_retval()
{
   local error_value="${?}"

   if [ ${error_value} = 0 ]; then
      log_success_msg2
   else
      log_failure_msg2
   fi
}

################################################################################
# check_signal()                                                               #
# Usage: check_signal [ -{signal} | {signal} ]                                 #
#                                                                              #
# Purpose: Check for a valid signal.  This is not defined by any LSB draft,    #
#          however, it is required to check the signals to determine if the    #
#          signals chosen are invalid arguments to the other functions.        #
#                                                                              #
# Inputs: Accepts a single string value in the form or -{signal} or {signal}   #
#                                                                              #
# Return values:                                                               #
#       0 - Success (signal is valid                                           #
#       1 - Signal is not valid                                                #
################################################################################
check_signal()
{
    local valsig

    # Add error handling for invalid signals
    valsig="-ALRM -HUP -INT -KILL -PIPE -POLL -PROF -TERM -USR1 -USR2"
    valsig="${valsig} -VTALRM -STKFLT -PWR -WINCH -CHLD -URG -TSTP -TTIN"
    valsig="${valsig} -TTOU -STOP -CONT -ABRT -FPE -ILL -QUIT -SEGV -TRAP"
    valsig="${valsig} -SYS -EMT -BUS -XCPU -XFSZ -0 -1 -2 -3 -4 -5 -6 -8 -9"
    valsig="${valsig} -11 -13 -14 -15"
```

```
        echo "${valsig}" | grep -- " ${1} " > /dev/null

    if [ "${?}" -eq "0" ]; then
        return 0
    else
        return 1
    fi
}

################################################################################
# check_sig_type()                                                             #
# Usage: check_signal [ -{signal} | {signal} ]                                 #
#                                                                              #
# Purpose: Check if signal is a program termination signal or a control signal #
#          This is not defined by any LSB draft, however, it is required to    #
#          check the signals to determine if they are intended to end a        #
#          program or simply to control it.                                    #
#                                                                              #
# Inputs: Accepts a single string value in the form or -{signal} or {signal}   #
#                                                                              #
# Return values:                                                               #
#       0 - Signal is used for program termination                            #
#       1 - Signal is used for program control                                #
################################################################################
check_sig_type()
{
    local valsig

    # The list of termination signals (limited to generally used items)
    valsig="-ALRM -INT -KILL -TERM -PWR -STOP -ABRT -QUIT -2 -3 -6 -9 -14 -15"

    echo "${valsig}" | grep -- " ${1} " > /dev/null

    if [ "${?}" -eq "0" ]; then
        return 0
    else
        return 1
    fi
}


################################################################################
# wait_for_user()                                                              #
#                                                                              #
# Purpose: Wait for the user to respond if not a headless system               #
#                                                                              #
################################################################################
wait_for_user()
{
   # Wait for the user by default
   [ "${HEADLESS=0}" = "0" ] && read ENTER
   return 0
}


################################################################################
# is_true()                                                                    #
#                                                                              #
# Purpose: Utility to test if a variable is true | yes | 1                     #
#                                                                              #
################################################################################
is_true()
{
```

```
    [ "$1" = "1" ] || [ "$1" = "yes" ] || [ "$1" = "true" ] ||  [ "$1" = "y" ] ||
    [ "$1" = "t" ]
}

# End /lib/lsb/init-functions
```

D.3. /etc/rc.d/init.d/functions

```
#!/bin/sh
########################################################################
# Begin boot functions
#
# Description : Run Level Control Functions
#
# Authors     : Gerard Beekmans - gerard@linuxfromscratch.org
# Update      : Bruce Dubbs - bdubbs@linuxfromscratch.org
#
# Version     : LFS 7.0
#
# Notes       : With code based on Matthias Benkmann's simpleinit-msb
#                 http://winterdrache.de/linux/newboot/index.html
#
#                 This file is only present for backward BLFS compatibility
#
########################################################################

## Environmental setup
# Setup default values for environment
umask 022
export PATH="/bin:/usr/bin:/sbin:/usr/sbin"

# Signal sent to running processes to refresh their configuration
RELOADSIG="HUP"

# Number of seconds between STOPSIG and FALLBACK when stopping processes
KILLDELAY="3"

## Screen Dimensions
# Find current screen size
if [ -z "${COLUMNS}" ]; then
   COLUMNS=$(stty size)
   COLUMNS=${COLUMNS##* }
fi

# When using remote connections, such as a serial port, stty size returns 0
if [ "${COLUMNS}" = "0" ]; then
   COLUMNS=80
fi

## Measurements for positioning result messages
COL=$((${COLUMNS} - 8))
WCOL=$((${COL} - 2))

## Provide an echo that supports -e and -n
# If formatting is needed, $ECHO should be used
case "`echo -e -n test`" in
   -[en]*)
      ECHO=/bin/echo
      ;;
   *)
```

```
        ECHO=echo
        ;;
esac

## Set Cursor Position Commands, used via $ECHO
SET_COL="\\033[${COL}G"      # at the $COL char
SET_WCOL="\\033[${WCOL}G"    # at the $WCOL char
CURS_UP="\\033[1A\\033[0G"   # Up one line, at the 0'th char

## Set color commands, used via $ECHO
# Please consult `man console_codes for more information
# under the "ECMA-48 Set Graphics Rendition" section
#
# Warning: when switching from a 8bit to a 9bit font,
# the linux console will reinterpret the bold (1;) to
# the top 256 glyphs of the 9bit font.  This does
# not affect framebuffer consoles
NORMAL="\\033[0;39m"          # Standard console grey
SUCCESS="\\033[1;32m"         # Success is green
WARNING="\\033[1;33m"         # Warnings are yellow
FAILURE="\\033[1;31m"         # Failures are red
INFO="\\033[1;36m"            # Information is light cyan
BRACKET="\\033[1;34m"         # Brackets are blue

STRING_LENGTH="0"   # the length of the current message

#*****************************************************************************
# Function - boot_mesg()
#
# Purpose:        Sending information from bootup scripts to the console
#
# Inputs:         $1 is the message
#                 $2 is the colorcode for the console
#
# Outputs:        Standard Output
#
# Dependencies: - sed for parsing strings.
#         - grep for counting string length.
#
# Todo:
#*****************************************************************************
boot_mesg()
{
   local ECHOPARM=""

   while true
   do
      case "${1}" in
         -n)
            ECHOPARM=" -n "
            shift 1
            ;;
         -*)
            echo "Unknown Option: ${1}"
            return 1
            ;;
         *)
            break
            ;;
      esac
   done
```

```
    ## Figure out the length of what is to be printed to be used
    ## for warning messages.
    STRING_LENGTH=$((${#1} + 1))

    # Print the message to the screen
    ${ECHO} ${ECHOPARM} -e "${2}${1}"

    # Log the message
    [ -d /run/var ] || return
    ${ECHO} ${ECHOPARM} -e "${2}${1}" >> /run/var/bootlog
}

boot_mesg_flush()
{
    # Reset STRING_LENGTH for next message
    STRING_LENGTH="0"
}

echo_ok()
{
    ${ECHO} -n -e "${CURS_UP}${SET_COL}${BRACKET}[${SUCCESS}  OK  ${BRACKET}]"
    ${ECHO} -e "${NORMAL}"
    boot_mesg_flush

    [ -d /run/var ] || return
    ${ECHO} -e "[ OK ]" >> /run/var/bootlog
}

echo_failure()
{
    ${ECHO} -n -e "${CURS_UP}${SET_COL}${BRACKET}[${FAILURE} FAIL ${BRACKET}]"
    ${ECHO} -e "${NORMAL}"
     boot_mesg_flush

    [ -d /run/var ] || return
    ${ECHO} -e "[ FAIL]"  >> /run/var/bootlog
}

echo_warning()
{
    ${ECHO} -n -e "${CURS_UP}${SET_COL}${BRACKET}[${WARNING} WARN ${BRACKET}]"
    ${ECHO} -e "${NORMAL}"
    boot_mesg_flush

    [ -d /run/var ] || return
    ${ECHO} -e "[ WARN ]"  >> /run/var/bootlog
}

echo_skipped()
{
    ${ECHO} -n -e "${CURS_UP}${SET_COL}${BRACKET}[${WARNING} SKIP ${BRACKET}]"
    ${ECHO} -e "${NORMAL}"
    boot_mesg_flush

    [ -d /run/var ] || return
    ${ECHO} -e "  [ SKIP ]" >> /run/var/bootlog
}

wait_for_user()
{
```

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```
    # Wait for the user by default
    [ "${HEADLESS=0}" = "0" ] && read ENTER
}

evaluate_retval()
{
   error_value="${?}"

   if [ ${error_value} = 0 ]; then
      echo_ok
   else
      echo_failure
   fi

   # This prevents the 'An Unexpected Error Has Occurred' from trivial
   # errors.
   return 0
}

print_status()
{
   if [ "${#}" = "0" ]; then
      echo "Usage: ${0} {success|warning|failure}"
      return 1
   fi

   case "${1}" in

      success)
         echo_ok
         ;;

      warning)
         # Leave this extra case in because old scripts
         # may call it this way.
         case "${2}" in
            running)
               ${ECHO} -e -n "${CURS_UP}"
               ${ECHO} -e -n "\\033[${STRING_LENGTH}G   "
               boot_mesg "Already running." ${WARNING}
               echo_warning
               ;;
            not_running)
               ${ECHO} -e -n "${CURS_UP}"
               ${ECHO} -e -n "\\033[${STRING_LENGTH}G   "
               boot_mesg "Not running." ${WARNING}
               echo_warning
               ;;
            not_available)
               ${ECHO} -e -n "${CURS_UP}"
               ${ECHO} -e -n "\\033[${STRING_LENGTH}G   "
               boot_mesg "Not available." ${WARNING}
               echo_warning
               ;;
            *)
               # This is how it is supposed to
               # be called
               echo_warning
               ;;
         esac
         ;;
```

```
      failure)
         echo_failure
      ;;

   esac

}

reloadproc()
{
   local pidfile=""
   local failure=0

   while true
   do
      case "${1}" in
         -p)
            pidfile="${2}"
            shift 2
            ;;
         -*)
            log_failure_msg "Unknown Option: ${1}"
            return 2
            ;;
         *)
            break
            ;;
      esac
   done

   if [ "${#}" -lt "1" ]; then
      log_failure_msg "Usage: reloadproc [-p pidfile] pathname"
      return 2
   fi

   # This will ensure compatibility with previous LFS Bootscripts
   if [ -n "${PIDFILE}" ]; then
      pidfile="${PIDFILE}"
   fi

   # Is the process running?
   if [ -z "${pidfile}" ]; then
      pidofproc -s "${1}"
   else
      pidofproc -s -p "${pidfile}" "${1}"
   fi

   # Warn about stale pid file
   if [ "$?" = 1 ]; then
      boot_mesg -n "Removing stale pid file: ${pidfile}. " ${WARNING}
      rm -f "${pidfile}"
   fi

   if [ -n "${pidlist}" ]; then
      for pid in ${pidlist}
      do
         kill -"${RELOADSIG}" "${pid}" || failure="1"
      done

      (exit ${failure})
```

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```
            evaluate_retval

    else
        boot_mesg "Process ${1} not running." ${WARNING}
        echo_warning
    fi
}

statusproc()
{
    local pidfile=""
    local base=""
    local ret=""

    while true
    do
        case "${1}" in
            -p)
                pidfile="${2}"
                shift 2
                ;;
            -*)
                log_failure_msg "Unknown Option: ${1}"
                return 2
                ;;
            *)
                break
                ;;
        esac
    done

    if [ "${#}" != "1" ]; then
        shift 1
        log_failure_msg "Usage: statusproc [-p pidfile] pathname"
        return 2
    fi

    # Get the process basename
    base="${1##*/}"

    # This will ensure compatibility with previous LFS Bootscripts
    if [ -n "${PIDFILE}" ]; then
        pidfile="${PIDFILE}"
    fi

    # Is the process running?
    if [ -z "${pidfile}" ]; then
        pidofproc -s "${1}"
    else
        pidofproc -s -p "${pidfile}" "${1}"
    fi

    # Store the return status
    ret=$?

    if [ -n "${pidlist}" ]; then
        ${ECHO} -e "${INFO}${base} is running with Process"\
            "ID(s) ${pidlist}.${NORMAL}"
    else
        if [ -n "${base}" -a -e "/var/run/${base}.pid" ]; then
            ${ECHO} -e "${WARNING}${1} is not running but"\
```

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```
                "/var/run/${base}.pid exists.${NORMAL}"
      else
         if [ -n "${pidfile}" -a -e "${pidfile}" ]; then
            ${ECHO} -e "${WARNING}${1} is not running"\
                "but ${pidfile} exists.${NORMAL}"
         else
            ${ECHO} -e "${INFO}${1} is not running.${NORMAL}"
         fi
      fi
   fi

   # Return the status from pidofproc
   return $ret
}

# The below functions are documented in the LSB-generic 2.1.0

#*******************************************************************************
# Function - pidofproc [-s] [-p pidfile] pathname
#
# Purpose: This function returns one or more pid(s) for a particular daemon
#
# Inputs: -p pidfile, use the specified pidfile instead of pidof
#         pathname, path to the specified program
#
# Outputs: return 0 - Success, pid's in stdout
#          return 1 - Program is dead, pidfile exists
#          return 2 - Invalid or excessive number of arguments,
#                     warning in stdout
#          return 3 - Program is not running
#
# Dependencies: pidof, echo, head
#
# Todo: Remove dependency on head
#       This replaces getpids
#       Test changes to pidof
#
#*******************************************************************************
pidofproc()
{
   local pidfile=""
   local lpids=""
   local silent=""
   pidlist=""
   while true
   do
      case "${1}" in
         -p)
            pidfile="${2}"
            shift 2
            ;;

         -s)
            # Added for legacy opperation of getpids
            # eliminates several '> /dev/null'
            silent="1"
            shift 1
            ;;
         -*)
            log_failure_msg "Unknown Option: ${1}"
            return 2
```

```
                ;;
            *)
                break
                ;;
        esac
    done

    if [ "${#}" != "1" ]; then
        shift 1
        log_failure_msg "Usage: pidofproc [-s] [-p pidfile] pathname"
        return 2
    fi

    if [ -n "${pidfile}" ]; then
        if [ ! -r "${pidfile}" ]; then
            return 3 # Program is not running
        fi

        lpids=`head -n 1 ${pidfile}`
        for pid in ${lpids}
        do
            if [ "${pid}" -ne "$$" -a "${pid}" -ne "${PPID}" ]; then
                kill -0 "${pid}" 2>/dev/null &&
                pidlist="${pidlist} ${pid}"
            fi

            if [ "${silent}" != "1" ]; then
                echo "${pidlist}"
            fi

            test -z "${pidlist}" &&
            # Program is dead, pidfile exists
            return 1
            # else
            return 0
        done

    else
        pidlist=`pidof -o $$ -o $PPID -x "$1"`
        if [ "${silent}" != "1" ]; then
            echo "${pidlist}"
        fi

        # Get provide correct running status
        if [ -n "${pidlist}" ]; then
            return 0
        else
            return 3
        fi

    fi

    if [ "$?" != "0" ]; then
        return 3 # Program is not running
    fi
}

#*******************************************************************************
# Function - loadproc [-f] [-n nicelevel] [-p pidfile] pathname [args]
#
# Purpose: This runs the specified program as a daemon
```

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```
#
# Inputs: -f, run the program even if it is already running
#         -n nicelevel, specifies a nice level. See nice(1).
#         -p pidfile, uses the specified pidfile
#         pathname, pathname to the specified program
#         args, arguments to pass to specified program
#
# Outputs: return 0 - Success
#          return 2 - Invalid of excessive number of arguments,
#                     warning in stdout
#          return 4 - Program or service status is unknown
#
# Dependencies: nice, rm
#
# Todo: LSB says this should be called start_daemon
#       LSB does not say that it should call evaluate_retval
#       It checks for PIDFILE, which is deprecated.
#        Will be removed after BLFS 6.0
#       loadproc returns 0 if program is already running, not LSB compliant
#
#*******************************************************************************
loadproc()
{
   local pidfile=""
   local forcestart=""
   local nicelevel="10"

# This will ensure compatibility with previous LFS Bootscripts
   if [ -n "${PIDFILE}" ]; then
      pidfile="${PIDFILE}"
   fi

  while true
   do
      case "${1}" in
         -f)
            forcestart="1"
            shift 1
            ;;
         -n)
            nicelevel="${2}"
            shift 2
            ;;
         -p)
            pidfile="${2}"
            shift 2
            ;;
         -*)
            log_failure_msg "Unknown Option: ${1}"
            return 2 #invalid or excess argument(s)
            ;;
         *)
            break
            ;;
      esac
   done

   if [ "${#}" = "0" ]; then
      log_failure_msg "Usage: loadproc [-f] [-n nicelevel] [-p pidfile] pathname [args]"
      return 2 #invalid or excess argument(s)
   fi
```

```
   if [ -z "${forcestart}" ]; then
      if [ -z "${pidfile}" ]; then
         pidofproc -s "${1}"
      else
         pidofproc -s -p "${pidfile}" "${1}"
      fi

      case "${?}" in
         0)
            log_warning_msg "Unable to continue: ${1} is running"
            return 0 # 4
            ;;
         1)
            boot_mesg "Removing stale pid file: ${pidfile}" ${WARNING}
            rm -f "${pidfile}"
            ;;
         3)
            ;;
         *)
            log_failure_msg "Unknown error code from pidofproc: ${?}"
            return 4
            ;;
      esac
   fi

   nice -n "${nicelevel}" "${@}"
   evaluate_retval # This is "Probably" not LSB compliant,
#                          but required to be compatible with older bootscripts
   return 0
}

#*******************************************************************************
# Function - killproc  [-p pidfile] pathname [signal]
#
# Purpose:
#
# Inputs: -p pidfile, uses the specified pidfile
#         pathname, pathname to the specified program
#         signal, send this signal to pathname
#
# Outputs: return 0 - Success
#          return 2 - Invalid of excessive number of arguments,
#                     warning in stdout
#          return 4 - Unknown Status
#
# Dependencies: kill, rm
#
# Todo: LSB does not say that it should call evaluate_retval
#       It checks for PIDFILE, which is deprecated.
#         Will be removed after BLFS 6.0
#
#*******************************************************************************
killproc()
{
   local pidfile=""
   local killsig=TERM # default signal is SIGTERM
   pidlist=""

   # This will ensure compatibility with previous LFS Bootscripts
   if [ -n "${PIDFILE}" ]; then
```

```
      pidfile="${PIDFILE}"
fi

while true
do
   case "${1}" in
      -p)
         pidfile="${2}"
         shift 2
         ;;
      -*)
         log_failure_msg "Unknown Option: ${1}"
         return 2
         ;;
      *)
         break
         ;;
   esac
done

if [ "${#}" = "2" ]; then
   killsig="${2}"
elif [ "${#}" != "1" ]; then
   shift 2
   log_failure_msg "Usage: killproc  [-p pidfile] pathname [signal]"
   return 2
fi

# Is the process running?
if [ -z "${pidfile}" ]; then
   pidofproc -s "${1}"
else
   pidofproc -s -p "${pidfile}" "${1}"
fi

# Remove stale pidfile
if [ "$?" = 1 ]; then
   boot_mesg "Removing stale pid file: ${pidfile}." ${WARNING}
   rm -f "${pidfile}"
fi

 # If running, send the signal
 if [ -n "${pidlist}" ]; then
for pid in ${pidlist}
do
   kill -${killsig} ${pid} 2>/dev/null

   # Wait up to 3 seconds, for ${pid} to terminate
   case "${killsig}" in
   TERM|SIGTERM|KILL|SIGKILL)
      # sleep in 1/10ths of seconds and
      # multiply KILLDELAY by 10
      local dtime="${KILLDELAY}0"
      while [ "${dtime}" != "0" ]
      do
         kill -0 ${pid} 2>/dev/null || break
         sleep 0.1
         dtime=$(( ${dtime} - 1))
      done
      # If ${pid} is still running, kill it
      kill -0 ${pid} 2>/dev/null && kill -KILL ${pid} 2>/dev/null
```

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```
            ;;
      esac
   done

   # Check if the process is still running if we tried to stop it
   case "${killsig}" in
   TERM|SIGTERM|KILL|SIGKILL)
      if [ -z "${pidfile}" ]; then
         pidofproc -s "${1}"
      else
         pidofproc -s -p "${pidfile}" "${1}"
      fi

      # Program was terminated
      if [ "$?" != "0" ]; then
         # Remove the pidfile if necessary
         if [ -f "${pidfile}" ]; then
            rm -f "${pidfile}"
         fi
         echo_ok
         return 0
      else # Program is still running
         echo_failure
         return 4 # Unknown Status
      fi
      ;;
   *)
      # Just see if the kill returned successfully
      evaluate_retval
      ;;
   esac
    else # process not running
   print_status warning not_running
    fi
}


#*****************************************************************************
# Function - log_success_msg "message"
#
# Purpose: Print a success message
#
# Inputs: $@ - Message
#
# Outputs: Text output to screen
#
# Dependencies: echo
#
# Todo: logging
#
#*****************************************************************************
log_success_msg()
{
   ${ECHO} -n -e "${BOOTMESG_PREFIX}${@}"
   ${ECHO} -e "${SET_COL}""${BRACKET}""[""${SUCCESS}""  OK  ""${BRACKET}""]""${NORMAL}"

   [ -d /run/var ] || return 0
   ${ECHO} -n -e "${@}  [ OK ]"  >> /run/var/bootlog
   return 0
}
```

```
#*******************************************************************************
# Function - log_failure_msg "message"
#
# Purpose: Print a failure message
#
# Inputs: $@ - Message
#
# Outputs: Text output to screen
#
# Dependencies: echo
#
# Todo: logging
#
#*******************************************************************************
log_failure_msg() {
   ${ECHO} -n -e "${BOOTMESG_PREFIX}${@}"
   ${ECHO} -e "${SET_COL}""${BRACKET}""[""${FAILURE}"" FAIL ""${BRACKET}""]""${NORMAL}"

   [ -d /run/var ] || return 0
   ${ECHO} -e "${@}  [ FAIL ]" >> /run/var/bootlog
   return 0
}

#*******************************************************************************
# Function - log_warning_msg "message"
#
# Purpose: print a warning message
#
# Inputs: $@ - Message
#
# Outputs: Text output to screen
#
# Dependencies: echo
#
# Todo: logging
#
#*******************************************************************************
log_warning_msg() {
   ${ECHO} -n -e "${BOOTMESG_PREFIX}${@}"
   ${ECHO} -e "${SET_COL}""${BRACKET}""[""${WARNING}"" WARN ""${BRACKET}""]""${NORMAL}"

   [ -d /run/var ] || return 0
   ${ECHO} -e "${@}  [ WARN ]" >> /run/var/bootlog
   return 0
}

#*******************************************************************************
# Function - log_skipped_msg "message"
#
# Purpose: print a message that the script was skipped
#
# Inputs: $@ - Message
#
# Outputs: Text output to screen
#
# Dependencies: echo
#
# Todo: logging
#
#*******************************************************************************
log_skipped_msg() {
```

```
    ${ECHO} -n -e "${BOOTMESG_PREFIX}${@}"
    ${ECHO} -e "${SET_COL}""${BRACKET}""["""${WARNING}"" SKIP ""${BRACKET}""]"""${NORMAL}"

    [ -d /run/var ] || return 0
    ${ECHO} -e "${@}  [ SKIP ]" >> /run/var/bootlog
    return 0
}

# End boot functions
```

D.4. /etc/rc.d/init.d/mountvirtfs

```
#!/bin/sh
########################################################################
# Begin mountvirtfs
#
# Description : Mount proc, sysfs, and run
#
# Authors     : Gerard Beekmans - gerard@linuxfromscratch.org
#               DJ Lucas - dj@linuxfromscratch.org
# Update      : Bruce Dubbs - bdubbs@linuxfromscratch.org
#
# Version     : LFS 7.0
#
########################################################################

### BEGIN INIT INFO
# Provides:           mountvirtfs
# Required-Start:
# Should-Start:
# Required-Stop:
# Should-Stop:
# Default-Start:      S
# Default-Stop:
# Short-Description:  Mounts /sys and /proc virtual (kernel) filesystems.
#                    Mounts /run (tmpfs) and /dev (devtmpfs).
# Description:        Mounts /sys and /proc virtual (kernel) filesystems.
#                    Mounts /run (tmpfs) and /dev (devtmpfs).
# X-LFS-Provided-By:  LFS
### END INIT INFO

. /lib/lsb/init-functions

case "${1}" in
   start)
      # Make sure /run/var is available before logging any messages
      if ! mountpoint /run >/dev/null; then
         mount -n /run || failed=1
      fi

      mkdir -p /run/var /run/lock /run/shm
      chmod 1777 /run/shm

      log_info_msg "Mounting virtual file systems: ${INFO}/run"

      if ! mountpoint /proc >/dev/null; then
         log_info_msg2 " ${INFO}/proc"
         mount -n -o nosuid,noexec,nodev /proc || failed=1
      fi
```

```
        if ! mountpoint /sys >/dev/null; then
            log_info_msg2 " ${INFO}/sys"
            mount -n -o nosuid,noexec,nodev /sys || failed=1
        fi

        if ! mountpoint /dev >/dev/null; then
            log_info_msg2 " ${INFO}/dev"
            mount -n -o mode=0755,nosuid /dev  || failed=1
        fi

        # Copy devices that Udev >= 155 doesn't handle to /dev
        cp -a /lib/udev/devices/* /dev

        ln -sfn /run/shm /dev/shm

        (exit ${failed})
        evaluate_retval
        exit $failed
        ;;

    *)
        echo "Usage: ${0} {start}"
        exit 1
        ;;
esac

# End mountvirtfs
```

D.5. /etc/rc.d/init.d/modules

```
#!/bin/sh
########################################################################
# Begin modules
#
# Description : Module auto-loading script
#
# Authors     : Zack Winkles
#               DJ Lucas - dj@linuxfromscratch.org
# Update      : Bruce Dubbs - bdubbs@linuxfromscratch.org
#
# Version     : LFS 7.0
#
########################################################################

### BEGIN INIT INFO
# Provides:            modules
# Required-Start:      mountvirtfs sysctl
# Should-Start:
# Required-Stop:
# Should-Stop:
# Default-Start:       S
# Default-Stop:
# Short-Description:   Loads required modules.
# Description:         Loads modules listed in /etc/sysconfig/modules.
# X-LFS-Provided-By:   LFS
### END INIT INFO

# Assure that the kernel has module support.
[ -e /proc/ksyms -o -e /proc/modules ] || exit 0
```

```
. /lib/lsb/init-functions

case "${1}" in
   start)
      # Exit if there's no modules file or there are no
      # valid entries
      [ -r /etc/sysconfig/modules ]              || exit 0
      egrep -qv '^($|#)' /etc/sysconfig/modules || exit 0

      log_info_msg "Loading modules:"

      # Only try to load modules if the user has actually given us
      # some modules to load.

      while read module args; do

         # Ignore comments and blank lines.
         case "$module" in
            ""|"#"*) continue ;;
         esac

         # Attempt to load the module, passing any arguments provided.
         modprobe ${module} ${args} >/dev/null

         # Print the module name if successful, otherwise take note.
         if [ $? -eq 0 ]; then
            log_info_msg2 " ${module}"
         else
            failedmod="${failedmod} ${module}"
         fi
      done < /etc/sysconfig/modules

      # Print a message about successfully loaded modules on the correct line.
      log_success_msg2

      # Print a failure message with a list of any modules that
      # may have failed to load.
      if [ -n "${failedmod}" ]; then
         log_failure_msg "Failed to load modules:${failedmod}"
         exit 1
      fi
      ;;

   *)
      echo "Usage: ${0} {start}"
      exit 1
      ;;
esac

exit 0

# End modules
```

D.6. /etc/rc.d/init.d/udev

```
#!/bin/sh
########################################################################
# Begin udev
#
# Description : Udev cold-plugging script
```

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```
#
# Authors       : Zack Winkles, Alexander E. Patrakov
#                 DJ Lucas - dj@linuxfromscratch.org
# Update        : Bruce Dubbs - bdubbs@linuxfromscratch.org
#
# Version       : LFS 7.0
#
########################################################################

### BEGIN INIT INFO
# Provides:            udev $time
# Required-Start:
# Should-Start:        modules
# Required-Stop:
# Should-Stop:
# Default-Start:       S
# Default-Stop:
# Short-Description:   Populates /dev with device nodes.
# Description:         Mounts a tempfs on /dev and starts the udevd daemon.
#                      Device nodes are created as defined by udev.
# X-LFS-Provided-By:   LFS
### END INIT INFO

. /lib/lsb/init-functions

case "${1}" in
   start)
      log_info_msg "Populating /dev with device nodes... "
      if ! grep -q '[[:space:]]sysfs' /proc/mounts; then
         log_failure_msg2
         msg="FAILURE:\n\nUnable to create "
         msg="${msg}devices without a SysFS filesystem\n\n"
         msg="${msg}After you press Enter, this system "
         msg="${msg}will be halted and powered off.\n\n"
         log_info_msg "$msg"
         log_info_msg "Press Enter to continue..."
         wait_for_user
         /etc/rc.d/init.d/halt stop
      fi

      # Udev handles uevents itself, so we don't need to have
      # the kernel call out to any binary in response to them
      echo > /proc/sys/kernel/hotplug

      # Start the udev daemon to continually watch for, and act on,
      # uevents
      /lib/udev/udevd --daemon

      # Now traverse /sys in order to "coldplug" devices that have
      # already been discovered
      /sbin/udevadm trigger --action=add     --type=subsystems
      /sbin/udevadm trigger --action=add     --type=devices
      /sbin/udevadm trigger --action=change --type=devices

      # Now wait for udevd to process the uevents we triggered
      if ! is_true "$OMIT_UDEV_SETTLE"; then
         /sbin/udevadm settle
      fi

      # If any LVM based partitions are on the system, ensure they
      # are activated so they can be used.
```

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```
        if [ -x /sbin/vgchange ]; then /sbin/vgchange -a y >/dev/null; fi

        log_success_msg2
        ;;

   *)
        echo "Usage ${0} {start}"
        exit 1
        ;;
esac

exit 0

# End udev
```

D.7. /etc/rc.d/init.d/swap

```
#!/bin/sh
########################################################################
# Begin swap
#
# Description : Swap Control Script
#
# Authors     : Gerard Beekmans - gerard@linuxfromscratch.org
#               DJ Lucas - dj@linuxfromscratch.org
# Update      : Bruce Dubbs - bdubbs@linuxfromscratch.org
#
# Version     : LFS 7.0
#
########################################################################

### BEGIN INIT INFO
# Provides:            swap
# Required-Start:      udev
# Should-Start:        modules
# Required-Stop:       localnet
# Should-Stop:
# Default-Start:       S
# Default-Stop:        0 6
# Short-Description:   Mounts and unmounts swap partitions.
# Description:         Mounts and unmounts swap partitions defined in
#                      /etc/fstab.
# X-LFS-Provided-By:   LFS
### END INIT INFO

. /lib/lsb/init-functions

case "${1}" in
   start)
      log_info_msg "Activating all swap files/partitions..."
      swapon -a
      evaluate_retval
      ;;

   stop)
      log_info_msg "Deactivating all swap files/partitions..."
      swapoff -a
      evaluate_retval
      ;;
```

```
    restart)
        ${0} stop
        sleep 1
        ${0} start
        ;;

    status)
        log_success_msg "Retrieving swap status."
        swapon -s
        ;;

    *)
        echo "Usage: ${0} {start|stop|restart|status}"
        exit 1
        ;;
esac

exit 0

# End swap
```

D.8. /etc/rc.d/init.d/setclock

```
#!/bin/sh
########################################################################
# Begin setclock
#
# Description : Setting Linux Clock
#
# Authors     : Gerard Beekmans - gerard@linuxfromscratch.org
#               DJ Lucas - dj@linuxfromscratch.org
# Update      : Bruce Dubbs - bdubbs@linuxfromscratch.org
#
# Version     : LFS 7.0
#
########################################################################

### BEGIN INIT INFO
# Provides:
# Required-Start:
# Should-Start:         modules
# Required-Stop:
# Should-Stop:          $syslog
# Default-Start:        S
# Default-Stop:
# Short-Description:    Stores and restores time from the hardware clock
# Description:          On boot, system time is obtained from hwclock.  The
#                       hardware clock can also be set on shutdown.
# X-LFS-Provided-By:    LFS BLFS
### END INIT INFO

. /lib/lsb/init-functions

[ -r /etc/sysconfig/clock ] && . /etc/sysconfig/clock


case "${UTC}" in
   yes|true|1)
      CLOCKPARAMS="${CLOCKPARAMS} --utc"
      ;;
```

```
   no|false|0)
       CLOCKPARAMS="${CLOCKPARAMS} --localtime"
       ;;

esac

case ${1} in
   start)
       hwclock --hctosys ${CLOCKPARAMS} >/dev/null
       ;;

   stop)
       log_info_msg "Setting hardware clock..."
       hwclock --systohc ${CLOCKPARAMS} >/dev/null
       evaluate_retval
       ;;

   *)
       echo "Usage: ${0} {start|stop}"
       exit 1
       ;;

esac

exit 0
```

D.9. /etc/rc.d/init.d/checkfs

```
#!/bin/sh
########################################################################
# Begin checkfs
#
# Description : File System Check
#
# Authors     : Gerard Beekmans - gerard@linuxfromscratch.org
#               A. Luebke - luebke@users.sourceforge.net
#               DJ Lucas - dj@linuxfromscratch.org
# Update      : Bruce Dubbs - bdubbs@linuxfromscratch.org
#
# Version     : LFS 7.0
#
# Based on checkfs script from LFS-3.1 and earlier.
#
# From man fsck
# 0    - No errors
# 1    - File system errors corrected
# 2    - System should be rebooted
# 4    - File system errors left uncorrected
# 8    - Operational error
# 16   - Usage or syntax error
# 32   - Fsck canceled by user request
# 128  - Shared library error
#
########################################################################

### BEGIN INIT INFO
# Provides:            checkfs
# Required-Start:      udev swap $time
# Should-Start:
```

```
# Required-Stop:
# Should-Stop:
# Default-Start:       S
# Default-Stop:
# Short-Description:   Checks local filesystems before mounting.
# Description:         Checks local filesystmes before mounting.
# X-LFS-Provided-By:   LFS
### END INIT INFO

. /lib/lsb/init-functions

case "${1}" in
   start)
      if [ -f /fastboot ]; then
         msg="/fastboot found, will omit "
         msg="${msg} file system checks as requested.\n"
         log_info_msg "${msg}"
         exit 0
      fi

      log_info_msg "Mounting root file system in read-only mode... "
      mount -n -o remount,ro / >/dev/null

      if [ ${?} != 0 ]; then
         log_failure_msg2
         msg="\n\nCannot check root "
         msg="${msg}filesystem because it could not be mounted "
         msg="${msg}in read-only mode.\n\n"
         msg="${msg}After you press Enter, this system will be "
         msg="${msg}halted and powered off.\n\n"
         log_failure_msg "${msg}"

         log_info_msg "Press Enter to continue..."
         wait_for_user
         /etc/rc.d/init.d/halt stop
      else
         log_success_msg2
      fi

      if [ -f /forcefsck ]; then
         msg="\n/forcefsck found, forcing file"
         msg="${msg} system checks as requested."
         log_success_msg "$msg"
         options="-f"
      else
         options=""
      fi

      log_info_msg "Checking file systems..."
      # Note: -a option used to be -p; but this fails e.g. on fsck.minix
      if is_true "$VERBOSE_FSCK"; then
        fsck ${options} -a -A -C -T
      else
        fsck ${options} -a -A -C -T >/dev/null
      fi

      error_value=${?}

      if [ "${error_value}" = 0 ]; then
         log_success_msg2
      fi
```

```
        if [ "${error_value}" = 1 ]; then
            msg="\nWARNING:\n\nFile system errors "
            msg="${msg}were found and have been corrected.\n"
            msg="${msg}You may want to double-check that "
            msg="${msg}everything was fixed properly."
            log_warning_msg "$msg"
        fi

        if [ "${error_value}" = 2 -o "${error_value}" = 3 ]; then
            msg="\nWARNING:\n\nFile system errors "
            msg="${msg}were found and have been been "
            msg="${msg}corrected, but the nature of the "
            msg="${msg}errors require this system to be rebooted.\n\n"
            msg="${msg}After you press enter, "
            msg="${msg}this system will be rebooted\n\n"
            log_failure_msg "$msg"

            log_info_msg "Press Enter to continue..."
            wait_for_user
            reboot -f
        fi

        if [ "${error_value}" -gt 3 -a "${error_value}" -lt 16 ]; then
            msg="\nFAILURE:\n\nFile system errors "
            msg="${msg}were encountered that could not be "
            msg="${msg}fixed automatically.  This system "
            msg="${msg}cannot continue to boot and will "
            msg="${msg}therefore be halted until those "
            msg="${msg}errors are fixed manually by a "
            msg="${msg}System Administrator.\n\n"
            msg="${msg}After you press Enter, this system will be "
            msg="${msg}halted and powered off.\n\n"
            log_failure_msg "$msg"

            log_info_msg "Press Enter to continue..."
            wait_for_user
            /etc/rc.d/init.d/halt stop
        fi

        if [ "${error_value}" -ge 16 ]; then
            msg="\nFAILURE:\n\nUnexpected Failure "
            msg="${msg}running fsck.  Exited with error "
            msg="${msg} code: ${error_value}."
            log_failure_msg $msg
            exit ${error_value}
        fi

        exit 0
        ;;
    *)
        echo "Usage: ${0} {start}"
        exit 1
        ;;
esac

# End checkfs
```

D.10. /etc/rc.d/init.d/mountfs

```
#!/bin/sh
########################################################################
# Begin mountfs
#
# Description : File System Mount Script
#
# Authors     : Gerard Beekmans - gerard@linuxfromscratch.org
#               DJ Lucas - dj@linuxfromscratch.org
# Update      : Bruce Dubbs - bdubbs@linuxfromscratch.org
#
# Version     : LFS 7.0
#
########################################################################

### BEGIN INIT INFO
# Provides:            $local_fs
# Required-Start:      udev checkfs
# Should-Start:
# Required-Stop:       swap
# Should-Stop:
# Default-Start:       S
# Default-Stop:        0 6
# Short-Description:   Mounts/unmounts local filesystems defined in /etc/fstab.
# Description:         Remounts root filesystem read/write and mounts all
#                      remaining local filesystems defined in /etc/fstab on
#                      start.  Remounts root filesystem read-only and unmounts
#                      remaining filesystems on stop.
# X-LFS-Provided-By:   LFS
### END INIT INFO

. /lib/lsb/init-functions

case "${1}" in
   start)
      log_info_msg "Remounting root file system in read-write mode..."
      mount -n -o remount,rw / >/dev/null
      evaluate_retval

      # Remove fsck-related file system watermarks.
      rm -f /fastboot /forcefsck

      log_info_msg "Recording existing mounts in /etc/mtab..."
      > /etc/mtab

      mount -f /     || failed=1
      mount -f /proc || failed=1
      mount -f /sys  || failed=1
      mount -f /run  || failed=1
      mount -f /dev  || failed=1
      (exit ${failed})
      evaluate_retval

      # This will mount all filesystems that do not have _netdev in
      # their option list.  _netdev denotes a network filesystem.

      log_info_msg "Mounting remaining file systems..."
      mount -a -O no_netdev >/dev/null
      evaluate_retval
```

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```
        exit $failed
        ;;

   stop)
        # Don't unmount tmpfs like /run
        log_info_msg "Unmounting all other currently mounted file systems..."
        umount -a -d -r -t notmpfs,nosysfs,nodevtmpfs,noproc >/dev/null
        evaluate_retval

        # Make all LVM volume groups unavailable, if appropriate
        # This fails if swap or / are on an LVM partition
        #if [ -x /sbin/vgchange ]; then /sbin/vgchange -an > /dev/null; fi
        ;;

   *)
        echo "Usage: ${0} {start|stop}"
        exit 1
        ;;
esac

# End mountfs
```

D.11. /etc/rc.d/init.d/udev_retry

```
#!/bin/sh
########################################################################
# Begin udev_retry
#
# Description : Udev cold-plugging script (retry)
#
# Authors     : Alexander E. Patrakov
#               DJ Lucas - dj@linuxfromscratch.org
# Update      : Bruce Dubbs - bdubbs@linuxfromscratch.org
#               Bryan Kadzban -
#
# Version     : LFS 7.0
#
########################################################################

### BEGIN INIT INFO
# Provides:            udev_retry
# Required-Start:      udev
# Should-Start:        $local_fs
# Required-Stop:
# Should-Stop:
# Default-Start:       S
# Default-Stop:
# Short-Description:   Replays failed uevents and creates additional devices.
# Description:         Replays any failed uevents that were skipped due to
#                      slow hardware initialization, and creates those needed
#                      device nodes
# X-LFS-Provided-By:   LFS
### END INIT INFO

. /lib/lsb/init-functions

case "${1}" in
   start)
        log_info_msg "Retrying failed uevents, if any..."
```

```
        # As of udev-186, the --run option is no longer valid
        #rundir=$(/sbin/udevadm info --run)
        rundir=/run/udev
        # From Debian: "copy the rules generated before / was mounted
        # read-write":

        for file in ${rundir}/tmp-rules--*; do
           dest=${file##*tmp-rules--}
           [ "$dest" = '*' ] && break
           cat $file >> /etc/udev/rules.d/$dest
           rm -f $file
        done

        # Re-trigger the uevents that may have failed,
        # in hope they will succeed now
        /bin/sed -e 's/#.*$//' /etc/sysconfig/udev_retry | /bin/grep -v '^$' | \
        while read line ; do
           for subsystem in $line ; do
              /sbin/udevadm trigger --subsystem-match=$subsystem --action=add
           done
        done

        # Now wait for udevd to process the uevents we triggered
        if ! is_true "$OMIT_UDEV_RETRY_SETTLE"; then
           /sbin/udevadm settle
        fi

        evaluate_retval
        ;;

    *)
        echo "Usage ${0} {start}"
        exit 1
        ;;
esac

exit 0

# End udev_retry
```

D.12. /etc/rc.d/init.d/cleanfs

```
#!/bin/sh
########################################################################
# Begin cleanfs
#
# Description : Clean file system
#
# Authors     : Gerard Beekmans - gerard@linuxfromscratch.org
#               DJ Lucas - dj@linuxfromscratch.org
# Update      : Bruce Dubbs - bdubbs@linuxfromscratch.org
#
# Version     : LFS 7.0
#
########################################################################

### BEGIN INIT INFO
# Provides:            cleanfs
# Required-Start:      $local_fs
# Should-Start:
```

```
# Required-Stop:
# Should-Stop:
# Default-Start:       S
# Default-Stop:
# Short-Description:   Cleans temporary directories early in the boot process.
# Description:         Cleans temporary directories /var/run, /var/lock, and
#                      optionally, /tmp.  cleanfs also creates /var/run/utmp
#                      and any files defined in /etc/sysconfig/createfiles.
# X-LFS-Provided-By:   LFS
### END INIT INFO

. /lib/lsb/init-functions

# Function to create files/directory on boot.
create_files()
{
   # Input to file descriptor 9 and output to stdin (redirection)
   exec 9>&0 < /etc/sysconfig/createfiles

   while read name type perm usr grp dtype maj min junk
   do
      # Ignore comments and blank lines.
      case "${name}" in
         ""|\#*) continue ;;
      esac

      # Ignore existing files.
      if [ ! -e "${name}" ]; then
         # Create stuff based on its type.
         case "${type}" in
            dir)
               mkdir "${name}"
               ;;
            file)
               :> "${name}"
               ;;
            dev)
               case "${dtype}" in
                  char)
                     mknod "${name}" c ${maj} ${min}
                     ;;
                  block)
                     mknod "${name}" b ${maj} ${min}
                     ;;
                  pipe)
                     mknod "${name}" p
                     ;;
                  *)
                     log_warning_msg "\nUnknown device type: ${dtype}"
                     ;;
               esac
               ;;
            *)
               log_warning_msg "\nUnknown type: ${type}"
               continue
               ;;
         esac

         # Set up the permissions, too.
         chown ${usr}:${grp} "${name}"
         chmod ${perm} "${name}"
```

```
        fi
    done

    # Close file descriptor 9 (end redirection)
    exec 0>&9 9>&-
    return 0
}

case "${1}" in
    start)
        log_info_msg "Cleaning file systems:"

        if [ "${SKIPTMPCLEAN}" = "" ]; then
            log_info_msg2 " /tmp"
            cd /tmp &&
            find . -xdev -mindepth 1 ! -name lost+found -delete || failed=1
        fi

        > /var/run/utmp

        if grep -q '^utmp:' /etc/group ; then
            chmod 664 /var/run/utmp
            chgrp utmp /var/run/utmp
        fi

        (exit ${failed})
        evaluate_retval

        if egrep -qv '^(#|$)' /etc/sysconfig/createfiles 2>/dev/null; then
            log_info_msg "Creating files and directories... "
            create_files       # Always returns 0
            evaluate_retval
        fi

        exit $failed
        ;;
    *)
        echo "Usage: ${0} {start}"
        exit 1
        ;;
esac

# End cleanfs
```

D.13. /etc/rc.d/init.d/console

```
#!/bin/sh
########################################################################
# Begin console
#
# Description : Sets keymap and screen font
#
# Authors     : Gerard Beekmans - gerard@linuxfromscratch.org
#               Alexander E. Patrakov
#               DJ Lucas - dj@linuxfromscratch.org
# Update      : Bruce Dubbs - bdubbs@linuxfromscratch.org
#
# Version     : LFS 7.0
#
########################################################################
```

```
### BEGIN INIT INFO
# Provides:            console
# Required-Start:
# Should-Start:        $local_fs
# Required-Stop:
# Should-Stop:
# Default-Start:       S
# Default-Stop:
# Short-Description:   Sets up a localised console.
# Description:         Sets up fonts and language settings for the user's
#                      local as defined by /etc/sysconfig/console.
# X-LFS-Provided-By:   LFS
### END INIT INFO

. /lib/lsb/init-functions

# Native English speakers probably don't have /etc/sysconfig/console at all
[ -r /etc/sysconfig/console ] && . /etc/sysconfig/console

is_true()
{
    [ "$1" = "1" ] || [ "$1" = "yes" ] || [ "$1" = "true" ]
}

failed=0

case "${1}" in
   start)
      # See if we need to do anything
      if [ -z "${KEYMAP}"         ] && [ -z "${KEYMAP_CORRECTIONS}" ] &&
         [ -z "${FONT}"           ] && [ -z "${LEGACY_CHARSET}"     ] &&
         ! is_true "${UNICODE}"; then
         exit 0
      fi

      # There should be no bogus failures below this line!
      log_info_msg "Setting up Linux console..."

      # Figure out if a framebuffer console is used
      [ -d /sys/class/graphics/fb0 ] && use_fb=1 || use_fb=0

      # Figure out the command to set the console into the
      # desired mode
      is_true "${UNICODE}" &&
         MODE_COMMAND="echo -en '\033%G' && kbd_mode -u" ||
         MODE_COMMAND="echo -en '\033%@\033(K' && kbd_mode -a"

      # On framebuffer consoles, font has to be set for each vt in
      # UTF-8 mode. This doesn't hurt in non-UTF-8 mode also.

      ! is_true "${use_fb}" || [ -z "${FONT}" ] ||
         MODE_COMMAND="${MODE_COMMAND} && setfont ${FONT}"

      # Apply that command to all consoles mentioned in
      # /etc/inittab. Important: in the UTF-8 mode this should
      # happen before setfont, otherwise a kernel bug will
      # show up and the unicode map of the font will not be
      # used.

      for TTY in `grep '^[^#].*respawn:/sbin/agetty' /etc/inittab |
```

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```
                grep -o '\btty[[:digit:]]*\b'`
        do
           openvt -f -w -c ${TTY#tty} -- \
               /bin/sh -c "${MODE_COMMAND}" || failed=1
        done

        # Set the font (if not already set above) and the keymap
        [ "${use_fb}" == "1" ] || [ -z "${FONT}" ] || setfont $FONT || failed=1

        [ -z "${KEYMAP}" ] ||
           loadkeys ${KEYMAP} >/dev/null 2>&1 ||
           failed=1

        [ -z "${KEYMAP_CORRECTIONS}" ] ||
           loadkeys ${KEYMAP_CORRECTIONS} >/dev/null 2>&1 ||
           failed=1

        # Convert the keymap from $LEGACY_CHARSET to UTF-8
        [ -z "$LEGACY_CHARSET" ] ||
           dumpkeys -c "$LEGACY_CHARSET" | loadkeys -u >/dev/null 2>&1 ||
           failed=1

        # If any of the commands above failed, the trap at the
        # top would set $failed to 1
        ( exit $failed )
        evaluate_retval

        exit $failed
        ;;

   *)
      echo "Usage:  ${0} {start}"
      exit 1
      ;;
esac

# End console
```

D.14. /etc/rc.d/init.d/localnet

```
#!/bin/sh
########################################################################
# Begin localnet
#
# Description : Loopback device
#
# Authors     : Gerard Beekmans  - gerard@linuxfromscratch.org
#               DJ Lucas - dj@linuxfromscratch.org
# Update      : Bruce Dubbs - bdubbs@linuxfromscratch.org
#
# Version     : LFS 7.0
#
########################################################################

### BEGIN INIT INFO
# Provides:            localnet
# Required-Start:      $local_fs
# Should-Start:
# Required-Stop:
# Should-Stop:
```

```
# Default-Start:        S
# Default-Stop:         0 6
# Short-Description:    Starts the local network.
# Description:          Sets the hostname of the machine and starts the
#                       loopback interface.
# X-LFS-Provided-By:    LFS
### END INIT INFO

. /lib/lsb/init-functions
[ -r /etc/sysconfig/network ] && . /etc/sysconfig/network

case "${1}" in
   start)
      log_info_msg "Bringing up the loopback interface..."
      ip addr add 127.0.0.1/8 label lo dev lo
      ip link set lo up
      evaluate_retval

      log_info_msg "Setting hostname to ${HOSTNAME}..."
      hostname ${HOSTNAME}
      evaluate_retval
      ;;

   stop)
      log_info_msg "Bringing down the loopback interface..."
      ip link set lo down
      evaluate_retval
      ;;

   restart)
      ${0} stop
      sleep 1
      ${0} start
      ;;

   status)
      echo "Hostname is: $(hostname)"
      ip link show lo
      ;;

   *)
      echo "Usage: ${0} {start|stop|restart|status}"
      exit 1
      ;;
esac

exit 0

# End localnet
```

D.15. /etc/rc.d/init.d/sysctl

```
#!/bin/sh
########################################################################
# Begin sysctl
#
# Description : File uses /etc/sysctl.conf to set kernel runtime
#               parameters
#
# Authors     : Nathan Coulson (nathan@linuxfromscratch.org)
```

```
#              Matthew Burgress (matthew@linuxfromscratch.org)
#              DJ Lucas - dj@linuxfromscratch.org
# Update     : Bruce Dubbs - bdubbs@linuxfromscratch.org
#
# Version    : LFS 7.0
#
########################################################################

### BEGIN INIT INFO
# Provides:           sysctl
# Required-Start:     mountvirtfs
# Should-Start:
# Required-Stop:
# Should-Stop:
# Default-Start:      S
# Default-Stop:
# Short-Description:  Makes changes to the proc filesystem
# Description:        Makes changes to the proc filesystem as defined in
#                     /etc/sysctl.conf.  See 'man sysctl(8)'.
# X-LFS-Provided-By:  LFS
### END INIT INFO

. /lib/lsb/init-functions

case "${1}" in
   start)
      if [ -f "/etc/sysctl.conf" ]; then
         log_info_msg "Setting kernel runtime parameters..."
         sysctl -q -p
         evaluate_retval
      fi
      ;;

   status)
      sysctl -a
      ;;

   *)
      echo "Usage: ${0} {start|status}"
      exit 1
      ;;
esac

exit 0

# End sysctl
```

D.16. /etc/rc.d/init.d/sysklogd

```
#!/bin/sh
########################################################################
# Begin sysklogd
#
# Description : Sysklogd loader
#
# Authors     : Gerard Beekmans - gerard@linuxfromscratch.org
#               DJ Lucas - dj@linuxfromscratch.org
# Update      : Bruce Dubbs - bdubbs@linuxfromscratch.org
#
# Version     : LFS 7.0
```

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```
#
################################################################################

### BEGIN INIT INFO
# Provides:            $syslog
# Required-Start:      localnet
# Should-Start:
# Required-Stop:       $local_fs sendsignals
# Should-Stop:
# Default-Start:       2 3 4 5
# Default-Stop:        0 1 6
# Short-Description:    Starts kernel and system log daemons.
# Description:         Starts kernel and system log daemons.
#                       /etc/fstab.
# X-LFS-Provided-By:    LFS
### END INIT INFO

. /lib/lsb/init-functions

case "${1}" in
   start)
      log_info_msg "Starting system log daemon..."
      parms=${SYSKLOGD_PARMS-'-m 0'}
      start_daemon /sbin/syslogd $parms
      evaluate_retval

      log_info_msg "Starting kernel log daemon..."
      start_daemon /sbin/klogd
      evaluate_retval
      ;;

   stop)
      log_info_msg "Stopping kernel log daemon..."
      killproc /sbin/klogd
      evaluate_retval

      log_info_msg "Stopping system log daemon..."
      killproc /sbin/syslogd
      evaluate_retval
      ;;

   reload)
      log_info_msg "Reloading system log daemon config file..."
      pid=`pidofproc syslogd`
      kill -HUP "${pid}"
      evaluate_retval
      ;;

   restart)
      ${0} stop
      sleep 1
      ${0} start
      ;;

   status)
      statusproc /sbin/syslogd
      statusproc klogd
      ;;

   *)
      echo "Usage: ${0} {start|stop|reload|restart|status}"
```

```
        exit 1
        ;;
esac

exit 0

# End sysklogd
```

D.17. /etc/rc.d/init.d/network

```
#!/bin/sh
########################################################################
# Begin network
#
# Description : Network Control Script
#
# Authors     : Gerard Beekmans - gerard@linuxfromscratch.org
#               Nathan Coulson - nathan@linuxfromscratch.org
#               Kevin P. Fleming - kpfleming@linuxfromscratch.org
#               DJ Lucas - dj@linuxfromscratch.org
# Update      : Bruce Dubbs - bdubbs@linuxfromscratch.org
#
# Version     : LFS 7.0
#
########################################################################

### BEGIN INIT INFO
# Provides:          $network
# Required-Start:    $local_fs swap localnet
# Should-Start:      $syslog
# Required-Stop:     $local_fs swap localnet
# Should-Stop:       $syslog
# Default-Start:     3 4 5
# Default-Stop:      0 1 2 6
# Short-Description: Starts and configures network interfaces.
# Description:       Starts and configures network interfaces.
# X-LFS-Provided-By: LFS
### END INIT INFO

case "${1}" in
   start)
      # Start all network interfaces
      for file in /etc/sysconfig/ifconfig.*
      do
         interface=${file##*/ifconfig.}

         # Skip if $file is * (because nothing was found)
         if [ "${interface}" = "*" ]
         then
            continue
         fi

         /sbin/ifup ${interface}
      done
      ;;

   stop)
      # Reverse list
      net_files=""
      for file in  /etc/sysconfig/ifconfig.*
```

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```
        do
            net_files="${file} ${net_files}"
        done

        # Stop all network interfaces
        for file in ${net_files}
        do
            interface=${file##*/ifconfig.}

            # Skip if $file is * (because nothing was found)
            if [ "${interface}" = "*" ]
            then
                continue
            fi

            /sbin/ifdown ${interface}
        done
        ;;

    restart)
        ${0} stop
        sleep 1
        ${0} start
        ;;

    *)
        echo "Usage: ${0} {start|stop|restart}"
        exit 1
        ;;
esac

exit 0

# End network
```

D.18. /etc/rc.d/init.d/sendsignals

```
#!/bin/sh
########################################################################
# Begin sendsignals
#
# Description : Sendsignals Script
#
# Authors     : Gerard Beekmans - gerard@linuxfromscratch.org
#               DJ Lucas - dj@linuxfromscratch.org
# Update      : Bruce Dubbs - bdubbs@linuxfromscratch.org
#
# Version     : LFS 7.0
#
########################################################################

### BEGIN INIT INFO
# Provides:            sendsignals
# Required-Start:
# Should-Start:
# Required-Stop:       $local_fs swap localnet
# Should-Stop:
# Default-Start:
# Default-Stop:        0 6
# Short-Description:   Attempts to kill remaining processes.
```

```
# Description:        Attempts to kill remaining processes.
# X-LFS-Provided-By:   LFS
### END INIT INFO

. /lib/lsb/init-functions

case "${1}" in
   stop)
      log_info_msg "Sending all processes the TERM signal..."
      killall5 -15
      error_value=${?}

      sleep ${KILLDELAY}

      if [ "${error_value}" = 0 -o "${error_value}" = 2 ]; then
         log_success_msg
      else
         log_failure_msg
      fi

      log_info_msg "Sending all processes the KILL signal..."
      killall5 -9
      error_value=${?}

      sleep ${KILLDELAY}

      if [ "${error_value}" = 0 -o "${error_value}" = 2 ]; then
         log_success_msg
      else
         log_failure_msg
      fi
      ;;

   *)
      echo "Usage: ${0} {stop}"
      exit 1
      ;;

esac

exit 0

# End sendsignals
```

D.19. /etc/rc.d/init.d/reboot

```
#!/bin/sh
########################################################################
# Begin reboot
#
# Description : Reboot Scripts
#
# Authors      : Gerard Beekmans - gerard@linuxfromscratch.org
#                DJ Lucas - dj@linuxfromscratch.org
# Update       : Bruce Dubbs - bdubbs@linuxfromscratch.org
#
# Version      : LFS 7.0
#
########################################################################
```

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```
### BEGIN INIT INFO
# Provides:            reboot
# Required-Start:
# Should-Start:
# Required-Stop:
# Should-Stop:
# Default-Start:       6
# Default-Stop:
# Short-Description:   Reboots the system.
# Description:         Reboots the System.
# X-LFS-Provided-By:   LFS
### END INIT INFO

. /lib/lsb/init-functions

case "${1}" in
   stop)
      log_info_msg "Restarting system..."
      reboot -d -f -i
      ;;

   *)
      echo "Usage: ${0} {stop}"
      exit 1
      ;;

esac

# End reboot
```

D.20. /etc/rc.d/init.d/halt

```
#!/bin/sh
########################################################################
# Begin halt
#
# Description : Halt Script
#
# Authors     : Gerard Beekmans - gerard@linuxfromscratch.org
#               DJ Lucas - dj@linuxfromscratch.org
# Update      : Bruce Dubbs - bdubbs@linuxfromscratch.org
#
# Version     : LFS 7.0
#
########################################################################

### BEGIN INIT INFO
# Provides:            halt
# Required-Start:
# Should-Start:
# Required-Stop:
# Should-Stop:
# Default-Start:       0
# Default-Stop:
# Short-Description:   Halts the system.
# Description:         Halts the System.
# X-LFS-Provided-By:   LFS
### END INIT INFO

case "${1}" in
```

```
    stop)
        halt -d -f -i -p
        ;;

    *)
        echo "Usage: {stop}"
        exit 1
        ;;
esac

# End halt
```

D.21. /etc/rc.d/init.d/template

```
#!/bin/sh
########################################################################
# Begin scriptname
#
# Description :
#
# Authors     :
#
# Version     : LFS x.x
#
# Notes       :
#
########################################################################

### BEGIN INIT INFO
# Provides:            template
# Required-Start:
# Should-Start:
# Required-Stop:
# Should-Stop:
# Default-Start:
# Default-Stop:
# Short-Description:
# Description:
# X-LFS-Provided-By:
### END INIT INFO

. /lib/lsb/init-functions

case "${1}" in
    start)
        log_info_msg "Starting..."
        start_daemon fully_qualified_path
        ;;

    stop)
        log_info_msg "Stopping..."
        killproc fully_qualified_path
        ;;

    restart)
        ${0} stop
        sleep 1
        ${0} start
        ;;
```

```
    *)
        echo "Usage: ${0} {start|stop|restart}"
        exit 1
        ;;
esac

exit 0

# End scriptname
```

D.22. /etc/sysconfig/modules

```
###############################################################################
# Begin /etc/sysconfig/modules
#
# Description : Module auto-loading configuration
#
# Authors     :
#
# Version     : 00.00
#
# Notes       : The syntax of this file is as follows:
#          <module> [<arg1> <arg2> ...]
#
# Each module should be on it's own line, and any options that you want
# passed to the module should follow it.  The line deliminator is either
# a space or a tab.
###############################################################################

# End /etc/sysconfig/modules
```

D.23. /etc/sysconfig/createfiles

```
###############################################################################
# Begin /etc/sysconfig/createfiles
#
# Description : Createfiles script config file
#
# Authors     :
#
# Version     : 00.00
#
# Notes       : The syntax of this file is as follows:
#          if type is equal to "file" or "dir"
#           <filename> <type> <permissions> <user> <group>
#          if type is equal to "dev"
#           <filename> <type> <permissions> <user> <group> <devtype>
#              <major> <minor>
#
#          <filename> is the name of the file which is to be created
#          <type> is either file, dir, or dev.
#                 file creates a new file
#                 dir creates a new directory
#                 dev creates a new device
#          <devtype> is either block, char or pipe
#                 block creates a block device
#                 char creates a character deivce
#                 pipe creates a pipe, this will ignore the <major> and
#            <minor> fields
#          <major> and <minor> are the major and minor numbers used for
```

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```
#     the device.
##############################################################################

# End /etc/sysconfig/createfiles
```

D.24. /etc/sysconfig/udev-retry

```
##############################################################################
# Begin /etc/sysconfig/udev_retry
#
# Description : udev_retry script configuration
#
# Authors     :
#
# Version     : 00.00
#
# Notes       : Each subsystem that may need to be re-triggered after mountfs
#               runs should be listed in this file.  Probable subsystems to be
#               listed here are rtc (due to /var/lib/hwclock/adjtime) and sound
#               (due to both /var/lib/alsa/asound.state and /usr/sbin/alsactl).
#               Entries are whitespace-separated.
##############################################################################

rtc

# End /etc/sysconfig/udev_retry
```

D.25. /sbin/ifup

```
#!/bin/sh
##############################################################################
# Begin /sbin/ifup
#
# Description : Interface Up
#
# Authors     : Nathan Coulson - nathan@linuxfromscratch.org
#               Kevin P. Fleming - kpfleming@linuxfromscratch.org
# Update      : Bruce Dubbs - bdubbs@linuxfromscratch.org
#
# Version     : LFS 7.2
#
# Notes       : The IFCONFIG variable is passed to the SERVICE script
#               in the /lib/services directory, to indicate what file the
#               service should source to get interface specifications.
#
##############################################################################

up()
{
  if ip link show $1 > /dev/null 2>&1; then
     link_status=`ip link show $1`

     if [ -n "${link_status}" ]; then
        if ! echo "${link_status}" | grep -q UP; then
           ip link set $1 up
        fi
     fi

  else
     log_failure_msg "\nInterface ${IFACE} doesn't exist."
```

```
      exit 1
   fi
}

RELEASE="7.2"

USAGE="Usage: $0 [ -hV ] [--help] [--version] interface"
VERSTR="LFS ifup, version ${RELEASE}"

while [ $# -gt 0 ]; do
    case "$1" in
        --help | -h)     help="y"; break ;;

        --version | -V)  echo "${VERSTR}"; exit 0 ;;

        -*)              echo "ifup: ${1}: invalid option" >&2
                         echo "${USAGE}" >& 2
                         exit 2 ;;

        *)               break ;;
    esac
done

if [ -n "$help" ]; then
    echo "${VERSTR}"
    echo "${USAGE}"
    echo
    cat << HERE_EOF
ifup is used to bring up a network interface.  The interface
parameter, e.g. eth0 or eth0:2, must match the trailing part of the
interface specifications file, e.g. /etc/sysconfig/ifconfig.eth0:2.

HERE_EOF
    exit 0
fi

file=/etc/sysconfig/ifconfig.${1}

# Skip backup files
[ "${file}" = "${file%""~""}" ] || exit 0

. /lib/lsb/init-functions

log_info_msg "Bringing up the ${1} interface... "

if [ ! -r "${file}" ]; then
   log_failure_msg2 "${file} is missing or cannot be accessed."
   exit 1
fi

. $file

if [ "$IFACE" = "" ]; then
   log_failure_msg2 "${file} does not define an interface [IFACE]."
   exit 1
fi

# Do not process this service if started by boot, and ONBOOT
# is not set to yes
if [ "${IN_BOOT}" = "1" -a "${ONBOOT}" != "yes" ]; then
   log_info_msg2 "skipped"
```

```
    exit 0
fi

for S in ${SERVICE}; do
  if [ ! -x "/lib/services/${S}" ]; then
    MSG="\nUnable to process ${file}.  Either "
    MSG="${MSG}the SERVICE '${S} was not present "
    MSG="${MSG}or cannot be executed."
    log_failure_msg "$MSG"
    exit 1
  fi
done

# Create/configure the interface
for S in ${SERVICE}; do
  IFCONFIG=${file} /lib/services/${S} ${IFACE} up
done

# Bring up the interface and any components
for I in $IFACE $INTERFACE_COMPONENTS; do up $I; done

# Set MTU if requested. Check if MTU has a "good" value.
if test -n "${MTU}"; then
    if [[ ${MTU} =~ ^[0-9]+$ ]] && [[ $MTU -ge 68 ]] ; then
        for I in $IFACE $INTERFACE_COMPONENTS; do
            ip link set dev $I mtu $MTU;
        done
    else
        log_info_msg2 "Invalid MTU $MTU"
    fi
fi

# Set the route default gateway if requested
if [ -n "${GATEWAY}" ]; then
    if ip route | grep -q default; then
        log_warning_msg "\nGateway already setup; skipping."
    else
        log_info_msg "Setting up default gateway..."
        ip route add default via ${GATEWAY} dev ${IFACE}
        evaluate_retval
    fi
fi

# End /sbin/ifup
```

D.26. /sbin/ifdown

```
#!/bin/bash
########################################################################
# Begin /sbin/ifdown
#
# Description : Interface Down
#
# Authors     : Nathan Coulson - nathan@linuxfromscratch.org
#               Kevin P. Fleming - kpfleming@linuxfromscratch.org
# Update      : Bruce Dubbs - bdubbs@linuxfromscratch.org
#
# Version     : LFS 7.0
#
# Notes       : the IFCONFIG variable is passed to the scripts found
```

```
#                  in the /lib/services directory, to indicate what file the
#                  service should source to get interface specifications.
#
########################################################################

RELEASE="7.0"

USAGE="Usage: $0 [ -hV ] [--help] [--version] interface"
VERSTR="LFS ifdown, version ${RELEASE}"

while [ $# -gt 0 ]; do
   case "$1" in
      --help | -h)     help="y"; break ;;

      --version | -V)  echo "${VERSTR}"; exit 0 ;;

      -*)              echo "ifup: ${1}: invalid option" >&2
                       echo "${USAGE}" >& 2
                       exit 2 ;;

      *)               break ;;
   esac
done

if [ -n "$help" ]; then
   echo "${VERSTR}"
   echo "${USAGE}"
   echo
   cat << HERE_EOF
ifdown is used to bring down a network interface.  The interface
parameter, e.g. eth0 or eth0:2, must match the trailing part of the
interface specifications file, e.g. /etc/sysconfig/ifconfig.eth0:2.

HERE_EOF
   exit 0
fi

file=/etc/sysconfig/ifconfig.${1}

# Skip backup files
[ "${file}" = "${file%""~""}" ] || exit 0

. /lib/lsb/init-functions

if [ ! -r "${file}" ]; then
   log_warning_msg "${file} is missing or cannot be accessed."
   exit 1
fi

. ${file}

if [ "$IFACE" = "" ]; then
   log_failure_msg "${file} does not define an interface [IFACE]."
   exit 1
fi

# We only need to first service to bring down the interface
S=`echo ${SERVICE} | cut -f1 -d" "`

if ip link show ${IFACE} > /dev/null 2>&1; then
   if [ -n "${S}" -a -x "/lib/services/${S}" ]; then
```

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```
        IFCONFIG=${file} /lib/services/${S} ${IFACE} down
    else
      MSG="Unable to process ${file}.  Either "
      MSG="${MSG}the SERVICE variable was not set "
      MSG="${MSG}or the specified service cannot be executed."
      log_failure_msg "$MSG"
      exit 1
  fi
else
    log_warning_msg "Interface ${1} doesn't exist."
fi

# Leave the interface up if there are additional interfaces in the device
link_status=`ip link show ${IFACE} 2>/dev/null`

if [ -n "${link_status}" ]; then
    if [ "$(echo "${link_status}" | grep UP)" != "" ]; then
        if [ "$(ip addr show ${IFACE} | grep 'inet ')" == ""  ]; then
            log_info_msg "Bringing down the ${IFACE} interface..."
            ip link set ${IFACE} down
            evaluate_retval
        fi
    fi
fi

# End /sbin/ifdown
```

D.27. /lib/services/ipv4-static

```
#!/bin/sh
########################################################################
# Begin /lib/services/ipv4-static
#
# Description : IPV4 Static Boot Script
#
# Authors     : Nathan Coulson - nathan@linuxfromscratch.org
#               Kevin P. Fleming - kpfleming@linuxfromscratch.org
# Update      : Bruce Dubbs - bdubbs@linuxfromscratch.org
#
# Version     : LFS 7.0
#
########################################################################

. /lib/lsb/init-functions
. ${IFCONFIG}

if [ -z "${IP}" ]; then
    log_failure_msg "\nIP variable missing from ${IFCONFIG}, cannot continue."
    exit 1
fi

if [ -z "${PREFIX}" -a -z "${PEER}" ]; then
    log_warning_msg "\nPREFIX variable missing from ${IFCONFIG}, assuming 24."
    PREFIX=24
    args="${args} ${IP}/${PREFIX}"

elif [ -n "${PREFIX}" -a -n "${PEER}" ]; then
    log_failure_msg "\nPREFIX and PEER both specified in ${IFCONFIG}, cannot continue."
    exit 1
```

```
elif [ -n "${PREFIX}" ]; then
   args="${args} ${IP}/${PREFIX}"

elif [ -n "${PEER}" ]; then
   args="${args} ${IP} peer ${PEER}"
fi

if [ -n "${BROADCAST}" ]; then
   args="${args} broadcast ${BROADCAST}"
fi

case "${2}" in
   up)
      if [ "$(ip addr show ${1} 2>/dev/null | grep ${IP}/)" = "" ]; then

         # Cosmetic output not needed for multiple services
         if ! $(echo ${SERVICE} | grep -q " "); then
           log_info_msg2 "\n" # Terminate the previous message
         fi

         log_info_msg "Adding IPv4 address ${IP} to the ${1} interface..."
         ip addr add ${args} dev ${1}
         evaluate_retval
      else
         log_warning_msg "Cannot add IPv4 address ${IP} to ${1}.  Already present."
      fi
   ;;

   down)
      if [ "$(ip addr show ${1} 2>/dev/null | grep ${IP}/)" != "" ]; then
         log_info_msg "Removing IPv4 address ${IP} from the ${1} interface..."
         ip addr del ${args} dev ${1}
         evaluate_retval
      fi

      if [ -n "${GATEWAY}" ]; then
         # Only remove the gateway if there are no remaining ipv4 addresses
         if [ "$(ip addr show ${1} 2>/dev/null | grep 'inet ')" != "" ]; then
            log_info_msg "Removing default gateway..."
            ip route del default
            evaluate_retval
         fi
      fi
   ;;

   *)
      echo "Usage: ${0} [interface] {up|down}"
      exit 1
   ;;
esac

# End /lib/services/ipv4-static
```

D.28. /lib/services/ipv4-static-route

```
#!/bin/sh
########################################################################
# Begin /lib/services/ipv4-static-route
#
# Description : IPV4 Static Route Script
```

```
#
# Authors      : Kevin P. Fleming - kpfleming@linuxfromscratch.org
#                DJ Lucas - dj@linuxfromscratch.org
# Update       : Bruce Dubbs - bdubbs@linuxfromscratch.org
#
# Version      : LFS 7.0
#
########################################################################

. /lib/lsb/init-functions
. ${IFCONFIG}

case "${TYPE}" in
    ("" | "network")
        need_ip=1
        need_gateway=1
    ;;

    ("default")
        need_gateway=1
        args="${args} default"
        desc="default"
    ;;

    ("host")
        need_ip=1
    ;;

    ("unreachable")
        need_ip=1
        args="${args} unreachable"
        desc="unreachable "
    ;;

    (*)
        log_failure_msg "Unknown route type (${TYPE}) in ${IFCONFIG}, cannot continue."
        exit 1
    ;;
esac

if [ -n "${need_ip}" ]; then
    if [ -z "${IP}" ]; then
        log_failure_msg "IP variable missing from ${IFCONFIG}, cannot continue."
        exit 1
    fi

    if [ -z "${PREFIX}" ]; then
        log_failure_msg "PREFIX variable missing from ${IFCONFIG}, cannot continue."
        exit 1
    fi

    args="${args} ${IP}/${PREFIX}"
    desc="${desc}${IP}/${PREFIX}"
fi

if [ -n "${need_gateway}" ]; then
    if [ -z "${GATEWAY}" ]; then
        log_failure_msg "GATEWAY variable missing from ${IFCONFIG}, cannot continue."
        exit 1
    fi
    args="${args} via ${GATEWAY}"
```

```
fi

if [ -n "${SOURCE}" ]; then
        args="${args} src ${SOURCE}"
fi

case "${2}" in
   up)
      log_info_msg "Adding '${desc}' route to the ${1} interface..."
      ip route add ${args} dev ${1}
      evaluate_retval
   ;;

   down)
      log_info_msg "Removing '${desc}' route from the ${1} interface..."
      ip route del ${args} dev ${1}
      evaluate_retval
   ;;

   *)
      echo "Usage: ${0} [interface] {up|down}"
      exit 1
   ;;
esac

# End /lib/services/ipv4-static-route
```

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Приложение E. Правила конфигурации Udev

В этом приложении для справки приведены правила Udev из udev-lfs-197-2.tar.bz2. Их установка производится по инструкциям из Раздел 6.61, «Udev-197 (Extracted from systemd-197)».

E.1. 55-lfs.rules

```
# /etc/udev/rules.d/55-lfs.rules: Rule definitions for LFS.

# Core kernel devices

# This causes the system clock to be set as soon as /dev/rtc becomes available.
SUBSYSTEM=="rtc", ACTION=="add", MODE="0644", RUN+="/etc/rc.d/init.d/setclock start"
KERNEL=="rtc", ACTION=="add", MODE="0644", RUN+="/etc/rc.d/init.d/setclock start"

# Comms devices

KERNEL=="ippp[0-9]*",        GROUP="dialout"
KERNEL=="isdn[0-9]*",        GROUP="dialout"
KERNEL=="isdnctrl[0-9]*",    GROUP="dialout"
KERNEL=="dcbri[0-9]*",       GROUP="dialout"
```

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