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Prepared by:
Internet and E-Commerce
Solutions Business Unit

Enterprise Solutions Division

Compaq Computer Corporation

Contents

Virtual Web Hosting using the Apache Web Server on Linux

Abstract:

Virtual Web Hosting is a way to use one web server to provide the content of a number of web sites. Each site is located by its own domain name, such as *www.customer-one.com*.

This document describes two approaches to implementing this solution, and the strengths and weaknesses of each. A simple and efficient method using the Apache "rewrite" module is highlighted.

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Virtual Web Hosting using the Apache Web Server on Linux
Technical Guide prepared by Internet and E-Commerce Solutions Business Unit

Enterprise Solutions Division

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1 Overview

One of the best ways for an ISP to build its business is to offer web hosting services. While most ISPs offer some limited hosting space for their residential customers, the Universal Resource Location (URL) is typically tied to the ISP's domain name.
For example, `http://www.your-isp.com/~smith`.

Business customers want to build their own brand loyalty and appear to be Internet-savvy so they want their own domain name -- `http://www.some-company.com`. Individuals and small to medium business customers cannot generally justify the expense of a dedicated web server at their office. An ISP can offer virtual web hosting where a number of web sites are hosted on a single system at the ISP's facility, but provide to the web surfer the illusion that it is dedicated system. This also makes the ISP the logical place for incremental sales of more sophisticated internet services like web site design, streaming audio/video, hosted mail domains, customer-focused mailing lists, and other value added services.

2 Virtual Hosting on Apache Web Server Sizing Guide

This section will help you determine the requirements for virtual hosting on Apache web server.

2.1 Standard Configurations

This document is applicable to the Compaq ProLiant 1850R, the ProLiant 1600, ProLiant 1600R, and the Prosignia Server 720.

The most popular configurations for ISPs doing web hosting or virtual web hosting is the ProLiant 1850R because of its sleek 3U rack-mounted design for high-density web farms and option of a second Pentium II CPU.

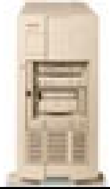
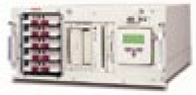
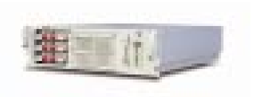
Note: The ProLiant 1850R is only available in a rack-mount configuration.

The ProLiant 1600R, the rack-mounted model, is also available in a tower model, the ProLiant 1600. The ProLiant 1600 includes tower server hardware rather than the rack-mounting hardware of the ProLiant 1600R.

The Prosignia 720 is not rack mountable.

The Prosignia and ProLiant servers used for testing come equipped with standard peripheral devices for which drivers already exist for Linux. Each server is outlined in Table 1.

Table 1: Prosignia/ProLiant Servers

	Prosignia 720	**ProLiant 1600**	**ProLiant 1600R**	**ProLiant 1850R**
				
Processor Speeds	350, 400, 450 MHz	350, 400, 450, 500 MHz	350, 400, 450, 500 MHz	400, 450, 500 MHz
SMP Support	No	Yes	Yes	Yes
L2 Cache	512 KB	512 KB	512 KB	512 KB
Maximum Memory	384 MB	1 GB	1 GB	1 GB
Maximum Number of Drives	3	5 1"-hot swap or 2 1.6" and 1 1" hot swap plus 2 internal 5.25" bays	5 1"-hot swap or 2 1.6" and 1 1" hot swap plus 2 internal 5.25" bays	3 1"- or 2 1.6"-hot swap plus 2 internal 5.25" bays
Drive Sizes Supported	4.3 & 9.1 GB	4.3 & 9.1 GB (1") & 18.2 GB (1.6") hot-plug, 4.3 & 9.1 GB non-hot-plug	4.3 & 9.1 GB (1") & 18.2 GB (1.6") hot-plug, 4.3 & 9.1 GB non-hot-plug	4.3 & 9.1 GB (1") & 18.2 GB (1.6") hot-plug, 4.3 & 9.1 GB non-hot-plug
Disk Controller	Wide Ultra2 SCSI	Wide-Ultra SCSI 3 (dual-channel)	Wide-Ultra SCSI 3 (dual-channel)	Wide-Ultra SCSI 3 (dual-channel)
Disk Controller Chipset	NCR 53c8xx	NCR 53c8xx	NCR 53c8xx	NCR 53c8xx

	Prosignia 720	**ProLiant 1600**	**ProLiant 1600R**	**ProLiant 1850R**
Maximum Internal Storage	27.3 GB	45.5 GB (hot-swap only) or 63.7 GB (hot-swap plus internal)	45.5 GB (hot-swap only) or 63.7 GB (hot-swap plus internal)	36.4 (2x18.2 GB) hot-swap only or 54.6 (2x18.2 GB hot swap plus 2x9.1 GB internal)
CD-ROM	IDE	IDE	IDE	IDE
Diskette Drive	IDE	IDE	IDE	IDE
Total PCI Expansion Slots (total | available)	3 | 2	2 | 2	2 | 2	3 | 3
Total PCI/ISA Expansion Slots (total | available)	1 | 1	4 | 4	4 | 4	1 | 1
Total ISA Expansion Slots (total | available)	1 | 1	0	0	0
Total AGP Expansion Slots (total | available)	1 | 1	0	0	0
Integrated NIC Brand Name	Netelligent 10/100 TX Embedded UTP Controller	Compaq Netelligent 10/100 TX Embedded UTP Controller	Compaq Netelligent 10/100 TX Embedded UTP Controller	Compaq 10/100 PCI Embedded UTP Controller
Integrated NIC Chipset	Intel 8255x	ThunderLan	ThunderLan	ThunderLan
Redundant Fans	No	No	No	No
Redundant Power Supply	No	Optional Hot-Pluggable Redundant	Optional Hot-Pluggable Redundant	Optional Hot-Pluggable Redundant
Power Supply	200 W	325 W	325 W	225 W
Ostensible Pre-Failure Warranty	Processor, Hard Drive	Processor, Memory, Hard Disk	Processor, Memory, Hard Disk	Processor, Memory, Hard Disk
Form Factor	Tower	Tower	5U Rack-Mount	3U Rack-Mount
Video	1024 KB, 1024x768 pixel resolution at 256 colors	1024 KB, 1024x768 pixel resolution at 256 colors	1024 KB, 1024x768 pixel resolution at 256 colors	1024 KB, 1024x768 pixel resolution at 256 colors
Video Card	ATI Rage Iic	Cirrus Logic 5430	Cirrus Logic 5430	ATI Rage IIc
Mouse	PS/2	PS/2	PS/2	PS/2
Keyboard	PS/2 Style	PS/2 Style	PS/2 Style	PS/2 Style

2.2 Sizing Tool

The sizing and configuration information has been developed using testing and performance data as well as best practices business rules gathered in Compaq laboratories and the Compaq ISP Competency Centers.

Use the online web server sizing tool available in the *Compaq ActiveAnswers* for Apache Web Server on Linux solution and *Compaq ActiveAnswers* for ISP Infrastructure on Linux solution.

3 Implementing Virtual Web Domains

Hosting of virtual web domains means a web server supports more than one domain. For example, the ISP's system hosting-server.isp.com answers to requests for www.first-company.com, www.second-company.com, etc.

There are two ways to implement virtual web hosting: IP-based and Name-based virtual web hosting.

The following table compares the steps needed to implement each approach.

Table 2: Comparision - Installation of IP-based and Name-based Virtual Web Hosting

Installation Tasks	IP-based	Name-based
Obtain new Linux kernel source kit	Yes (minimal Version 2.2.2)	No (assumes V2.0.36 or higher is already installed)
Recompile & install new Linux kernel	Yes	No
Reconfigure server's network configuration	Yes (every time a new virtual domain is added)	No
Update DNS Entries	Yes	Yes
Edit Apache configuration files	Yes (every time a new virtual domain is added)	Yes (only during initial apache configuration)
Obtain new Apache source kit	No (assumes Apache V1.3.4 or higher has been installed)	Yes (needs V1.3.4 or higher)
Recompile & install new Apache	No	Yes
Edit Apache virtual host-to-directory file	No	Yes

3.1 IP-based Overview

Each of the hosted domains require its own IP address assigned to it in the ISP's Domain Name System (DNS[1]) server. This can be a problem for some ISPs if they do not have a large number of available addresses to dedicate to each customer. The advantage of an IP-based implementation is that it is guaranteed to work with all versions of all browsers. Since the HTTP request is received from a specific IP address, the web server can easily decide which domain content it needs to send. Also some customers request their own dedicated IP address.

However, this method has more dependencies and requires more work to support additional domains. The steps are:

- Obtain a new Linux Kernel source kit
- Rebuild and install the new Linux kernel with IP aliasing support
- Updating the server's network configuration for IP aliasing
- Update the primary DNS server
- Edit the Apache web server configuration file

[1] For more information about DNS, see the Internet Software Consortium's bind server (http://www.isc.org/bind.html).

See Section 3.3 , Implementing IP-based Virtual Web Domains, for information about how to implement virtual web hosting using an IP-based approach.

3.2 Name-based Overview

Using the Name-based method, all hosted domains share an IP address. The DNS entries for each of the customer domains all point to the same IP address.

The primary disadvantage of this method is that it relies on web browsers to support the HTTP/1.1 protocol which includes a hostname when it requests a URL. All current major browsers support this protocol, however older web browsers, notably some versions of the AOL web browser, did not. In that case, the web user sees the default page of the server hosting the system. The usual practice is for the hosting server's default page with links to the hosted domains relative to the top level pages, as described later in this section.

The usual way of adding more domains involves updating DNS and editing Apache's configuration file. While effective, a large number of domains can make updating the configuration file a risky operation and it requires that the Apache web server be restarted.

A cleaner approach is to use Apache's "rewrite" module, which makes it possible to add domains in two simple steps:

- Update the domain name to the file location map file
- Update the primary DNS server

Additionally the Apache web server does not have to be restarted.

See Section 3.4 , Implementing Name-based Virtual Web Domains, for information on how to implement virtual web hosting using an IP-based approach.

3.3 Implementing IP-based Virtual Web Domains

This section describes the four steps to implementing an IP-based virtual web server:

- Install and configure the Linux kernel with additional IP aliasing support
- Reconfigure the network configuration
- Update the primary DNS server
- Update the Apache configuration file

We assume that your system already has a recent version of a Linux distribution and you have previously configured the network.

3.3.1 Installing and Configuring Linux V2.2.x with IP Aliasing

The first step is to build a Linux kernel that supports IP aliasing. This enables the system to have more than one IP address supported on a network interface card (NIC). None of the major Linux distributions ship with a kernel with this functionality enabled, so you must rebuild your own kernel. For detailed instructions on how to build a kernel for your particular Linux distribution, please refer to the documentation that came with it.

3.3.1.1 Obtaining the Linux V2.2.x Kernel

Obtain the Linux V2.2.x kernel source and unpack it in the `/usr/src/linux` directory.

The central repository for the Linux kernel source is on `ftp://ftp.kernel.org`. Since that FTP site is frequently overloaded, check for an available mirror closer to you on `http://www.kernel.org/mirror`. The mirror for North America is `ftp://ftp.us.kernel.org/`.

The version naming convention the Linux kernel developers use is to assign even minor versions for stable, production systems, such as V2.2.x; and odd minor versions for development systems, such as V2.3.x. As of this writing the current, stable version is V2.2.2. The previous stable version that most Linux distributions ship is V2.0.36.

If the `wget` tool is installed on your Linux system, use following command to pull a copy of the kernel sources from the official linux kernel web site:

```
# cd /usr/src/
# wget -c ftp://ftp.us.kernel.org/pub/linux/kernel/v2.2/linux-2.2.2.tar.gz
```

You can also use the regular FTP client or a web browser to download the sources.

3.3.2 Additional required steps to upgrade to the Linux V2.2.x Kernel

There are a number of other components that need to be upgraded in order to fully upgrade to the Linux V2.2.x kernel. The document `/usr/src/linux/Documentation/Changes` in the new source directory details twenty components that should be verified your system is at the right version level and where to obtain them.

See `http://www.linuxhq.com/` for more information on upgrading from current versions of major Linux distributions to the V2.2.x kernel.

The following web pages describe these additional steps for specific Linux distributions:

- Debian Linux

  `http://www.debian.org/releases/stable/running-kernel-2.2`
- Red Hat Linux

  `http://www.redhat.com/support/docs/rhl/kernel-2.2/kernel2.2-upgrade-3.html`
- `Pacific HiTech Linux`

  ftp://ftp.pht.com/pub/turbolinux/updates/

3.3.2.1 APIC Settings (SMP)

The default APIC interrupt settings for the ProLiant 1600, 1600R, 1850R (the Prosignia 720 is uni-processor capable only) will not allow for Linux SMP support. However, the APIC settings can be modified to be compatible through the Compaq System Configuration Utility included with Compaq SmartStart. The following procedures are from the document “Linux on Compaq Server Products”, located at http://potter.ieee.uh.edu/compaq.html:

- Enter the System Configuration Utility (also known as the EISA Configuration Utility).
- At the main screen, press control-A to enable advanced mode.
- Use the menu to select “View or Edit Details”.
- Scroll down to where the APIC settings are located and modify the default setting to be in “FULL TABLE” mode.

This configuration will make the server Intel-SMP compliant, and any such Intel-SMP compliant kernel will now recognize and boot this machine as SMP (provided, of course, that two or more processors and their respective processor power modules are present).

3.3.2.2 Configuring the Linux Kernel for IP Aliasing

Before you unpack the new kernel sources, it is a good idea to move the existing kernel source files to a safe location in case you need to back out of the new kernel. Enter the following command:

```
# mv /usr/src/linux /usr/src/linux.old
```

Some Linux distributions may have a softlink from `/usr/src/linux` to the kernel sources in `/usr/src/linux-2.0.36`. In that case you can simply remove the linux file.

The next step is to unpack the sources. If you already have a `/usr/src/linux` directory, it is a good idea to rename it to something else. The follow command uncompresses and extracts the kernel sources into the /usr/src/linux directory:

```
# tar zxvf linux-2.2.2.tar.gz
# cd linux
```

Once the kernel is unpacked, it needs to be configured with the appropriate options. The Linux kernel source includes a set of tools to help you choose the right options. The simplest to use is the X windows interface, using the following command:

```
# make xconfig
```

If you only have a terminal interface, use either of the following commands:

```
# make menuconfig
```

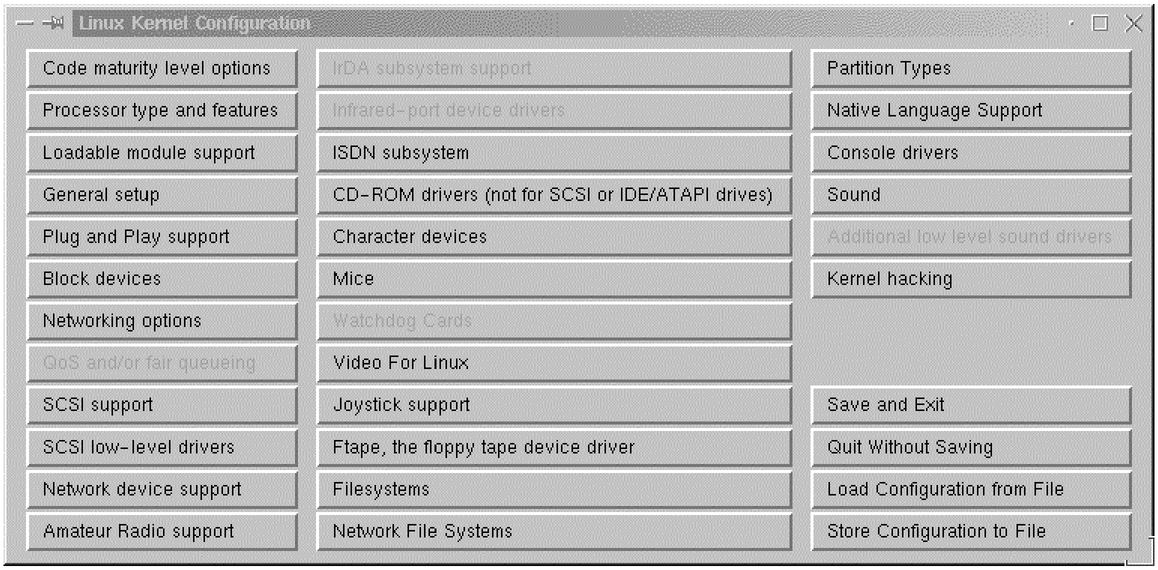
or

```
# make config
```

Then the appropriate tool is compiled and run.

Figure 1 below shows the Linux Kernel Configuration interface used to enable various features in the kernel. These screen shots are from the V2.2.2 kernel sources. Later versions of the kernel may have slightly different configuration menus.

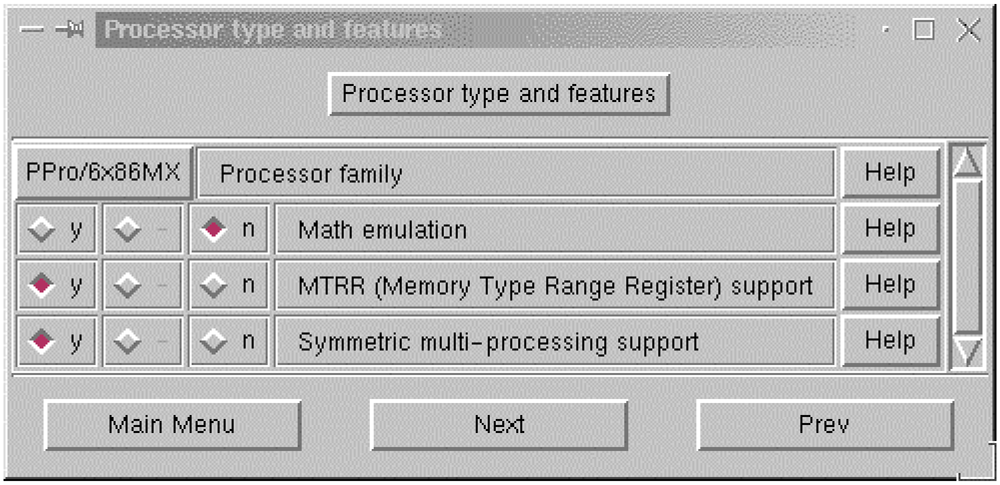
Figure 1: Linux Kernel Configuration



The Compaq ProLiant 1600, 1850R systems use an Intel Pentium II CPU. Enable the optimizations for the PPro/6x86MX, described in the section *Processor Type and Features Options*.

If the server has more than one CPU, be sure to *enable MTRR (Memory Type Range Register) support* and *Symmetric multi-processing support*, shown in Figure 2.

Figure 2: Processor Type and Features



PPro/6x86MX Processor family

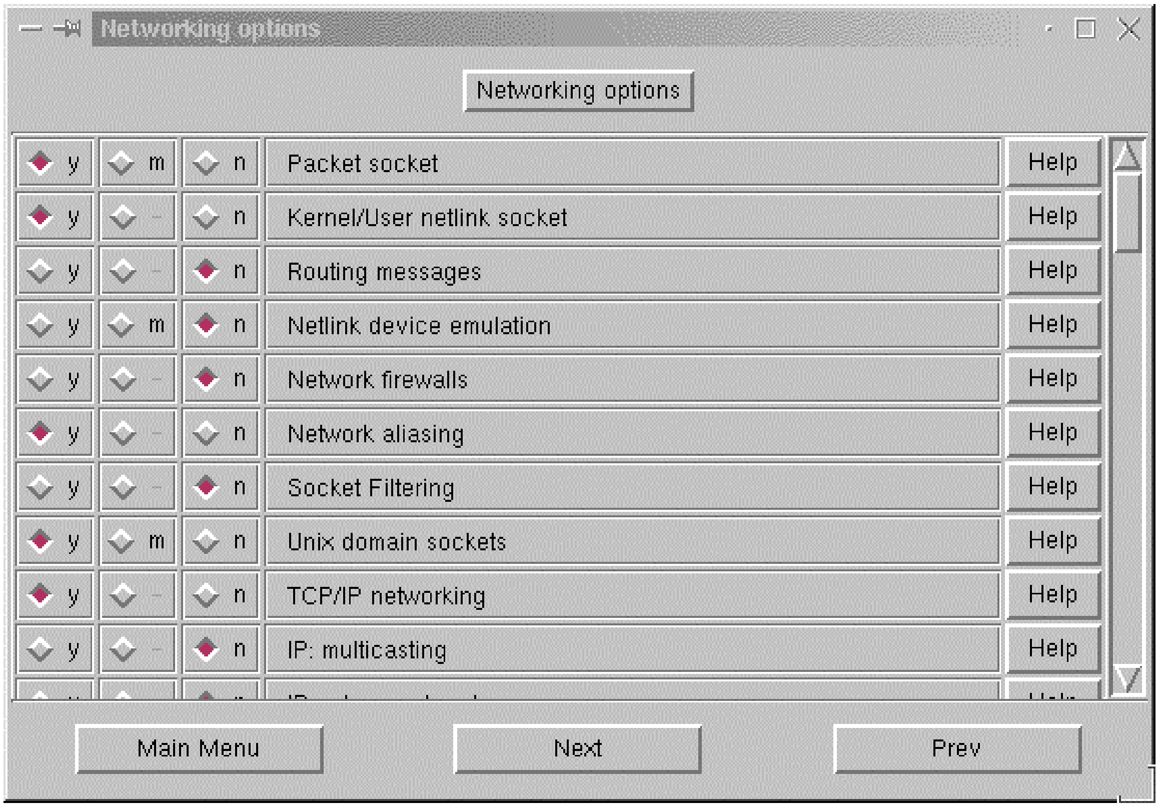
○ y ○ - ● n Math emulation

● y ○ - ○ n MTRR (Memory Type Range Register) support

● y ○ - ○ n Symmetric multi-processing support

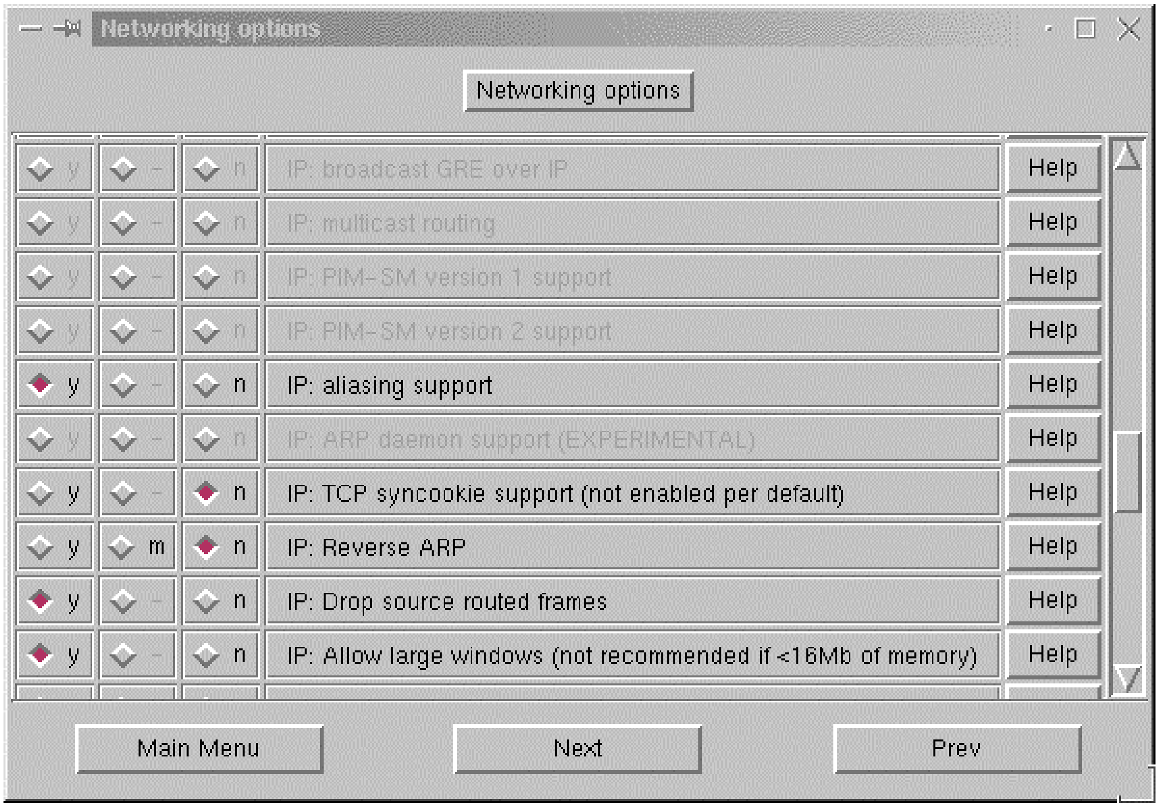
Enable *Network Aliasing*, as shown in Figure 3, and, as you scroll further down the table, enable *IP: Aliasing*, as shown in Figure 4.

Figure 3: Networking Options



◆ y	◇ m	◇ n	Packet socket
◆ y	◇ -	◇ n	Kernel/User netlink socket
◇ y	◇ -	◆ n	Routing messages
◇ y	◇ m	◆ n	Netlink device emulation
◇ y	◇ -	◆ n	Network firewalls
◆ y	◇ -	◇ n	Network aliasing
◇ y	◇ -	◆ n	Socket Filtering
◆ y	◇ m	◇ n	Unix domain sockets
◆ y	◇ -	◇ n	TCP/IP networking
◇ y	◇ -	◆ n	IP: multicasting

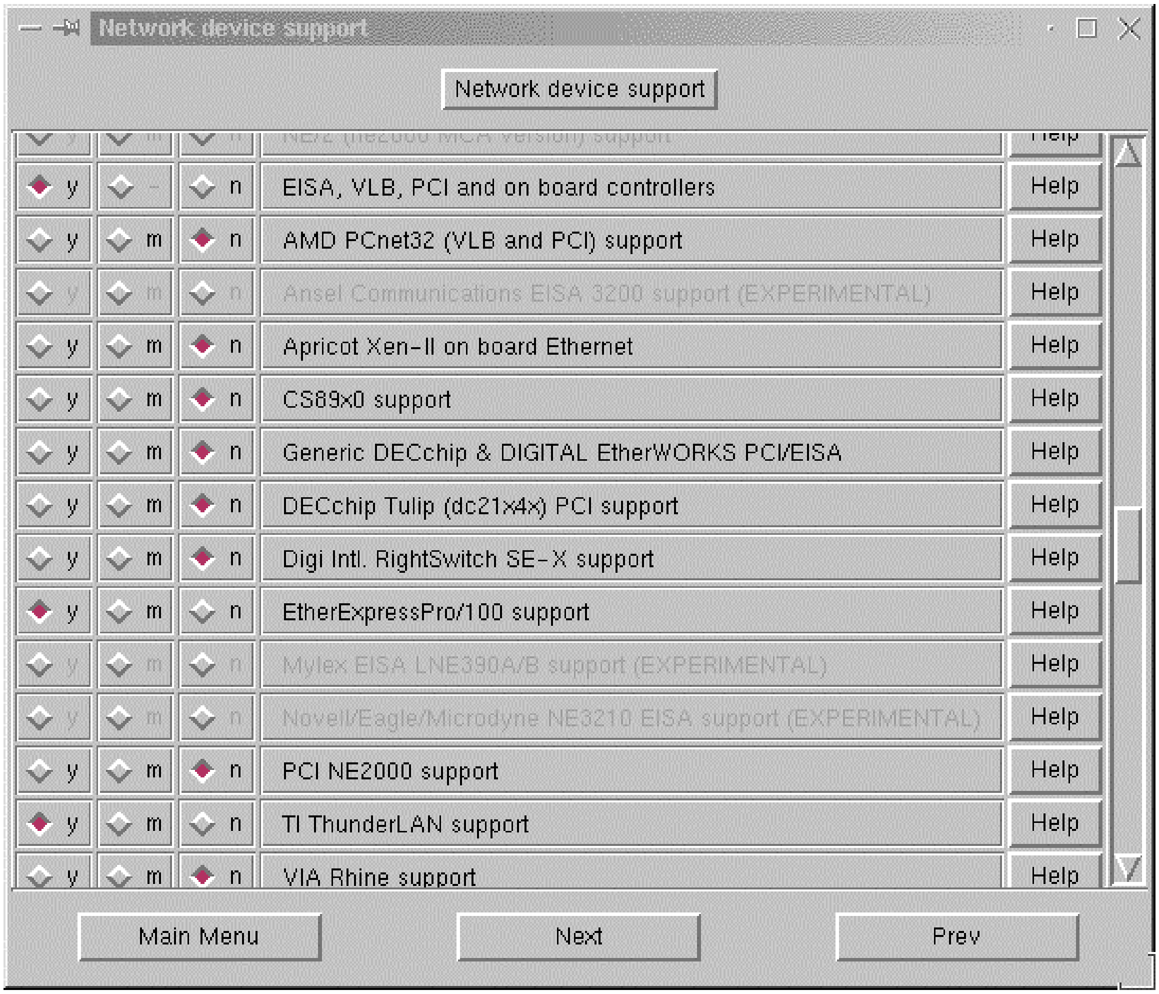
Figure 4: More Networking Options



○ y	○ -	○ n	IP: broadcast GRE over IP	Help
○ y	○ -	○ n	IP: multicast routing	Help
○ y	○ -	○ n	IP: PIM-SM version 1 support	Help
○ y	○ -	○ n	IP: PIM-SM version 2 support	Help
● y	○ -	○ n	IP: aliasing support	Help
○ y	○ -	○ n	IP: ARP daemon support (EXPERIMENTAL)	Help
○ y	○ -	● n	IP: TCP syncookie support (not enabled per default)	Help
○ y	○ m	● n	IP: Reverse ARP	Help
● y	○ -	○ n	IP: Drop source routed frames	Help
● y	○ -	○ n	IP: Allow large windows (not recommended if <16Mb of memory)	Help

In the Network device support window, the support for your Ethernet card must be enabled. The Prosignia 720 Ethernet card, the Netelligent 10/100 TX Embedded UTP Controller, requires the Intel 8255x Network. The ProLiant 1600, 1600, and 1850R systems' uses the Compaq Netelligent 10/100 TX Embedded UTP Controller and requires the TI ThunderLAN support option. Unlike previous versions, the Linux V2.2.x kernel directly supports the Compaq onboard NIC card with the TI ThunderLAN driver. Be sure that the *EISA, VLB, PCI and on board controllers* option is selected and then enable the *TI ThunderLAN support* option. This is shown in Figure 5.

Figure 5 Network Device Support



◇ y ◇ m ◇ n NE/2 (ne2000 MCA version) support Help
◆ y ◇ - ◇ n EISA, VLB, PCI and on board controllers Help
◇ y ◇ m ◆ n AMD PCnet32 (VLB and PCI) support Help
◇ y ◇ m ◇ n Ansel Communications EISA 3200 support (EXPERIMENTAL) Help
◇ y ◇ m ◆ n Apricot Xen-II on board Ethernet Help
◇ y ◇ m ◆ n CS89x0 support Help
◇ y ◇ m ◆ n Generic DECchip & DIGITAL EtherWORKS PCI/EISA Help
◇ y ◇ m ◆ n DECchip Tulip (dc21x4x) PCI support Help
◇ y ◇ m ◆ n Digi Intl. RightSwitch SE-X support Help
◆ y ◇ m ◇ n EtherExpressPro/100 support Help
◇ y ◇ m ◇ n Mylex EISA LNE390A/B support (EXPERIMENTAL) Help
◇ y ◇ m ◇ n Novell/Eagle/Microdyne NE3210 EISA support (EXPERIMENTAL) Help
◇ y ◇ m ◆ n PCI NE2000 support Help
◆ y ◇ m ◇ n TI ThunderLAN support Help
◇ y ◇ m ◆ n VIA Rhine support Help

After you have made these changes, select "Save and Exit" to exit.

The next step is to recalculate the dependencies and ensure there are no old files existing, by entering the following commands:

```
# make dep
# make clean
```

Now you are ready to recompile the kernel with the following command. If the system you are doing the recompile on has two CPUs and is already running a kernel with SMP support enabled, add `-j 2` to `make` to significantly speed up the compiling:

```
make –j 2
```

If you chose to enable some features as kernel modules (by selecting the "m" radio button), you also need to build them. Enter the following command:

```
make modules
```

Once the kernel and modules are rebuilt, they can be installed with the following command. This moves the new kernel to /boot/vmlinux-2.2.2 and makes a softlink to it from /boot/linux. It also installs the new kernel modules in the /lib/modules/linux-2.2.2 directory:

```
# make install
# make modules_install
```

The *make install* step updates the LILO boot loader, so the `linux` option will boot the new kernel. Before rebooting, you should edit /etc/lilo.conf and add new entry for the new kernel and keep an entry to let you boot the old kernel if needed. Then enter the following command so you can boot the old kernel at the `lilo:` prompt. Be sure to run `lilo` after making the change.

```
image=/boot/vmlinuz-2.2.2
      label=linux
      root=/dev/sda1
      initrd=/boot/initrd-2.0.36-0.7.img
      read-only

image=/boot/vmlinux-2.0.36-0.7
      label=linuxold
      root=/dev/sda1
      initrd=/boot/initrd-2.0.36-0.7.img
      read-only
```

Now, you can reboot the new kernel.

For more detailed instructions on how to build a kernel for your particular Linux distribution, please refer to that distributions website or the documentation. The website `http://www.linuxhq.com/` has pointers to notes on upgrading from current versions of major Linux distributions to the V2.2.x kernel.

3.3.3 Updating the Linux Network Configuration for IP-based Hosting

Once you have rebooted using the new kernel, you can reconfigure your network for additional virtual IP addresses.

Note: The `linuxconf` tool that ships with RedHat V5.2 does not support the Linux V2.2 kernel for virtual IP addresses. Use the following manual procedure:

1. To add the IP addresses 111.222.333.444 and 111.222.333.555 to the first ethernet device, use the following commands. If you get an error, verify that you are using the new kernel with IP Aliasing support:

```
ifconfig eth0:0 111.222.333.444 up
ifconfig eth0:1 111.222.333.555 up
            .
            .
            .
```

2. From another system, verify that the addresses are working. You can also telnet to those addresses to verify that they go to the web hosting system.

```
# ping 111.222.333.444
PING 111.222.333.444 (111.222.333.444): 56 data bytes
64 bytes from 111.222.333.444: icmp_seq=0 ttl=255 time=0.3 ms
64 bytes from 111.222.333.444: icmp_seq=1 ttl=255 time=0.3 ms
64 bytes from 111.222.333.444: icmp_seq=2 ttl=255 time=0.3 ms
^C
--- 111.222.333.444 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max = 0.3/0.3/0.3 ms

# ping 111.222.333.555
PING 111.222.333.555 (111.222.333.555): 56 data bytes
64 bytes from 111.222.333.555: icmp_seq=0 ttl=255 time=0.3 ms
64 bytes from 111.222.333.555: icmp_seq=1 ttl=255 time=0.3 ms
64 bytes from 111.222.333.555: icmp_seq=2 ttl=255 time=0.3 ms
^C
--- 111.222.333.555 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max = 0.3/0.3/0.3 ms
```

3. In order for the addresses to be activated the next time the system is rebooted, add the `ifconfig` commands to the local startup file `/etc/rc.d/rc.local.`

4. If you need to disable the addresses, enter the following commands:

```
 ifconfig eth0:0 down
 ifconfig eth0:1 down
          ...
```

3.3.3.1 Updating DNS for IP-based Hosting

The next step to the IP-based method is to update the primary DNS server's configuration to add the new IP addresses.

Most Linux distributions ship the `bind` DNS server whose configuration is typically in

`/etc/named.conf`. Once your DNS servers have been designated as authoritative for the new domain, enter the following lines:

1. In DNS bind server's configuration file `/etc/named.conf`, enter:

```
zone "first-company.com" {
      type master;
      file "db.first-company.com";
};
```

Be sure to update the serial number near the top of the file. The convention is to use the current date expressed as number and two revision numbers. For example, a file updated for the second time on March 20, 1999 would have a serial number of 1999032003.

2. In `/var/named/db.first-company.com`, create an A record that points www.first-company.com to the new IP address assigned to this domain:

```
www.first-company.com.  IN A  111.222.333.444.
```

3. In `/var/named/db.111.222.333`, create a reverse lookup record that points from the new address back to the name www.first-company.com:

   ```
   444.333.222.111.in-addr.arpa. IN PTR  www.first-company.com.
   ```

4. To restart DNS, enter `/etc/rc.d/init.d/named restart`, or `kill -HUP` on the named process id.

5. Verify your change by querying your DNS servers:

   ```
   # nslookup -q=a www.first-company.com dns1.isp.com
   Server:  dns1.isp.com
   Address:  111.222.333.1

   Name:    www.first-company.com
   Address:  111.222.333.444
   ```

3.3.3.2 Updating Apache Web Server for IP-based Hosting

Once you have the network configured, you must notify Apache about the new virtual domains it will host.

Each virtual web host has it's own set of configuration options. If you are hosting over about fifty virtual web sites, then you can use a separate log file for each domain's error and access logs. Below is an example of the lines to add to the apache configuration file, The default location is `/usr/local/apache/conf/httpd.conf`.

```
<VirtualHost www.first-company.com>
 ServerAdmin webmaster@www.first-company.com
 DocumentRoot /usr/local/apache/htdocs/www.first-company.com
 ServerName www.first-company.com
 ErrorLog logs/www.first-company.com-error_log
 CustomLog logs/www.first-company.com-access_log common
</VirtualHost>

<VirtualHost www.second-company.com>
 ServerAdmin webmaster@www.second-company.com
 DocumentRoot /usr/local/apache/htdocs/www.second-company.com
 ServerName www.second-company.com
 ErrorLog logs/www.second-company.com-error_log
 CustomLog logs/www.second-company.com-access_log common
</VirtualHost>
```

However, if you have a large number of virtual web domains, you may reach the maximum open files the kernel will allow. There are two ways to avoid this:

- Increase the maximum number of open files by tuning the kernel.
- Use just one set of log files tagged with each virtual domain on Apache. This is a simpler approach.

In httpd.conf, comment out the existing CustomLog line and insert the following lines:

```
LogFormat "%h %l %u %t \"%r\" %>s %b \"%{Referer}i\" \"%{User-Agent}i\"
%U %v" combined_virt

CustomLog /usr/local/apache/logs/access_log combined_virt
```

This adds the virtual domain name in the first column of the access log on the Apache server.

The simple perl script to split the common log into individual logfiles for each virtual website is included in Appendix A.

3.4 Implementing Name-based Virtual Web Domains

Implementing a Name-based virtual web host has the advantage of only modifying DNS and a simple lookup table on the server. The Apache web server doesn't need to be restarted.

There are four to implementing a Name-based virtual web server:

1. Obtain the Apache source kit
2. Rebuild and install the new Apache web server with "mod_rewrite" support
3. Configure the Apache web server.
4. Update the primary DNS server.

We assume that your system already has a recent version of a Linux distribution and have previously configured the network.

3.4.1 Obtaining Apache Web Server Sources

The central repository for the Apache web server source is on `http://www.apache.org`. If possible use a mirror that is closer. The Apache group provides a handy way to find a closer mirror. The URL `http://www.apache.org/dyn/closer.cgi` will present you with a list of alternate sites. Downloading a kit using the FTP protocol is typically faster than using HTTP.

Compaq maintains an Apache mirror at: `http://www3.service.digital.com/apache` or by anonymous FTP at `www3.service.digital.com`

If the `wget` tool is installed on your Linux system, use the following command to pull a copy of the kernel sources:

```
# cd /usr/src/
# wget -c ftp://www.apache.org/apache/dist/apache_1.3.4.tar.gz
```

3.4.2 Building Apache with mod_rewrite Support

Apache V1.3.4 or later can be built with the "rewrite" module. This will allow for simple configuration of virtual web servers and make it easier to maintain as more virtual web domains are added.

Unlike the IP-based approach which requires manual editing of the Apache configuration file and restarting the Apache web server every time you add more virtual domains, Name-based using the "rewrite" module does not.

Now rebuild Apache as follows:

```
# tar zxvf apache_1.3.4.tar.gz

# cd apache_1.3.4/
# ./configure --prefix=/usr/local/apache \
            --enable-module=rewrite \

            --enable-module=status \

            --enable-module=info

make
```

NOTE: If you are running a Linux server from an RPM-based distribution, the Apache web server may already be installed. You should stop and remove the old version before installing the newly built version as follows:

```
# apachectl stop
```

(or "killall httpd" if apachectl is not available)

Now you can install the newly built images.

```
make install

# rpm -qa | grep apache
apache-1.3.3-1
apache-devel-1.3.3-1

# rpm -e apache-1.3.3-1 apache-devel-1.3.3-1
```

If other apache components have been installed, you will get a warning about dependencies on other packages. They will have to be removed first. See the RPM man page ("man rpm") for information about using this tool.

```
# rpm -e mod_perl-1.15-3 mod_php-2.0.1-5 mod_php3-3.0.5-2
# rpm -e apache-1.3.3-1 apache-devel-1.3.3-1
```

If your site requires those additional modules, you will have to obtain and install them. It is beyond the scope of this document. For more information about integrating the perl programming language into your Apache server, see http://perl.apache.com. Information about the server-side HTML embedded scripting language PHP may be found at http://www.php.net

3.4.3 Configuring Apache Web Server for Name-based hosting

After you have installed the new version of apache, edit the httpd.conf the Apache configuration file. The default location is /usr/local/apache/conf/httpd.conf.

The "rewrite" module is a powerful extension that allows the Apache web server to manipulate the requested URL using regular expression.

First, create a file that has the mapping from the virtual web host name to the physical location of the files for each site and store it in /usr/local/apache/conf/vhost.map:

```
www.first-company.com:80        /home/cust1/public_html
www.second-company.com:80       /home/cust2/public_html
...
www.last-company.com:80         /home/cust999/public_html
```

If you are hosting a large number of virtual domains, you may want to use a DBM database to speed up hostname lookups. See the Apache documentation of the rewrite module for more information.

Now, edit the Apache `httpd` configuration file to add:

```
UseCanonicalName On

LogFormat "%{VHOST}e %l %u %t \"%r\" %>s %b \"%{Referer}i\" \"%{User-
Agent}i\" %U %v" combined_virt

CustomLog /usr/local/apache/logs/access_log combined_virt

line 1: RewriteEngine on
line 2: # RewriteLog /usr/local/apache/logs/rewrite.log"
line 3: # RewriteLogLevel 6

line 4: RewriteMap    lowercase    int:tolower
line 5: RewriteMap    vhost txt:/usr/local/apache/conf/vhost.map

line 6: RewriteCond   %{REQUEST_URI}  !^/icons/.*
line 7: RewriteCond   %{REQUEST_URI}  !^/cgi-bin/.*
line 8: RewriteCond   %{HTTP_HOST}  !^$
line 9: RewriteCond   ${lowercase:%{HTTP_HOST}|NONE}  ^(.+)$
line 10: RewriteCond   ${vhost:%1}  ^(/.*)$
line 11: RewriteRule   ^/(.*)$   %1/$1  [E=VHOST:${lowercase:%{HTTP_HOST}}]
```

Description of the Configuration

This section describes a sample Apache configuration.

Line 1 First, enable the rewrite capability.

Lines 2, 3 For debugging purposes it is useful to uncomment these lines and inspect the log file to see if the rewrite rules are doing as expected.

Line 4 Define a mapping to make converting URLs to lowercase easier.

Line 5 Define a mapping from virtual host name (www.first-company.com) to the physical location of the files for that website (/home/cust1/public_html/). The 1 to 1 mapping is found in the file /usr/local/apache/conf/vhost.map.

Line 6 Continue if the URL does not reference a file in the /icons directory (eg: http://www.somewhere.com/icons/isp-logo.gif). This allows the ISP to provide common graphics for all hosted sites in one directory.

Line 7 Continue if the URL does not reference a file in the /cgi-bin directory (eg: http://www.somewhere.com/cgi-bin/counter.cgi). This allows the ISP to provide a set of CGI programs for use by all hosted sites in one directory.

Line 8 Continue if the HTTP_HOST (eg: www.somewhere.com) is not empty. This happens if the web browser did not include the entire URL with the hostname. It is good practice to put a pointer to all the hosted sites (in the form http://hosting-server.isp.com/~cust1/), on the default web page for hosting-server.isp.com.

Line 9 Compare the lowercase version of the domain name (HTTP_HOST) with the requested URL and store it in the special variable %1.

Line 10 Do a lookup in the vhost mapping and store the physical mapping in the special variable %1.

Line 11 If all the preceding conditions are true, then rewrite the URL with physical mapping to the files. For the URL, http://www.first-company.com/product/specs/widget.html , the file in /home/cust1/public html/product/specs/widget.html is used. Set the environment variable VHOST to the virtual hostname. This is used by the log configuration.

3.4.4 Updating DNS for Named-based Hosting

As with the IP-based virtual web domain method, the next step is to update DNS server's configuration to add the new IP addresses. Most Linux distributions ship the `bind` DNS server whose configuration is typically in `/etc/named.conf`. Once your DNS servers have been designated as authoritative for the new domain, enter the following lines:

```
zone "first-company.com" {
     type master;
     file "db.first-company.com";
  };
```

Be sure to update the serial number near the top of the file. The convention is to use the current date expressed as number and two revision numbers. For example, a file updated for the second time on March 20, 1999 would have a serial number of 1999032003.

Unlike the previous method, the new domain name resolves to the IP address of the Apache web server. `In /var/named/db.first-company.com`, create a CNAME (an Alias) entry that points www.first-company.com to your web server's hostname:

```
www.first-company.com. IN CNAME hosting-server.isp.com.
```

To restart DNS, enter `/etc/rc.d/init.d/named restart`, or `kill -HUP` on the `named` process id. Verify the changes have taken effect by directly querying your DNS server:

```
# nslookup www.first-customer.com dns1.isp.com
Server:  dns1.isp.com
Address:  206.183.137.1

Name:    hosting-server.isp.com
Address:  206.183.137.13
Aliases:  www.first-customer.com
```

4 Managing Virtual Hosting on Apache Web Server

Once installed, the Apache web server should run unattended for long periods of time. It is wise to keep an eye on the server to make sure everything runs smoothly.

4.1 Storage

There are two areas that must be monitored to make sure the system doesn't run out of disk space. The first is the partition that holds the access and error log files. The default location for the apache web server logs is `/usr/local/apache/log/`. The rate of growth of a log file is highly variable depending on frequency of hits as well as the URL being requested.

While it is dependent on the structure of the web content's directory structure and naming conventions, a good rule of thumb is each hit logs about 150 bytes of data. That means one megabyte of log for every 7000 hits.

4.1.1 Logrotate

The open source tool `logrotate` describes itself as designed to ease administration of systems that generate large numbers of log files. It allows automatic rotation, compression, removal, and mailing of log files. Each log file may be handled daily, weekly, monthly, or when it grows too large. If your Linux distribution does not include `logrotate`, you can obtain it from
`ftp://ftp.redhat.com/pub/linux/RedHat/redhat/code/logrotate/`
or one of the many RedHat mirrors.

4.2 Networking

There are a number of third party open source Apache modules that can throttle access to virtual web domains by the amount of bandwidth used or number of simultaneous connections. ApacheWeek maintains a list of these modules. See the web page `http://www.apacheweek.com/features/modulesoup` for more information.

4.3 System Performance

There are a number of open source tools to monitor systems in general and web servers in particular.

4.3.1 Apache's status and info modules

An Apache web server built as described in the Section, "Building Apache with mod_rewrite Support", enabled two special URLs: /server-status and /server-info.

The module mod_status displays information about the general health of the Apache web server — uptime, number of current requests, number of apache child processes, total number of accesses and bytes sent out. By default the Apache configuration file (httpd.conf) has web access denied from everywhere. Uncomment and edit the Allow line to include a list of systems or domains that are allowed access to that URL.

```
#
# Allow server status reports, with the URL of http://servername/server-status
# Change the ".your_domain.com" to match your domain to enable.
#
<Location /server-status>
    SetHandler server-status
    Order deny,allow
    Deny from all
    Allow from .isp.com
</Location>
```

See the Apache documentation for more information at:
`http://www.apache.org/docs/mod/mod_status.html`

The module mod_info displays detailed information about the server configuration including all installed modules and directives in the configuration files.

By default the Apache configuration file (httpd.conf) has web access for that URL denied from everywhere. Uncomment and change the Allow line to include a list of systems or domains that are allowed access to that URL.

```
#
# Allow remote server configuration reports, with the URL of
#  http://servername/server-info (requires that mod_info.c be loaded).
# Change the ".your_domain.com" to match your domain to enable.
#
<Location /server-info>
    SetHandler server-info
    Order deny,allow
    Deny from all
    Allow from .isp.com
</Location>
```

See the Apache documentation for more information at:
`http://www.apache.org/docs/mod/mod_info.html`

4.3.2 Big Brother System and Network Monitor

The open source Big Brother package is a collection of monitoring tools that let remote UNIX-based as well as Microsoft Windows NT systems to be centrally monitored through a web-based interface and can notify operators of warnings and severe errors by sending a page. It can monitor basic availability of the following services: Web servers, DNS, NNTP (USENET news), SMTP, POP3. And it can also monitor disk space and CPU usage, monitor syslog messages as well as verify that critical system processes are running.

See the web site `http://MacLawran.ca` for more information, for a demonstration and to download the source.

4.3.3 mon Service Monitoring Daemon

Another open source package for general-purpose resource monitoring is mon. The mon daemon can be used to monitor network service availability, server problems and can be extended to other areas.

As with Big Brother, mon can monitor basic availability of standard services including Web servers, DNS, NNTP, SMTP, POP3, LDAP, FTP, and telnet. It can also monitor disk space and CPU usage, and verify that critical system processes are running.

See the web site `http://www.kernel.org/software/mon` for more information, a sample page, and to download the source.

4.4 User Resources

4.4.1 Customer Accounts

The important step not covered so far is how customers get access to their web space. The simplest way is to create normal user accounts using the `adduser` tool. We suggest that you also create a `public_html` directory where they can put their content.

To increase security, we recommend that virtual web hosting customers be allowed FTP access but not shell access. FTP and telnet send the username and password in the clear over the network and is vulnerable to packet sniffing tools.

If shell access is required, using Secure Shell (ssh) which encrypts all traffic is highly recommended. This includes the ISP staff who require shell access to the web hosting server. For more information about Secure Shell see the web site:
`http://www.ssh.fi/sshprotocols2/`
and
http://dir.yahoo.com/Computers_and_Internet/Communications_and_Networking/Software/Unix_Utilities/Ssh__Secure_Shell_/

As with all tools that include encryption, be aware of the laws in your area regarding importing and exporting of encryption technology.

To implement accounts that only have FTP access, first add `/bin/true` to the list of allowed shells in `/etc/shells`. Then for each customer account in `/etc/passwd`, set `/bin/true` for the shell. The line for `cust1` would look something like this:

```
cust1:hyaXntha2puU:507:508::/home/cust1:/bin/true
```

Customers can use any of the FTP clients to move content from their systems to your web hosting system. Popular FTP clients for the Microsoft Windows platform, Apple Macintosh and other platforms may be found on the TUCOWS site (`http://www.tucows.com`)

If you use the default location for user accounts, the location for customers to FTP files to is /home/cust1/public_html/ on their virtual web domain, for example `www.first-customer.com`. Customers can also be told to use the ISP's name for system doing the virtual web hosting, for example `hosting-server.isp.com`.

4.4.2 Customer provided CGI scripts

Frequently customers will want to use server-side CGI scripts on their hosted web site. Because of the risk of a poorly written script taking up excessive CPU and memory resources, some hosting sites will not allow user-written scripts or require that they inspect them before they can be used. An ISP may provide a limited number of approved CGI scripts to be used for such things as page counters, guest books or simple information gathering scripts.

If you decide to allow CGI scripts to be used by your customers, the document Apache suEXEC Support (`http://www.apache.org/docs/suexec.html`) describes how to have customer written scripts run in the context of the customer's account.

4.4.3 Providing access to customer's access logs

The primary thing virtual web hosting customers are interested in is access to their website access and error log files. If your web server logs are configured as described in the Section 3.3.3.2 , *Updating Apache Web Server for IP-based Hosting*, the simple perl file in Appendix A will split the logs into individual logs for each of the virtual web hosting customers.

4.4.3.1 Providing simple access to log files

At a bare minimum, the perl script should be run once a month and the logs moved into the customer's directory on the web server. One way to provide this securely to the customer is to create a `logs` directory parallel to their `public_html` directory and move the log files into it. The customer can then use FTP to pull down the log files for their own analysis. Alternatively, the log files could be put into a protected directory in their `public_ht`ml directory.

For example, create a directory in the customer's area, `~cust1/public_html/log`s. In that directory, create a file named `.htaccess` that contains the following lines:

```
AuthName "Access to Log files"
AuthType Basic
AuthUserFile /etc/passwd
Require cust1
```

And in the Apache httpd.conf file, change the section to include AuthConfig:

```
<Directory />
     Options FollowSymLinks Includes
     AllowOverride None AuthConfig
</Directory>
```

This requires cust1 to enter the username and password before gaining access to any files in `http://www.first-customer.com/logs/`.

Be aware that HTTP Basic Authentication does not use strong encryption of the username and password and is vulnerable to packet sniffing tools. This is the reason for implementing account without shell access.

If you have a large number of virtual web domains, you may want to deploy a database backed authentication scheme. For more information on using a database to limit access, see `http://www.apacheweek.com/features/userauth/`

4.4.3.2 Providing sophisticated access to log files

The next step up in functionality is to provide pre-generated graphical representations of the access log information. Two popular open source web log analysis tools are Webalizer and Analog. Both generate similar reports. Which one to use is mostly personal preference.

Yahoo! maintains a comprehensive list of log analysis tools at:

```
http://dir.yahoo.com/Computers_and_Internet/Software/Internet/
World_Wide_Web/Servers/Log_Analysis_Tools/
```

Freshmeat.net is another good resource for locating log analysis tools specifically for Linux:

http://www.freshmeat.net/appindex/console/log-analyzers.html

4.4.3.3 Webalizer

Webalizer is a fast, free web server log file analysis program. It produces highly detailed, easily onfigurable usage reports in HTML format, for viewing with a standard web browser. It can access information displayed by top URLs, source IP addresses of web browsers, URLs of pages that refer to your web site, a chart of countries from which people are viewing the web site, and browsers used.

See the web site `http://www.mrunix.net/webalizer` for more information and to download the source.

4.4.3.4 Analog

Analog claims to be the most popular logfile analyzer in the world and can also generate highly detailed and configurable usage reports in HTML format. It is not quite as graphical as Webalizer, but is a solid tool.

See the web site `http://www.statslab.cam.ac.uk/~sret1/analog/` for more information and to download the source.

5 Further Reading

- Official web site for the Apache Web Server (http://www.apache.org)

  Download the Apache Web Server source kit from here. Documentation for the web server is also available. Of particular interest is the mod_rewrite documentation, http://www.apache.org/docs/mod/mod_rewrite.html

- ApacheWeek (http://www.apacheweek.com)

  The site has a wealth of information about virtual web hosting, user authorization, server configuration and extensive information about extending Apache with modules.

- Ralf S. Engelschall's "A Users Guide to URL Rewriting with the Apache Webserver" (http://www.engelschall.com/pw/apache/rewriteguide/)

  This document has practical examples of using mod_rewrite. Some of examples are rather cryptic.

- RedHat Secure Web Server [US/Canada] (http://www.redhat.com)

  RedHat Secure Web Server is a secure web server based on Apache 1.3.1 that includes the RSA Data Security's encryption engine to allow your site full-strength 128-bit encryption. **NOTE:** *Due to restrictions imposed by the US Government, this version of Red Hat Secure Web Server may not be shipped outside the U.S. and Canada, or to a national of a country other than the U.S. and Canada.*

- Stronghold Web Server [US/Canada] (http://www.c2.net/products/sh2/)

  Stronghold is a secure SSL web server based on the Apache 1.3.6 which allows you to give your web site full-strength, 128-bit encryption. **NOTE:** *Due to restrictions imposed by the US Government, this version of Stronghold Server may not be shipped outside the U.S. and Canada, or to a national of a country other than the U.S. and Canada*

- Stronghold Web Server [outside US/Canada] (http://www.int.c2.net/home.php3)

  Stronghold is a secure SSL web server based on the Apache 1.3.6 which allows you to give your web site full-strength, 128-bit encryption. **NOTE:** *Because of its European development base, this software is not restricted by controls that allow US products only to be exported with easily cracked 40-, 56- and 64-bit technology and can offer the same level of uncompromised full strength 128-bit (and better) encryption worldwide*.

- Linux Documentation Project (http://metalab.unc.edu/LDP)

  Of particular interest are the HOWTOs on Virtual Services and IP-Alias. Most Linux distributions ship with these documents in `/usr/doc/HOWTO/`

- Caldera Linux Distribution (http://www.calderasystems.com)

  The web site of the Caldera Linux distribution.

- RedHat Linux Distribution (http://www.redhat.com)

  The web site for the official RedHat Linux distribution. Upgrading to Linux kernel V2.2.x information is available at `http://www.redhat.com/support/docs/rhl/kernel-2.2/kernel2.2-upgrade-3.html`

- S.u.S.E Linux Distribution (http://www.suse.com)

  The web site for the official S.u.S.E. Linux distribution.

- Slackware Linux Distribution (http://www.slackware.org)

  The web site for the official Slackware Linux distribution.

- Pacific HiTech Linux Distribution (http://www.pht.com)

  The web site for the official TurboLinux distribution. . Upgrading to Linux kernel V2.2.x information is available at ftp://ftp.pht.com/pub/turbolinux/updates/

- Debian Linux Distribution (http://www.debian.org)

  The web site of the official Debian distribution. Upgrading to Linux kernel V2.2.x information is available at `http://www.debian.org/releases/stable/running-kernel-2.2`

- Freshmeat.net (http://www.freshmeat.net)

  A great site for Open Source solutions.

- Internet Software Consortium (http://www.isc.org)

  The `bind` DNS server is available from this web site.

6 Appendix A

This perl script will read an Apache access or error logfile as configured in the Section 3.3.3.1 , *Updating Apache Web Server for IP-based Hosting* and generate separate log files for each virtual web site. The generated log files will be named access_log.www.first-customer.com and error_log.www.first-customer.com

```
#!/usr/bin/perl
#
# split-virt-logs -- Split Apache access_logs based on virtual web domains
#
# Usage:  split-virt-logs < access_log
#
# It generates one log file per virtual web domain in the form
# www.domain1.com-access_log in the current directory
#

use FileCache;             # keep more files open than the system permits

while (<>) {

    # Split off the first word as the domain name
    unless (defined ($domain = (split)[0])) {
       warn "Invalid line: $.\n";
       next;
    }

    $path = "$domain-access_log"; # build output log filename
    cacheout $path;               # let FileCache worry about open files

    s/^$domain //;           # remove domain name from $_

    print $path $_;

}
```

7 Appendix B

Below is a sample Linux kernel configuration file that may be used on a standard 1 CPU ProLiant 1850R. It includes the configuration changes noted in Section 3.3.2.2 *Configuring the Linux Kernel for IP Aliasing*

```
#
# Automatically generated make config: don't edit
#

#
# Code maturity level options
#
# CONFIG_EXPERIMENTAL is not set

#
# Processor type and features
#
# CONFIG_M386 is not set
# CONFIG_M486 is not set
# CONFIG_M586 is not set
# CONFIG_M586TSC is not set
CONFIG_M686=y
CONFIG_X86_WP_WORKS_OK=y
CONFIG_X86_INVLPG=y
CONFIG_X86_BSWAP=y
CONFIG_X86_POPAD_OK=y
CONFIG_X86_TSC=y
CONFIG_X86_GOOD_APIC=y
# CONFIG_MATH_EMULATION is not set
CONFIG_MTRR=y
CONFIG_SMP=y

#
# Loadable module support
#
CONFIG_MODULES=y
# CONFIG_MODVERSIONS is not set
# CONFIG_KMOD is not set

#
# General setup
#
CONFIG_NET=y
CONFIG_PCI=y
# CONFIG_PCI_GOBIOS is not set
# CONFIG_PCI_GODIRECT is not set
CONFIG_PCI_GOANY=y
CONFIG_PCI_BIOS=y
CONFIG_PCI_DIRECT=y
CONFIG_PCI_QUIRKS=y
CONFIG_PCI_OLD_PROC=y
# CONFIG_MCA is not set
# CONFIG_VISWS is not set
CONFIG_X86_IO_APIC=y
CONFIG_X86_LOCAL_APIC=y
CONFIG_SYSVIPC=y
# CONFIG_BSD_PROCESS_ACCT is not set
CONFIG_SYSCTL=y
CONFIG_BINFMT_AOUT=y
CONFIG_BINFMT_ELF=y
```

```
CONFIG_BINFMT_MISC=y
# CONFIG_PARPORT is not set
# CONFIG_APM is not set

#
# Plug and Play support
#
# CONFIG_PNP is not set

#
# Block devices
#
CONFIG_BLK_DEV_FD=y
CONFIG_BLK_DEV_IDE=y

#
# Please see Documentation/ide.txt for help/info on IDE drives
#
# CONFIG_BLK_DEV_HD_IDE is not set
CONFIG_BLK_DEV_IDEDISK=y
CONFIG_BLK_DEV_IDECD=y
# CONFIG_BLK_DEV_IDETAPE is not set
# CONFIG_BLK_DEV_IDEFLOPPY is not set
# CONFIG_BLK_DEV_IDESCSI is not set
CONFIG_BLK_DEV_CMD640=y
# CONFIG_BLK_DEV_CMD640_ENHANCED is not set
CONFIG_BLK_DEV_RZ1000=y
CONFIG_BLK_DEV_IDEPCI=y
CONFIG_BLK_DEV_IDEDMA=y
# CONFIG_BLK_DEV_OFFBOARD is not set
CONFIG_IDEDMA_AUTO=y
# CONFIG_IDE_CHIPSETS is not set

#
# Additional Block Devices
#
# CONFIG_BLK_DEV_LOOP is not set
# CONFIG_BLK_DEV_NBD is not set
# CONFIG_BLK_DEV_MD is not set
# CONFIG_BLK_DEV_RAM is not set
# CONFIG_BLK_DEV_XD is not set
CONFIG_PARIDE_PARPORT=y
# CONFIG_PARIDE is not set
# CONFIG_BLK_DEV_HD is not set

#
# Networking options
#
CONFIG_PACKET=y
# CONFIG_NETLINK is not set
# CONFIG_FIREWALL is not set
CONFIG_NET_ALIAS=y
# CONFIG_FILTER is not set
CONFIG_UNIX=y
CONFIG_INET=y
# CONFIG_IP_MULTICAST is not set
# CONFIG_IP_ADVANCED_ROUTER is not set
# CONFIG_IP_PNP is not set
# CONFIG_IP_ROUTER is not set
# CONFIG_NET_IPIP is not set
# CONFIG_NET_IPGRE is not set
CONFIG_IP_ALIAS=y
# CONFIG_SYN_COOKIES is not set
```

```
#
# (it is safe to leave these untouched)
#
# CONFIG_INET_RARP is not set
CONFIG_IP_NOSR=y
CONFIG_SKB_LARGE=y

#
#
#
# CONFIG_IPX is not set
# CONFIG_ATALK is not set

#
# SCSI support
#
CONFIG_SCSI=y

#
# SCSI support type (disk, tape, CD-ROM)
#
CONFIG_BLK_DEV_SD=y
# CONFIG_CHR_DEV_ST is not set
# CONFIG_BLK_DEV_SR is not set
# CONFIG_CHR_DEV_SG is not set

#
# Some SCSI devices (e.g. CD jukebox) support multiple LUNs
#
CONFIG_SCSI_MULTI_LUN=y
CONFIG_SCSI_CONSTANTS=y
# CONFIG_SCSI_LOGGING is not set

#
# SCSI low-level drivers
#
# CONFIG_SCSI_7000FASST is not set
# CONFIG_SCSI_ACARD is not set
# CONFIG_SCSI_AHA152X is not set
# CONFIG_SCSI_AHA1542 is not set
# CONFIG_SCSI_AHA1740 is not set
# CONFIG_SCSI_AIC7XXX is not set
# CONFIG_SCSI_ADVANSYS is not set
# CONFIG_SCSI_IN2000 is not set
# CONFIG_SCSI_AM53C974 is not set
# CONFIG_SCSI_MEGARAID is not set
# CONFIG_SCSI_BUSLOGIC is not set
# CONFIG_SCSI_DTC3280 is not set
# CONFIG_SCSI_EATA is not set
# CONFIG_SCSI_EATA_DMA is not set
# CONFIG_SCSI_EATA_PIO is not set
# CONFIG_SCSI_FUTURE_DOMAIN is not set
# CONFIG_SCSI_GDTH is not set
# CONFIG_SCSI_GENERIC_NCR5380 is not set
# CONFIG_SCSI_G_NCR5380_PORT is not set
# CONFIG_SCSI_G_NCR5380_MEM is not set
# CONFIG_SCSI_INITIO is not set
# CONFIG_SCSI_NCR53C406A is not set
# CONFIG_SCSI_NCR53C7xx is not set
CONFIG_SCSI_NCR53C8XX=y
CONFIG_SCSI_NCR53C8XX_DEFAULT_TAGS=4
CONFIG_SCSI_NCR53C8XX_MAX_TAGS=32
```

```
CONFIG_SCSI_NCR53C8XX_SYNC=20
# CONFIG_SCSI_NCR53C8XX_PROFILE is not set
# CONFIG_SCSI_NCR53C8XX_IOMAPPED is not set
# CONFIG_SCSI_PAS16 is not set
# CONFIG_SCSI_PCI2000 is not set
# CONFIG_SCSI_PCI2220I is not set
# CONFIG_SCSI_PSI240I is not set
# CONFIG_SCSI_QLOGIC_FAS is not set
# CONFIG_SCSI_QLOGIC_ISP is not set
# CONFIG_SCSI_SEAGATE is not set
# CONFIG_SCSI_DC390T is not set
# CONFIG_SCSI_T128 is not set
# CONFIG_SCSI_U14_34F is not set
# CONFIG_SCSI_ULTRASTOR is not set

#
# Network device support
#
CONFIG_NETDEVICES=y
# CONFIG_ARCNET is not set
CONFIG_DUMMY=m
# CONFIG_EQUALIZER is not set
CONFIG_NET_ETHERNET=y
# CONFIG_NET_VENDOR_3COM is not set
# CONFIG_LANCE is not set
# CONFIG_NET_VENDOR_SMC is not set
# CONFIG_NET_VENDOR_RACAL is not set
# CONFIG_NET_ISA is not set
CONFIG_NET_EISA=y
# CONFIG_PCNET32 is not set
# CONFIG_APRICOT is not set
# CONFIG_CS89x0 is not set
# CONFIG_DE4X5 is not set
# CONFIG_DEC_ELCP is not set
# CONFIG_DGRS is not set
CONFIG_EEXPRESS_PRO100=y
# CONFIG_NE2K_PCI is not set
CONFIG_TLAN=y
# CONFIG_VIA_RHINE is not set
# CONFIG_NET_POCKET is not set
# CONFIG_FDDI is not set
# CONFIG_DLCI is not set
# CONFIG_PPP is not set
# CONFIG_SLIP is not set
# CONFIG_NET_RADIO is not set
# CONFIG_TR is not set
# CONFIG_HOSTESS_SV11 is not set
# CONFIG_COSA is not set
# CONFIG_RCPCI is not set
# CONFIG_WAN_DRIVERS is not set

#
# Amateur Radio support
#
# CONFIG_HAMRADIO is not set

#
# ISDN subsystem
#
# CONFIG_ISDN is not set

#
# Old CD-ROM drivers (not SCSI, not IDE)
```

```
#
# CONFIG_CD_NO_IDESCSI is not set

#
# Character devices
#
CONFIG_VT=y
CONFIG_VT_CONSOLE=y
CONFIG_SERIAL=y
# CONFIG_SERIAL_CONSOLE is not set
# CONFIG_SERIAL_EXTENDED is not set
# CONFIG_SERIAL_NONSTANDARD is not set
CONFIG_UNIX98_PTYS=y
CONFIG_UNIX98_PTY_COUNT=256
CONFIG_MOUSE=y

#
# Mice
#
# CONFIG_ATIXL_BUSMOUSE is not set
# CONFIG_BUSMOUSE is not set
# CONFIG_MS_BUSMOUSE is not set
CONFIG_PSMOUSE=y
CONFIG_82C710_MOUSE=y
# CONFIG_PC110_PAD is not set
# CONFIG_QIC02_TAPE is not set
# CONFIG_WATCHDOG is not set
# CONFIG_NVRAM is not set
# CONFIG_RTC is not set

#
# Video For Linux
#
# CONFIG_VIDEO_DEV is not set

#
# Joystick support
#
# CONFIG_JOYSTICK is not set

#
# Ftape, the floppy tape device driver
#
# CONFIG_FTAPE is not set
# CONFIG_FT_NORMAL_DEBUG is not set
# CONFIG_FT_FULL_DEBUG is not set
# CONFIG_FT_NO_TRACE is not set
# CONFIG_FT_NO_TRACE_AT_ALL is not set
# CONFIG_FT_STD_FDC is not set
# CONFIG_FT_MACH2 is not set
# CONFIG_FT_PROBE_FC10 is not set
# CONFIG_FT_ALT_FDC is not set

#
# Filesystems
#
# CONFIG_QUOTA is not set
CONFIG_AUTOFS_FS=y
# CONFIG_AFFS_FS is not set
# CONFIG_HFS_FS is not set
# CONFIG_FAT_FS is not set
CONFIG_ISO9660_FS=y
# CONFIG_JOLIET is not set
# CONFIG_MINIX_FS is not set
# CONFIG_NTFS_FS is not set
# CONFIG_HPFS_FS is not set
CONFIG_PROC_FS=y
CONFIG_DEVPTS_FS=y
# CONFIG_ROMFS_FS is not set
CONFIG_EXT2_FS=y
# CONFIG_SYSV_FS is not set
# CONFIG_UFS_FS is not set

#
# Network File Systems
#
# CONFIG_CODA_FS is not set
CONFIG_NFS_FS=y
CONFIG_SUNRPC=y
CONFIG_LOCKD=y
# CONFIG_SMB_FS is not set
# CONFIG_NCP_FS is not set

#
# Partition Types
#
# CONFIG_BSD_DISKLABEL is not set
# CONFIG_MAC_PARTITION is not set
# CONFIG_SMD_DISKLABEL is not set
# CONFIG_SOLARIS_X86_PARTITION is not set
# CONFIG_NLS is not set

#
# Console drivers
#
CONFIG_VGA_CONSOLE=y
# CONFIG_VIDEO_SELECT is not set

#
# Sound
#
# CONFIG_SOUND is not set

#
# Kernel hacking
#
# CONFIG_MAGIC_SYSRQ is not set
```