

# SAGE

## *Advice*

The Journal of The System Administrators Guild of Australia

**March / April 2002 Edition**

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***Setting up DNS Views***

***SSH Port Forwarding and Tunnelling***

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### Editor

Andrew Whyte  
editor@sage-au.org.au

### Membership Information

Lee Monette  
office@sage-au.org.au

### Contact Details

Contact details for SAGE-AU are:

SAGE-AU  
GPO Box 2974  
Sydney NSW 2001  
Phone: (03) 9625 2823  
Fax: 0500 5444 88

### Internet Server

<http://www.sage-au.org.au/>

## SAGE-AU Committee

### President

Andrew Hennell  
andrew.hennell@member.sage-au.org.au

### Vice President

Simon Woodhead  
simon.woodhead@member.sage-au.org.au

### Secretary

Mike Ciavarella  
michael.ciavarella@member.sage-au.org.au

### Treasurer

Steven Pemberton  
steven.pemberton@member.sage-au.org.au

### General Committee

Zebee Johnstone  
zebee.johnstone@member.sage-au.org.au

Brad Marshall  
brad.marshall@member.sage-au.org.au

Steven Plunkett  
steven.plunkett@member.sage-au.org.au

Andrew Whyte  
andrew.whyte@member.sage-au.org.au

### Associate Representative

Hal Miller  
hal.miller@member.sage-au.org.au

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Greetings all,

I thought you may be interested in how the National Exec are busy working behind the scenes. This year has been a bit of a "taking stock" year for the exec - identifying where we're at, where we can go, and how to get there.

### *SAGE-AU Conference - Melbourne, August, 2002*

The 2002 conference is shaping up to be one of our best ever. This year will see the conference hosted in Melbourne at the Novotel on Collins during August. The date has been moved back in response to your feedback about avoiding the end of financial year commitments during July.

The Conference Tutorial and Conference Paper proposals deadline has passed, however there is scope for further papers to be presented. If you would like to present a paper at the conference, or would like to know what's involved, contact Mike Ciavarella at [mikec@cyber.com.au](mailto:mikec@cyber.com.au)

Negotiations are well under way with International guests for the conference, and that lineup will be announced shortly.

Mark the 5th to the 9th of August in your diary now, and make arrangements with your work for that time. When you receive the conference flyer and booking form, complete and return it asap. Space at the conference this year will be limited, so it is essential that SAGE-AU members book early to avoid disappointment.

Keep checking <http://www.sage-au.org.au/conf/> for more information.

### *Sponsorship*

Sponsors of SAGE-AU help cover our running costs, which in turn keeps your membership low - one of the lowest membership fees of a professional guild in Australia.

SAGE-AU has flexible and innovative sponsorship packages available, and can work with any company to achieve common goals. Simon Woodhead

wrote about sponsorship in the last newsletter - if you know of anyone who may be interested in sponsoring SAGE-AU, let Simon know at [simon.woodhead@member.sage-au.org.au](mailto:simon.woodhead@member.sage-au.org.au)

### *Membership*

At a time when more and more networks are being installed across Australia, and more and more people employed to maintain them, why is SAGE-AU membership static?

The strength of an organisation comes through its membership - the more members, the stronger the organisation. The more projects, resources, benefits the organisation can provide those members.

I'd like to thank Rohan Durrant, who recently referred eleven (11!!) new members to SAGE-AU on the same day - this was an outstanding achievement, and one that was rewarded by SAGE-AU with a gift voucher for an O'Reilly book.

Remember: "A System Administrator is anyone who manages a computer not solely for their own use" - who do you know that should be a SAGE-AU member?

### *15% off IIT Training courses*

IIT Training have offered 15% off any of their training courses to SAGE-AU members, and we thank them for this initiative.

For more information on IIT Training, visit <http://www.iit-training.com.au/>

### *New Merchandise*

Keep an eye out for the new range of SAGE-AU merchandise.

This will include:

- new coffee mugs (bigger and better than before!)
- new SAGE-AU Polo Shirts (in Black and bottle green)
- SAGE-AU Letterman jackets (just in time for winter!)
- Stress Mice

See page 14 for photos of our new

# President's Report

**President's Report (continued)**

merchandise and your chance to win a stress mouse.

*New Public Relations Firm appointed*

McCorkell & Associates have been appointed by SAGE-AU to assist with improving the visibility of our organisation.

Part of their task is to create a SAGE-AU Media Kit, prepare and publish press releases, and in raising our profile within government, industry and media sectors. This will lead media and government to approach SAGE-AU for comment and involvement when necessary, as is appropriate for the peak industry body representing System Administrators.

So, you should start to see more of SAGE-AU in the press over the coming months. This will not only help our standing, but also with sponsorship and membership gains.

*New Server*

Our oldest server, a Sun Sparc Station 20, is finally being replaced. The old server has done us well, never skipping a beat in its long and distinguished career as the SAGE-AU webserver.

The new server is also a Sun - a Netra X1, and we trust it will give us the same long term stability that the old SS20 has.

What's happening to the old SS20?

Well, that's still being decided - but one option is to auction it at the conference

dinner with the proceeds to go to support homeless children in Melbourne.

*FTP Arrangements*

In the early days of SAGE-AU, it was often difficult to find the latest patches and software tools to do our jobs. These days, things have changed - not least because of sites such as mirror.aarnet.edu.au and planetmirror.com.

SAGE-AU is pleased to announce a joint partnership with Planet Mirror that will see ftp.sage-au.org.au pointed to planet mirror. PlanetMirror currently has around 1.2 Terabytes of disk space, making them Australia's largest and most comprehensive software archive. There are over 500 mirrors including opensource and system administration resources which provide SAGE-AU members with fast, local downloads. Working with SAGE-AU, PlanetMirror will provide management and resources for a dedicated System Administration archive.

Well, that's it for now - the SAGE-AU exec will continue working behind the scenes. If you'd like to contact the exec about anything, just email [sage-au-exec@sage-au.org.au](mailto:sage-au-exec@sage-au.org.au)

Cheers,  
Andrew Hennell  
President, SAGE-AU

---

The System Administrator's Guild of Australia thanks our generous Sponsor for their support.



# Debian Kernel Packages and Boot Loaders

Brad Marshall  
(brad.marshall@member.sage-au.org.au)

Debian has very good support for building packages of kernels, managing patches, and updating boot loaders, all in a fairly automated fashion. This article will cover how to build a kernel package (with optional kernel patches), and how to update the boot loader configuration.

## Kernel Packages

The package needed for creating kernel packages is called 'kernel-package'. There are many advantages to creating packages for kernels, quite apart from the convenience of using dpkg to keep track of what versions you have installed. It gives you the ability to easily compile a kernel for a different computer locally, and move it across to the destination with very little effort.

It also integrates very well with debian packaged kernel patches, allowing you to keep your local kernel sources without patches, and have them automatically applied for compilation. It also integrates neatly with the various modules that may be required, such as pcmcia-cs or graphics drivers.

Debian kernel patch packages are named 'kernel-patch-blah', where blah is representative of what the patch does. To see what kernel patches are available, simply type:

```
$ apt-cache search kernel-patch-
```

Note that all of the following assumes you have your kernel source tree in /usr/src/linux, and are in that directory.

To begin building a kernel, make sure you have the kernel-package package installed, as well as any patches you may require. To configure the kernel, run the following command:

```
$ export PATCH_THE_KERNEL=YES
# Only needed if you have
patches
```

```
$ make-kpkg clean
$ make-kpkg --config=menuconfig
--revision=host1.0 configure
```

This will apply any appropriate patches, and bring you into your chosen kernel configuration method (in this case, menuconfig) and give the kernel package the appropriate revision (in this case, host1.0). Simply configure the kernel as required, and then exit out. The process will then continue by running a make dep for you.

To create the actual kernel package, now run:


```
$ fakeroot make-kpkg binary
```

This will now actually compile the kernel, and create the kernel image, header, source and doc packages. If you only want the header and image packages, replace binary with binary-arch. Note that the fakeroot command can be replaced with whatever you need to run the program as root.

The files will be output in /usr/src, and will be named in the following manner:

```
kernel-
{image,header,source,doc}-
x.y.z_host1.0_i386.deb
```

It is now a simple matter of installing the package. This will install the



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# Debian Kernel Packages (continued)

kernel into `/boot/vmlinuz-x.y.z`, and update the `/vmlinuz` and `/vmlinuz.old` symlinks. The kernel configuration is kept in `/boot/config-x.y.z`.

Now, before we reboot we need to ensure that the boot loader configuration is correct.

## Boot loaders

Under i386, there are 2 main popular boot loaders - lilo, and grub. They both have their advantages and disadvantages which will not be covered fully here.

### LILO

Kernel package comes configured assuming you will be using lilo. If you have something like the following `lilo.conf`, you will have to do very little work.

```
boot=/dev/hda
root=/dev/hda5
install=/boot/boot.b
map=/boot/map
delay=20
vga=normal
default=Linux
image=/vmlinuz
    label=Linux
    read-only
image=/vmlinuz.old
    label=LinuxOLD
    read-only
    optional
```

### Grub

After installing the grub package, you will need to do something like the following:

```
$ sudo grub-install /dev/hda
# or your install device
    OR if you have a separate
/boot
$ sudo grub-install --root-
directory=/boot /dev/hda
$ sudo $EDITOR /boot/grub/
menu.lst
$ sudo update-grub
```

Now update your `kernel-img.conf` to include the following lines:

```
postinst_hook = /sbin/update-
grub
postrm_hook = /sbin/update-
grub
do_bootloader = no
```

Now, whenever you install a new kernel package, it will automatically update the grub configuration as appropriate.

## Conclusion

As you can see, creating a kernel package under Debian is very simple and convenient, and has many advantages from doing it the old way. Keeping the kernel image, modules and configuration together makes it easy to build the kernel on one host, and move it to another. There is also the facility for giving a kernel package arbitrary post install scripts, which is also very useful.

For more information, see `kernel-package(5)`, `make-kpkg(1)`, `lilo(8)`, `lilo.conf(5)`, `grub(8)`, `grub-install(8)` and `update-grub(8)`. ●

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# Setting up DNS Views

This article is aimed at providing a basic guide to setting up DNS Views. Views in DNS allow you to restrict the hostnames that resolve depending on the client requesting a lookup. This means that for security or other reasons, you can supply one view of your hosts to the outside world, and a more complete view to your internal hosts. There are of course many other uses for views in the DNS; one such use might be to direct users to Web servers in different countries depending on their client IP address. This article shows the Internal/External setup for the purposes of restricting which hostnames are visible to the public.

Lets start with a description of the systems used to provide our split DNS. You will need 2 machines for serving Internal DNS requests, 2 machines for External DNS requests, and 1 machine as your "Master".

First the common configuration items on the machines. All the machines will run BIND in a chrooted environment. This greatly improves the security of your BIND implementation but can sometimes support some confusion. Also, some logging options allow for the logs to be separated out a bit for easier reading.

## Directory Structure:

Let's place Bind's config and data in `/usr/local/named_root` - this directory is laid out as follows.

```
/usr/local/named_root/conf          - Configuration files – named.conf and
                                     rndc.conf
/usr/local/named_root/zones         - Zone files – forward and reverse files.
/usr/local/named_root/logs          - Log files
```

Depending on your Operating System you may need a "zero" device and some timezone files duplicated into the chroot tree to get this working. For my examples which are running on Tru64 Unix, you need these:

```
/usr/local/named_root/dev/zero      - 'mknod /usr/local/named_root/
dev/zero c 38 0'
/usr/local/named_root/etc/svc.conf   - Copy from /etc
/usr/local/named_root/etc/zoneinfo/localtime - Copy from /etc/zoneinfo
```

Once your environment is setup, the following can be used to start the named.conf file:

```
options {
    directory "/zones";
    pid-file "/logs/named.pid";

    recursion no;
    additional-from-auth yes;
    additional-from-cache no;
    zone-statistics yes;

    allow-notify {192.168.1.25; };
    allow-transfer { none; };
};
```

Any options to do with file paths should not contain `/usr/local/named_root` chroot parent path, once Bind is running all the paths will be relative to this point as its root directory.

Hence "directory" is set to "/zones" not "/usr/local/named\_root/zones".

The config on the External DNS boxes will have recursion disabled, and additional from cache disabled. These options stop the DNS daemons from performing and caching recur-

**Andrew Whyte**  
 (andrew.whyte@member.sage-au.org.au)

# Setting up DNS Views (continued)

sive lookups for a client. I.e. they will only respond for zones with which they have zones configured. Ignoring additional info from the cache ensures that you cannot get record tainting from the lookup cache.

In the above example, notify messages are allowed from 192.168.1.25, this will be the IP address of the "Master" server which is hosted on the internal network.

Next, logging directives to split up parsing messages and general notices for easier reading, again note the directory paths used:

```
logging {

    channel info_log {
        file "/logs/named.info" ;
        severity info;
        print-time yes ;
        print-category yes ;
    };

    channel default_log {
        file "/logs/named.log" ;
        print-time yes ;
        print-category yes;
    };

    channel parse_log {
        file "/logs/named.parser" ;
        print-time yes ;
        print-category yes ;
    };

    channel notify_log {
        file "/logs/named.notify" ;
        print-time yes ;
        print-category yes ;
    };

    category security      { info_log; };
    category default      { default_log; };
    category config        { parse_log; } ;
    category notify        { notify_log; } ;

};
```

The logging directives can be used on all the DNS servers both Internal and External, and the Master.

If you are using Bind version 9, as this example does, you will need `rndc` keys to allow you to control Bind through the `rndc` admin tool.

```
key "rndc-key" {
    algorithm hmac-md5;
    secret "LZ+2D+6ec1hhT32U84MzZs==" ;
};

controls {
    inet 127.0.0.1 port 953
    allow { 127.0.0.1; } keys { "rndc-key"; };
};
```

The `rndc` config blocks can be created using `rndc-confgen` which is included with Bind 9. This utility provides a basic config snippet and produces the keys. Each of the DNS servers can have these blocks, and they can be different per host or the same if you want to keep it simple. A copy of the `rndc` snippet is also placed into `conf/rndc.conf` so that the `rndc` tool can locate the keys for controlling the `named` process.

This completes the setup for the External DNS hosts; you simply need to add zone lines for each domain you will be serving. All zones are setup as slaves and their master is the internally hosted Master Server. You may wish to use ACL's to provide limits on what clients can x-fer zones or perform lookups against your external servers. This is left as an exercise for the reader to expand upon.

The Internal DNS hosts basically mirror the External hosts, but since they will be used as your main resolvers internally, you should allow recursion and fetch-glue, and probably add forwards to assist effective use of DNS caching upstream.

The Master Server, which is commonly referred to as a "Stealth Server", provides a central place for managing your DNS records; it will possibly also provide better control over zone changes.

Your Stealth is called that because as far as clients are concerned it doesn't exist. They never see references to it and certainly **never** perform lookups against it. The 'options' block for the config file is somewhat different for this host:

```
options {
    directory "/zones";
    pid-file "/logs/named.pid" ;
    recursion no;
    notify explicit ;
    also-notify { 10.10.10.1; 10.10.10.2; 192.168.5.25; };
};
```

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# DNS Views (continued)

As you can see, recursion is disabled again. Even though this server will never get used, nor allow lookup requests through ACL's, Disabling recursion also reduces the memory footprint of the Bind daemon on the system as it doesn't need to allocate memory for a possible lookup cache.

The explicit notify option instructs Bind to not try and send update notifications to the configured NS hosts in the SOA records for zone files. This was specifically useful in my implementation to ensure the correct hosts got the updates.

The also-notify directive lists the hosts that this server should notify. This will be the 2 External DNS hosts, and your 2 internal hosts. This example shows only 1 internal host, as that host is then used to provide a master source to many internal DNS servers within the organisation. This was done for simplicity in migrating from a single central DNS, into split views. So without updating some 50 DNS servers around the organisation, we simply update their master host, and let Bind take care of the x-fer's.

Your Stealth Server should have ACL's to specify your internal and external host IP's. This is what ensures that the correct View is transferred to the requesting Slave.

continued page 13 ...

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# SSH Port Forwarding and Tunnelling

Brad Marshall  
(brad.marshall@member.sage-au.org.au)

SSH can be used for far more than simply a secure version of telnet / rsh. It is possible to securely forward TCP over it, to talk to CVS servers over it, synchronise data, and to run X11 programs over it.

## SSH Proxy Command

It is possible to specify a command to use to connect to a server. This is useful for several reasons. You can “proxy” a SSH connection through another host to reach hosts you can’t reach via normal methods. Alternatively, you can use a proxy server that supports CONNECT to tunnel ssh over it.

To proxy an ssh session over another ssh, there are two ways:

```
$ ssh -t host1 ssh -t host2
```

or put the following in your ssh config file (usually .ssh/config, unless otherwise specified)

```
host host1 host2
    ProxyCommand ssh -q -a -x proxyhost nc %h 22
```

The second way is perhaps more useful, as you can also use scp with it.

To restrict where people can ssh, or if you don’t want to give accounts out on the proxy box, you can emulate this using authorized\_keys. Create a user on the proxy box, and put the users ssh keys in the authorized\_keys file.

```
command="/usr/bin/ssh username@server" 1024 37 105798033118795863
58021686052300103980941764797682379061591207704158565700576345615
85946731592562930534179289740531679597143419198424296224711392290
02288832904077518817454048858496739972992172603601941585694169789
39883160304574378786044084860173524731416414440764165352480435096
4976595515178392252529415424289 bmarshal@gosling
```

## SSH Port Forwarding

Forwarding TCP over ssh is possible using port forwarding. This can be done in a couple of ways - either via command line, or by settings in a config file.

Command line:

```
$ ssh -L 8000:host1:80 host2
```

Config extract:

```
host host2
    LocalForward 8000 host1:80
```

This command forwards local port 8000 to port 80 on host1.

## CVS over SSH

To access CVS remotely, the traditional method is using CVS’s pserver. This is insecure, as it is a plain text password. It is possible to tunnel CVS over ssh, both if the users have an account on the box, and if they don’t.

If the user doesn’t have an account on the box, it can be done using the authorized\_keys file.

```
command="/usr/bin/cvs server" 1024 37 105798033
11879586358021686052300103980941764797682379061
59120770415856570057634561585946731592562930534
17928974053167959714341919842429622471139229002
28883290407751881745404885849673997299217260360
19415856941697893988316030457437878604408486017
35247314164144407641653524804350964976595515178
392252529415424289 bmarshal@gosling
```

Regardless, to use CVS over ssh, use something like the following.

```
$ export CVS_RSH=ssh
$ export CVSROOT=:ext:username@host:/path/to/cvsroot
$ cvs co module
```

### *Rsync over SSH*

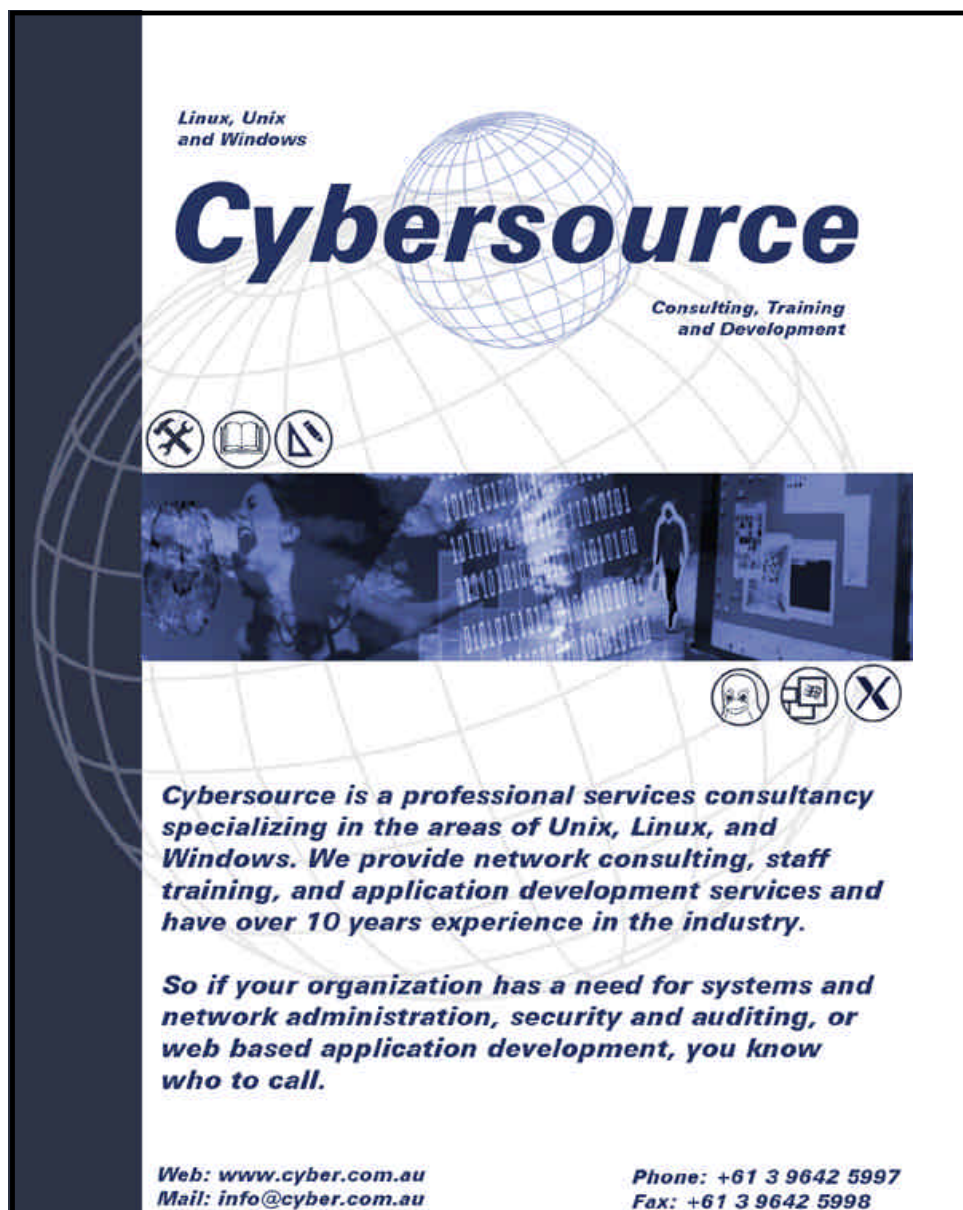
Rsync is a program that is used to transfer files between hosts—much like scp or rcp—but uses an efficient protocol that means only the differences are transferred. By default, it uses rsh as a transport layer but can be configured to use ssh rather easily.

This is done either by setting the RSYNC\_RSH environment variable to point to your ssh binary, or by using the -e command line option. Further details about rsync are available from the rsync(1) manpage.

### *Conclusion*

As you have seen, ssh is much more than a secure version of telnet. It is able to encrypt just about any kind of TCP connection with very little setup on either side, other than installing ssh.

For more information, see the ssh(1), sshd(8), cvs(1), and rsync(1) manpages, as well as the OpenSSH, CVS and Rsync websites. ●



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```
acl "internal_tx" {
    192.168.5.25;
};
```

```
acl "external_tx" {
    10.10.10.1;
    10.10.10.2;
};
```

From here, you can create your Views on the Stealth Master. For each view you allow clients, queries and transfers from the ACL which that view are for:

```
view "internal" {
    recursion no;
    match-clients { internal_tx; };
    allow-query { internal_tx; };
    allow-transfer { internal_tx; };
    zone "mydomain.edu.au" { type master; file "mydomain.edu.au";
};
};
```

```
view "external" {
    recursion no;
    match-clients { external_tx; };
    allow-query { external_tx; };
    allow-transfer { external_tx; };
    zone "mydomain.edu.au" { type master; file
"external.mydomain.edu.au"; };
};
```

What you have now is the same zone configured in each view block, but they get their data from different files. The external zone file should include those hosts you want externally visible, perhaps a wildcard MX record for all hosts in the domain.

Hopefully this should provide you with a useful example for setting up DNS with split views. Some things to note about your external view however. Because recursion is disabled, you cannot have CNAME records in your zone that point to outside hostnames. For example:

```
mywebserver IN CNAME www.somewhere.outthere.com.
```

This would break. The server cannot perform recursive lookups, and having additional-from-auth set true stops it from looking up the www.somewhere.outthere.com record and returning a valid result. You can use CNAMEs to host entries for which your server has authority. This is where additional-from-auth plays an important role, it allows the server to gather this CNAME result and serve it back to the client.

If this inspires people to give views a go because you've put it off in the past, I would be happy to provide more examples, full conf file examples and any further information if you think it useful. Just ask. ●

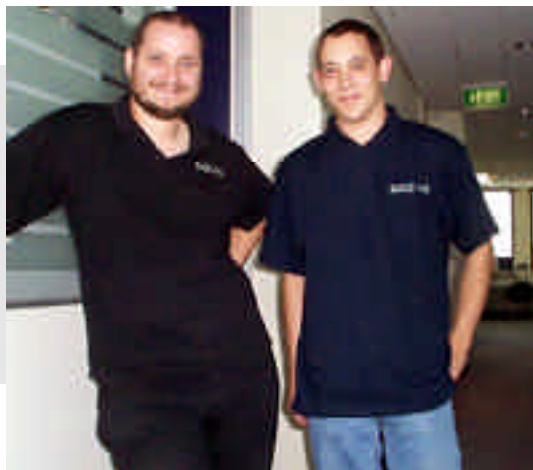
*Would you like to advertise in SAGE Advice and reach 700+ system administrations?  
Would you like to submit an article, product or book review to SAGE Advice?*

**Please contact [editor@sage-au.org.au](mailto:editor@sage-au.org.au) before June 15th 2002 to be part of the bumper pre-conference edition.**

# Merchandise

[www.sage-au.org.au/merchandise.html](http://www.sage-au.org.au/merchandise.html)

*Our 100% cotton polo shirts are available in Black, Navy (limited sizes) and Bottle Green with the SAGE-AU logo stitched in SAGE-AU green on the left breast. Available in sizes from M to XXL.  
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*Our new 'letterman' jackets have a 100% wool body in black, and bottle green suede sleeves. They are quilted inside with a large inside pocket and our logo is subtly stitched in bottle green on the left breast. Available in sizes to XXXXL.  
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*Those of you who have attended the last two conferences will know what great pens these are!*

*If you can't wait until SAGE-AU2002 for your free SAGE-AU pen, use the order form to buy one for only \$3.30 (incl GST)*



*The range of SAGE booklets are still available - check the website for titles.*

*Most titles are \$16.50 (incl GST) but due to the American/Australian dollar the price will rise when the current stocks are gone - get your set while the price is still low!!*

## *Thank you ...*

Simon Collyer and Dougal Scott ... our new SAGE-AU supermodels

Connect Internet Solutions ... for the use of their offices and staff for merchandise photos

Simon Woodhead and Zebbee Johnstone ... for proofreading this edition of SAGE Advice

Rohan Durrant ... for his exceptional work in promoting SAGE-AU in Victoria

Mike Ciavarella ... for all his work so far organising the conference program, and for all the long nights yet to come

Bev and Len ... for their tireless work in collating and mailing this newsletter to 700+ members each quarter

*... we are always looking for volunteers - could you help?*

*If there is a yellow sticker in the box to the left of this paragraph, you are one of the lucky ten members chosen at random to receive one of SAGE-AU's new stress mice.*

*Simply email [lee@sage-au.org.au](mailto:lee@sage-au.org.au) with the code number written on the sticker **before 30 April 2002** to receive your mouse!*

*If you missed out this time, perhaps you might like to go to the merchandise page on the website and order a mouse of your very own (see opposite for details)?*

# Regional Groups

## Victorian Chapter

The Victorian group currently meets on the second Tuesday of the month at 7:00pm at:

VTR Consulting  
Roseneath Place, South Melbourne

### President

Rohan Durrant  
rohan.durrant@member.sage-au.org.au

### Vice President

Luke Mewburn  
luke.mewburn@member.sage-au.org.au

### Treasurer

Ben White  
ben.white@member.sage-au.org.au

### List Chair

Morrie Wyatt  
morrie.wyatt@member.sage-au.org.au

The group mailing list is sage-vic@sage-au.org.au

## Queensland Chapter

The Queensland group currently meets on the second Thursday of the month at 7.00pm at:

Room 102  
Frank White Building (No. 43)  
Cooper Road  
University of Queensland, St Lucia

### President

Mark Suter  
mark.suter@member.sage-au.org.au

### Secretary

James Lever  
james.lever@member.sage-au.org.au

### Treasurer

Colin Ridell  
colin.ridell@member.sage-au.org.au

The group mailing list is sage-qld@sage-au.org.au

## South Australian Chapter

The South Australian group currently meets on the last Wednesday of the month at 6.30pm at:

Vectra Corporation  
38 Sir Donald Bradman Drive, Mile End

### President

Phil Kernick  
phil.kernick@member.sage-au.org.au

### Secretary

Monica Ciric  
monica.ciric@member.sage-au.org.au

### Committee

Leanne Davis  
leanne.davis@member.sage-au.org.au  
Leigh Anderson (student representative)  
leigh.anderson@member.sage-au.org.au

The group mailing list is sage-sa@sage-au.org.au

## New South Wales Chapter

The New South Wales group currently meets on the second Tuesday of the month at 6.45pm at:

Compaq Office  
Level 6/76 Berry Street, North Sydney

### President

Stuart Ritchie  
stuart.ritchie@member.sage-au.org.au

### Vice President

Titus Chiu  
titus.chiu@member.sage-au.org.au

### Secretary

Philip Saunders  
philip.saunders@member.sage-au.org.au

### Treasurer

David Herd  
david.herd@member.sage-au.org.au

The group mailing list is sage-nsw@sage-au.org.au

## Australian Capital Territory Chapter

The ACT group currently meets on the last Tuesday of the month (except December) at 6.00pm at:

University House  
Cnr Balmain Cres & Liversidge St, Acton

### Interim President

Roy Meuronen  
roy.meuronen@member.sage-au.org.au

### Interim Secretary/Treasurer

Steve Jenkin  
steve.jenkin@member.sage-au.org.au

The group mailing list is sage-act@sage-au.org.au

## Tasmanian Chapter

The Tasmanian group currently meets on the third Monday of the month at a different location depending on the event being held (check <http://www.sage-au.org.au/rg/tas> for info).

### President

Chris Fishwick  
chris.fishwick@member.sage-au.org.au

### Secretary

Andreas Modinger  
andreas.modinger@member.sage-au.org.au

### Treasurer

Anthony Vialle  
anthony.vialle@member.sage-au.org.au

### Committee

John Dalton  
john.r.dalton@member.sage-au.org.au  
Alan Gough  
alan.gough@member.sage-au.org.au

The group mailing list is sage-tas@sage-au.org.au

## West Australian Chapter

The West Australian group currently meets on the first Wednesday of the month at 6.30pm at:

Moon & Sixpence British Pub  
300 Murray Street, Perth

### Organiser

Tom Hallam  
tom.hallam@member.sage-au.org.au

The group mailing list is sage-wa@sage-au.org.au