BSD MAGAZINE

FOR NOVICE AND ADVANCED USERS

OpenBSD 5.4

CONFIGURE OPENBSD BASIC SERVICES

GETTING TO GRIPS WITH THE GIMP

USER, GROUP AND PASSWORD MANAGEMENT ON LINUX AND SOLARIS

HOW SECURE CAN SECURE SHELL (SSH) BE?

SECURING CENTOS AND SOLARIS 11 WITH PUPPET

VOL.8 NO.02
ISSUE 02/2014(55)
1898-9144

E5-2600

High Performance,
High Density Servers for
Data Center, Virtualization, & HPC

MODEL: iXR-22X4IB

http://www.iXsystems.com/e5

768GB of RAM in 1U

KEY FEATURES

iXR-22X4IB	iXR-1204+10G
• Dual Intel® Xeon® Processors E5-2600 Family per node • Intel® C600 series chipset • Four server nodes in 2U of rack space • Up to 256GB main memory per server node • One Mellanox® ConnectX QDR 40Gbp/s Infiniband w/QSFP Connector per node • 12 SAS/SATA drive bays, 3 per node • Hardware RAID via LSI2108 controller • Shared 1620W redundant high-efficiency Platinum level (91%+) power supplies	• Dual Intel® Xeon® Processors E5-2600 Family • Intel® C600 series chipset • Intel® X540 Dual-Port 10 Gigabit Ethernet Controllers • Up to 16 Cores and 32 process threads • Up to 768GB main memory • Four SAS/SATA drive bays • Onboard SATA RAID 0, 1, 5, and 10 • 700W high-efficiency redundant power supply with FC and PMBus (80%+ Gold Certified)

Call iXsystems toll free or visit our website today! **1-855-GREP-4-IX | www.iXsystems.com**

High-Density iXsystems Servers powered by the Intel® Xeon® Processor E5-2600 Family and Intel® C600 series chipset can pack up to 768GB of RAM into 1U of rack space or up to 8 processors - with up to 128 threads - in 2U.

On-board 10 Gigabit Ethernet and Infiniband for Greater Throughput in less Rack Space.

Servers from iXsystems based on the Intel® Xeon® Processor E5-2600 Family feature high-throughput connections on the motherboard, saving critical expansion space. The Intel® C600 Series chipset supports up to 384GB of RAM per processor, allowing performance in a single server to reach new heights. This ensures that you're not paying for more than you need to achieve the performance you want.

The iXR-1204 +10G features dual onboard 10GigE + dual onboard 1GigE network controllers, up to 768GB of RAM and dual Intel® Xeon® Processors E5-2600 Family, freeing up critical expansion card space for application-specific hardware. The uncompromised performance and flexibility of the iXR-1204 +10G makes it suitable for clustering, high-traffic webservers, virtualization, and cloud computing applications - anywhere you need the most resources available.

For even greater performance density, the iXR-22X4IB squeezes four server nodes into two units of rack space, each with dual Intel® Xeon® Processors E5-2600 Family, up to 256GB of RAM, and an on-board Mellanox® ConnectX QDR 40Gbp/s Infiniband w/QSFP Connector. The iXR-22X4IB is perfect for high-powered computing, virtualization, or business intelligence applications that require the computing power of the Intel® Xeon® Processor E5-2600 Family and the high throughput of Infiniband.

HIGH Throughput & INCREDIBLE Performance Density

IXR-1204+10G: **10GbE On-Board**

4 Server Nodes in 2U

IXR-22X4IB

Call iXsystems toll free or visit our website today! **1-855-GREP-4-IX | www.iXsystems.com**

Dear BSD Readers,

We are pleased to present you with the newest issue of BSD Magazine. In the February issue, we have decided to focus on various important aspects for Unix users.

Inside, you will find interesting articles, such as Configure OpenBSD 5.4 Basic Services. In short, thanks to reading this article, you will learn what you need to do to configure a vether (Virtual Ethernet Device Driver) to be able to provide NAT for your PPTP clients.

The next article in the newest issue is entitled Getting to Grips with the Gimp. In Rob's new series on image manipulation and design, you will look at graphic design basics, and you will learn how to use the most popular Open Source graphics software – The Gimp.

In the following section, that is Unix, you will find an article entitled User, Group and Password Management on Linux and Solaris and Securing CentOS and Solaris 11 with Puppet. The first one will cover the user, group and password management tools and the second one will provide you with detail about how security can be managed on CentOS 6.x and Solaris 11.1 hosts with Puppet 3.x.

We would also like to encourage you to read the interview with Peter N.M. Hansteen in the February Issue.

Thank you BSD fans for your invaluable support and contribution.

Enjoy reading!
BSD Team

MAGAZINE BSD

Editor in Chief:
Ewa Dudzic
ewa.dudzic@software.com.pl

Contributing:
Michael Shirk, Andrey Vedikhin, Petr Topiarz, Charles Rapenne, Anton Borisov, Jeroen van Nieuwenhuizen, José B. Alós, Luke Marsden, Salih Khan, Arkadiusz Majewski, BEng, Toki Winter, Wesley Mouedine Assaby

Top Betatesters & Proofreaders:
Annie Zhang, Denise Ebery, Eric Geissinger, Luca Ferrari, Imad Soltani, Olaoluwa Omokanwaye, Radjis Mahangoe, Mani Kanth, Ben Milman, Mark VonFange

Special Thanks:
Annie Zhang
Denise Ebery

Art Director:
Ireneusz Pogroszewski

DTP:
Ireneusz Pogroszewski
ireneusz.pogroszewski@software.com.pl

Senior Consultant/Publisher:
Paweł Marciniak
pawel@software.com.pl

CEO:
Ewa Dudzic
ewa.dudzic@software.com.pl

Production Director:
Andrzej Kuca
andrzej.kuca@software.com.pl

Publisher:
Hakin9 Media SK
02-676 Warsaw, Poland
Postepu 17D
Poland
worldwide publishing
editors@bsdmag.org
www.bsdmag.org

Hakin9 Media SK is looking for partners from all over the world. If you are interested in cooperation with us, please contact us via e-mail: editors@bsdmag.org.

Configure OpenBSD 5.4 Basic Services

The webserver has only one nic, so we need to configure a vether (Virtual ethernet device driver) to be able to provide NAT for our PPTP clients. It is connected to the internet through a simple modem-router. We use OpenBSD 5.4. Tested with Apple, Samsung phones, and a laptop running Windows 8: PPTP connection / reach a webpage hosted by the webserver.

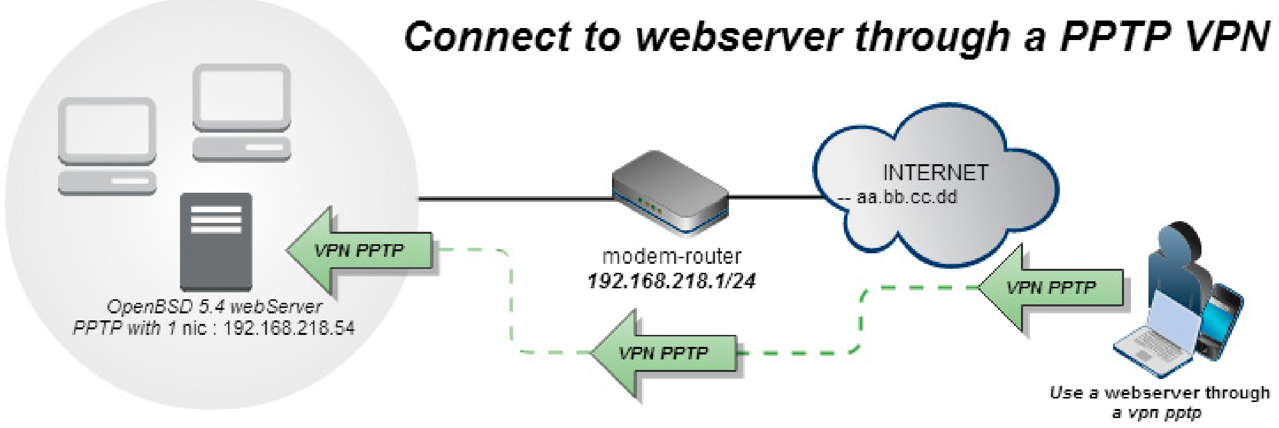
What you will learn…

- Configure OpenBSD basic services.
- Understand Packet Filter.
- Build a PPTP vpn server.
- How to use vether

What you should know…

- Basic TCP/IP knowledge, OpenBSD installation and post-configuration.

The role-play: The webserver has only one nic, so we need to configure vether to be able to provide NAT for our PPTP clients. It is connected to the Internet through a simple modem-router. We use OpenBSD 5.4-RELEASE-i386 on the webserver. Tested with Apple, Samsung phones, and a laptop running Windows 8: PPTP connection / reach a webpage hosted by the webserver. First, read the man pages for, PF.CONF(5), PFCTL(8), NPPPD(8), NPPPCTL(8), PPPX(4), PIPEX(4), GRE(4), VETHER(4). Make sure the webserver is connected to the Internet.


Connect to webserver through a PPTP VPN
INTERNET
-- aa.bb.cc.dd
modem-router
192.168.218.1/24
VPN PPTP
VPN PPTP
VPN PPTP
OpenBSD 5.4 webServer
PPTP with 1 nic : 192.168.218.54
Use a webserver through a vpn pptp

Update with a fresh copy of OpenBSD and install to -stable, using Openup

```
# Get it
ftp https://stable.mtier.org/openup

# Run it
./openup

# You need to reboot if the kernel has been replaced
```

Set the kernel state (reboot is not needed)

```
# Permit forwarding (routing) of IPv4 packets
sysctl net.inet.ip.forwarding=1

# Allow GRE packets in and out of the system
sysctl net.inet.gre.allow=1

# Enable pipex (used with tun and pppx)
sysctl net.pipex.enable=1

# Do not forget to enable them in the file /etc/sysctl.
   conf to keep these settings at reboot.
```

Configure vether with this address : 172.17.2.54/24 (it is my choice)

```
# Create interface vether0
echo "inet 172.17.2.54 255.255.255.0" > /etc/hostname.
   vether0
sh /etc/netstart vether0

# Verify
ifconfig vether0

# By default, vether0 is associated to a group named
   vether
# And the internet interface is associated to the egress
   group
```

Configure Packet-Filter (/etc/pf.conf)

```
# No filters on loopback interface
set skip on lo

# We do not want to load fingerprints
set fingerprints "/dev/null"

#  NAT for PPTP clients
match out on egress inet from vether:network to any
   nat-to egress

# Policy : block all and log all blocked packets
block log all
```

m:tier

BSD development and consultancy

Zabbix Monitoring

Bacula enterprise backup

BSD Thin Client

Corporate BSD Desktop

Solution management with Puppet

and more ...

www.mtier.org
contact@mtier.org

```
# We trust outbound
pass out

# PPTP traffic
pass in on vether
pass proto gre
pass on pppx0
pass in on egress inet proto tcp from any to any port
    PPTP

# Permit computers in our local network to use our
    webserver
pass in on egress inet proto tcp from any to any port
    www
```

Load the new ruleset

```
/sbin/pfctl -vf /etc/pf.conf
```

Configure npppd authentication using the file /etc/npppd/npppd-users, this last one contains:

```
# a username wesley and his password welCom3

wesley:\
 :password=welCom3:
```

Configure npppd authentication using the file /etc/npppd/npppd-users, this last one contains

```
# a username wesley and his password welCom3

wesley:\
 :password=welCom3:
```

Configure npppd (/etc/npppd/npppd.conf)

```
authentication LOCAL type local {
 users-file "/etc/npppd/npppd-users"
}

tunnel VPN protocol PPTP {
 listen on 0.0.0.0
}

ipcp IPCP {
 pool-address 172.17.2.100-172.17.2.150
 dns-servers 8.8.8.8
 }

interface pppx0 address 172.17.2.1 ipcp IPCP
Bind tunnel from VPN authenticated by LOCAL to pppx0
```

Configure npppd authentication using the file /etc/npppd/npppd-users, this last one contains :

```
# a username wesley and his password welCom3

wesley:\
 :password=welCom3:
```

Start npppd

```
echo "npppd_flags=" >> /etc/rc.conf.local

# For troubleshootings : tail -f /var/log/daemon &

/etc/rc.d/npppd start

# Verify that it listens on port 1723 (PPTP)
netstat -anf inet | grep 1723
```

Do not forget to open the port 1723 TCP in the modem-router (Port forwarding from Any to 192.168.218.54:1723 TCP).

Start apache (webserver)

```
echo "httpd_flags=" >> /etc/rc.conf.local
/etc/rc.d/httpd start

# Try on a computer in the local network
    http://192.168.218.54
# On PPTP clients : http://172.17.2.54
```

To connect a client, use the following information:
PPTP connection / IP: aa.bb.cc.dd / Username : wesley / and password: welCom3

view connected clients (on the webserver)

```
npppctl session all
```

Conclusions

The trick is to use vether(4), and now we can provide nat for our PPTP clients.

WESLEY MOUEDINE ASSABY

Wesley MOUEDINE ASSABY lives in Reunion island, near Mauritius. He works as a network administrator at AISE-INFORMATIQUE (http://www.aise.re) where he installs some firewalls (Soekris appliances) and mail servers, all using OpenBSD systems. He has used OpenBSD since 2007.
To contact the author write at wesley [at] mouedine [dot] net
© Copyright 2013

UPDATE
NOW WITH
STIG
AUDITING

"IN SOME CASES
nipper studio
HAS VIRTUALLY
REMOVED
the NEED FOR a
MANUAL AUDIT"

CISCO SYSTEMS INC.

Titania's award winning Nipper Studio configuration auditing tool is helping security consultants and end-user organizations worldwide improve their network security. Its reports are more detailed than those typically produced by scanners, enabling you to maintain a higher level of vulnerability analysis in the intervals between penetration tests.

Now used in over 45 countries, Nipper Studio provides a thorough, fast & cost effective way to securely audit over 100 different types of network device. The NSA, FBI, DoD & U.S. Treasury already use it, so why not try it for free at www.titania.com

2012 Computing Security Awards
WINNER
Enterprise Security
Solution of the Year

Security Products' GOVIES
2013 Government Security Awards

2012 Computing Security Awards
WINNER
Network Security
Solution of the Year

www.titania.com

How Secure can Secure Shell (SSH) be?

(OpenSSH VPN tunnelling)

This article is the fourth part of the OpenSSH and configurations series, and includes some tricks which make the protocol more secure. The article concentrates on SFTP (SSH File Transfer Protocol) supported by OpenSSH and sftp-server subsystem, but has useful information for a standard file transfer preferring SFTP to FTP (File Transfer Protocol).

What you will learn…

- How to configure VPN using OpenSSH.
- A good foundation to make something new and secure on your own.

What you should know…

- Unix/Linux commands and SHELL environments.
- The basics of TCP/IP.
- Basic configuration of SSH (1st and 2nd parts of the article series)
- Understanding of security necessities.

First, and most important, is security. SFTP is supported by OpenSSH and is secure by default. Traffic between client and server is encrypted.

How to configure WinSCP client for SFTP was mentioned in the first article of the series named: Basic Configuration of OpenSSH (issue 11/2013). You can use private/public keys and one time passwords just like a normal SSH connection. Be informed that the application Locker (*www.iptrace.pl* and Download->Locker) does not support WinSCP client and others, so if you are going to use your server as an SFTP server you need to disable and comment the locker application in the .profile file.

When you configure SSH, SFTP is enabled by default and can be used simultaneously with SSH terminal access, VPNs, etc. The system service responsible for SFTP is a subsystem sftp-server non-standalone system, but is ready to work with the sshd daemon and has its own configuration in the sshd_config file. The main option in this file is:

```
subsystem sftp /usr/libexec/sftp-server
```

If you comment out the above line, you can still use your system as an SFTP server.

The rest of the sshd_config file can be the same for SSH terminal connections. If you want to apply the file transfer for more than one or two users, just add the users to the appropriate option in the sshd_config file.

Sometimes it is required to use SFTP in read-only mode. In this case use the uncommented line above. Add the sftp-server option `-R` to deny the writing of any data for every user. The option with values is shown below:

```
subsystem sftp /usr/libexec/sftp-server -R
```

Some users may have read access to one or more directories and can copy some files, especially configuration files, and have the ability to read and find bugs in your configurations that are only useful for internal administrators.

References (order of relevance)

- man sshd_config.
- man sftp-server.
- man sshd.
- *www.openssh.org.*

For the rest of the users, separate directories can be used for each user, or group, to log in. One time passwords must be disabled, because they cannot be used in this case. How to disable OTP was mentioned in the second article of this series named: One Time Password aka OTP (issue 12/2013).

Add the following lines to your sshd_config file. You can specify group or user for such access.

```
Subsystem sftp internal-sftp

Match Group sftpusers
   ChrootDirectory %h
   ForceCommand internal-sftp
   AllowTcpForwarding no

Match User username
   ChrootDirectory %h
   ForceCommand internal-sftp
```

Sometimes it is desirable to allow a group to have read-only access to files for a particular user. In this case you can just use standard chown and chmod commands.

Conclusion

SSH, and especially OpenSSH, are very powerful applications when beginners use a Unix-like or Linux operating system. It is very useful for administrators to secure access to the system and improve scalability to whole networks. I hope this article on OpenSSH expanded your knowledge and challenges you to use it. Try to employ it in your next project.

ARKADIUSZ MAJEWSKI, BENG

Arkadiusz Majewski comes from Poland. He has 15 years' experience with ICT technologies, including 15 years of IT networks, 10 years of BSD systems and MS Windows Server solutions. Ha has also 5 years' experience with programming languages and Telco solutions. He's interested in security on all business and ICT levels. In his free time he reads ICT books and deepens his knowledge about science (math, physics, chemistry). His hobbies are cycling and motorization. He's a graduate of Warsaw Information Technology under the auspices of the Polish Academy of Sciences. He's the IT Manager at an international company. Feel free to contact the author via e-mail at bsd.magazine@iptrace.pl.

[GEEKED AT BIRTH]

University of Advancing Technology
UAT
Learn. Experience. Innovate.

You can talk the talk.
Can you walk the walk?

[IT'S IN YOUR DNA]

LEARN:
Advancing Computer Science
Artificial Life Programming
Digital Media
Digital Video
Enterprise Software Development
Game Art and Animation
Game Design
Game Programming
Human-Computer Interaction
Network Engineering
Network Security
Open Source Technologies
Robotics and Embedded Systems
Serious Game and Simulation
Strategic Technology Development
Technology Forensics
Technology Product Design
Technology Studies
Virtual Modeling and Design
Web and Social Media Technologies

www.uat.edu > 877.UAT.GEEK

Please see www.uat.edu/fastfacts for the latest information about degree program performance, placement and costs.

Getting to Grips with the Gimp – Part 1

In our new series on image manipulation and design, we will look at graphic design basics, and how to use the most popular Open Source graphics software – The Gimp.

What you will learn…

- How to manipulate images like a design pro

What you should know…

- General PC administration skills

It might seem strange having a "non-technical" how-to series, but in this age of digital photography, graphics intensive website design and visual icons, more and more emphasis is being placed on imagery as a method of communication. Good graphic design is also useful for presentations, flyers, and publications; the list is endless. Some people just lift images from Google or make use of professional stock images, the latter being expensive and the former dubious from a copyright perspective. What can be more satisfying than manipulating and creating your own artwork?

I first became hooked on graphics programs in the mid-eighties when I got my hands on an Amiga and Deluxe Paint. Sadly no more, I spent years working with other vector based programs such as Corel Draw, Arts and Letters, etc. until I came across the Gimp in the early days of Open Source. While Adobe Photoshop has always been around, it was (and still is) prohibitively expensive for the

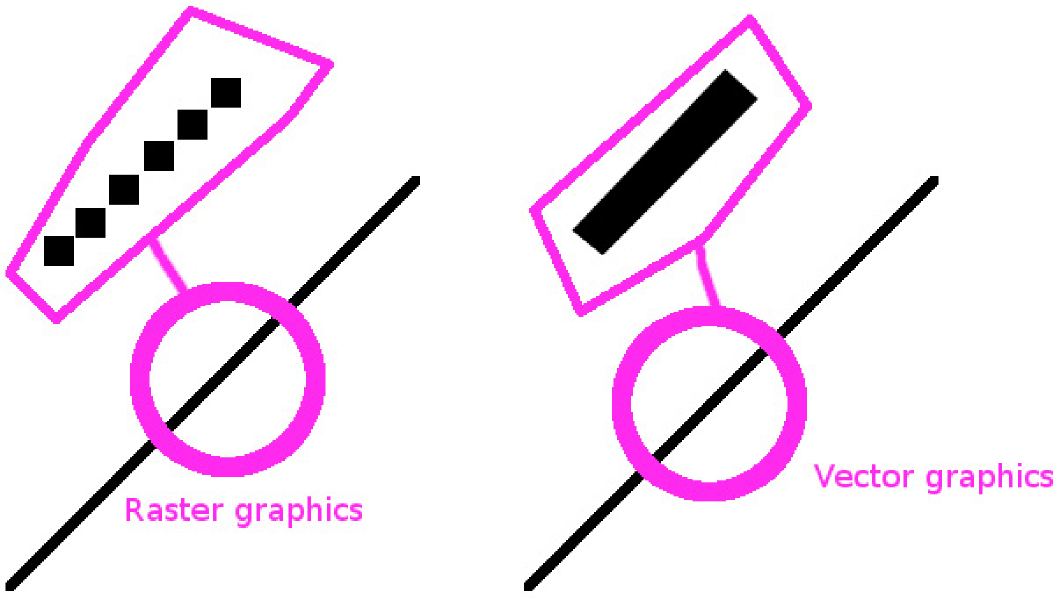


Figure 1. *Raster and Vector images*

amateur design enthusiast, and until the Gimp arrived there was no real raster based alternative.

The Gimp (the GNU Image Manipulation Program) can be used for photo retouching, image authoring and a host of other functions including creating animated GIFs, etc.

While both vector and raster based programs have their uses, the former is mainly used for posters, logos and artwork that requires high definition at high resolutions. Gimp on the other hand works at the pixel level and therefore is suitable for image manipulation. For vector graphics manipulation, Inkscape is an excellent Open Source tool. [See Figure 1 – Raster and Vector graphics].

Requirements

The Gimp is available for Mac (OSX), Windows and virtually every flavour of Linux and *BSD. While version numbers may vary slightly across platforms, I will be using 2.8.4 for this tutorial though some platforms may still be on 2.6.x. There are some subtle differences between the two versions (e.g. window docking, file import and export, etc.) but the majority of functions are the same. What is more important than the version is the PC you run the software on. You will need plenty of RAM if you are going to be working with large images. A good quality graphics card and monitor are also important, but most modern kits will be fine. The biggest issue is colour drift and lighting – editing an image on a CRT monitor under flourescent light will be a different visual experience from using an LCD or LED monitor under tungsten lighting. One of the reasons why graphic designers are fanatical about Mac's is the excellent colour balance and font support, something that is not consistent across different manufacturers.

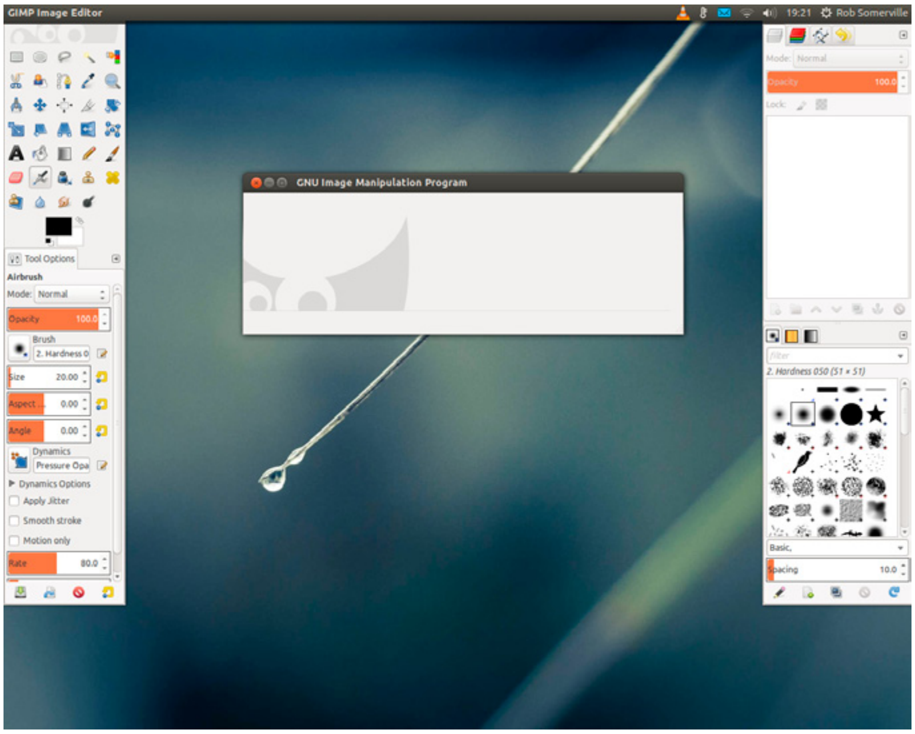


Figure 2. *Default Gimp layout*

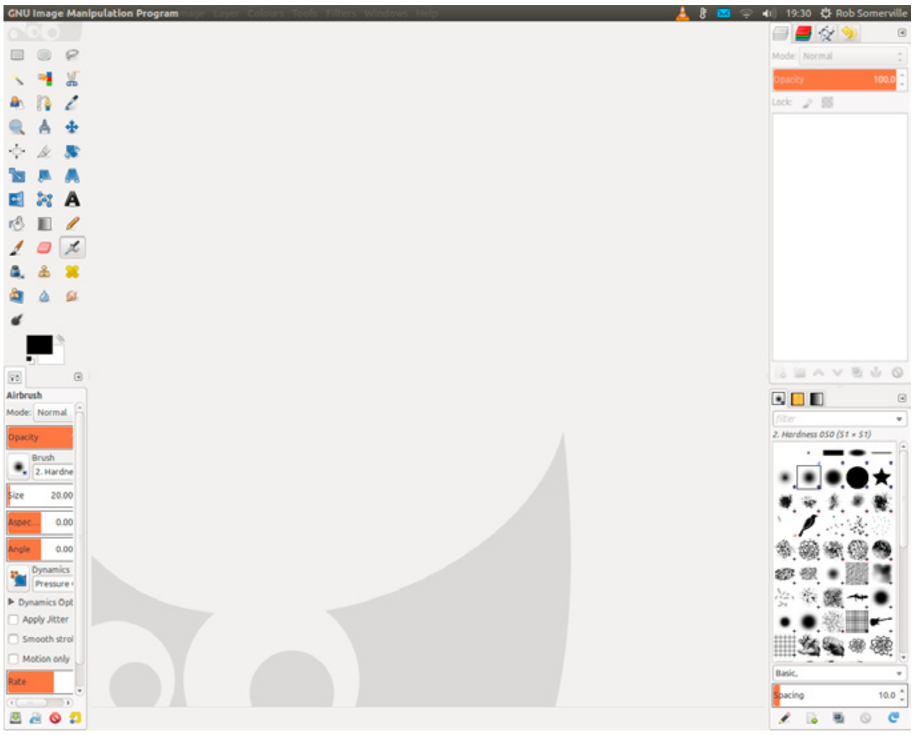


Figure 3. *Single window mode*

Also, it is important to respect copyright and attribute credit where it is due. All images used in this series will either come from the author's own collection, royalty free from *http://www.sxc.hu* or under a Creative Commons licence.

Your Chance to Contribute

If you have an image you would like manipulated, or have some ideas for the series, please contact me via BSD magazine. While my favourite task is taking mundane images and applying liberal doses of satire, surrealism or atmosphere, I am open to suggestions and any commissions from readers.

Let's get started

Install Gimp on a PC and platform of your choice, either via your package management system or by download from *www.gimp.org/downloads*. Upon opening the Gimp, you will be presented with multiple windows [Figure 2]. As I am left handed and I don't like multiple floating windows cluttering my desktop, I have selected Windows → Single-Window mode [Figure 3]. I have also moved all the tabs from Layers, Brushes, Gradients etc. across to the left hand side dock, and expanded the width slightly so all the controls are visible [Figure 4]. You may want to tweak the default settings as well [Figure 5 – 8].

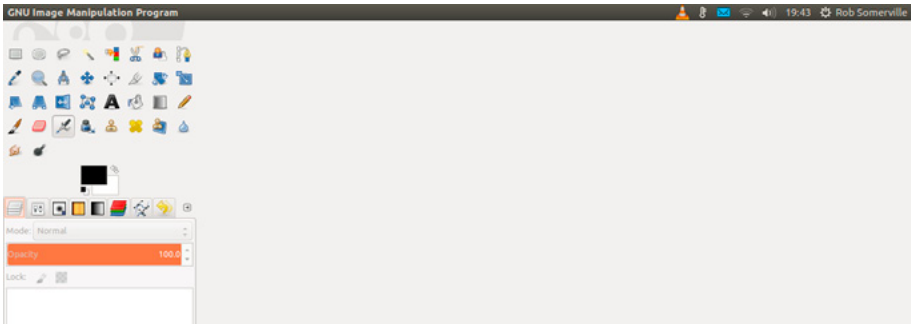
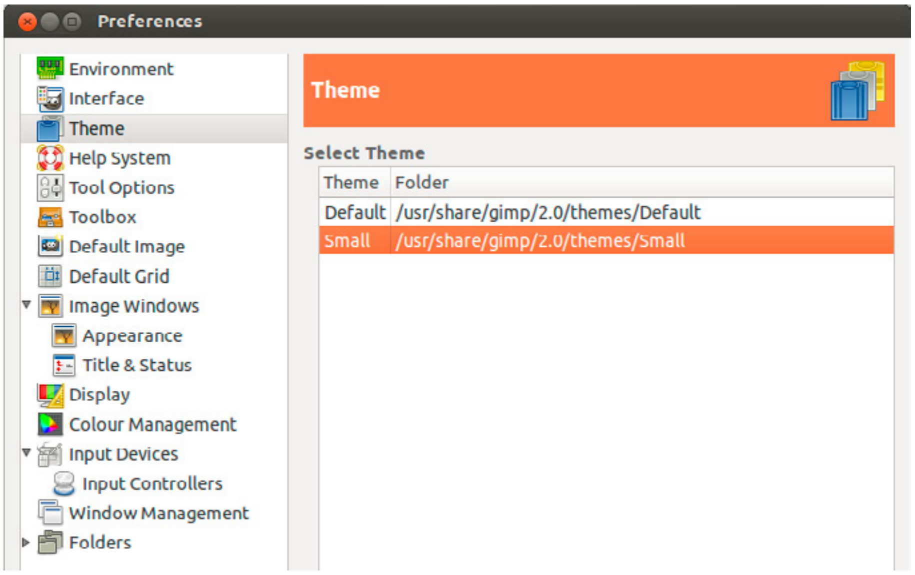


Figure 4. *Controls moved to the left hand side*



Preferences

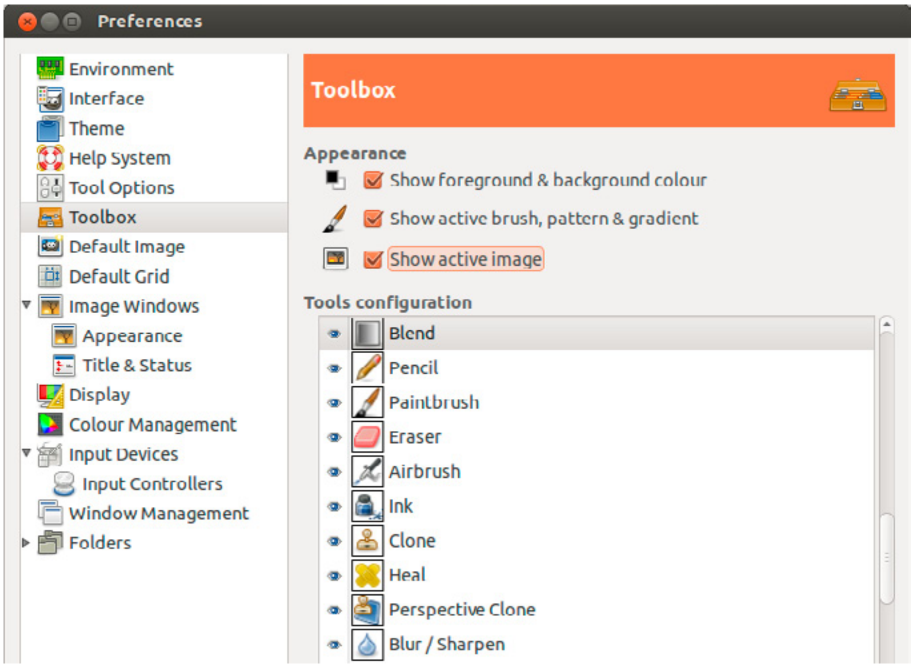
- Environment
- Interface
- Theme
- Help System
- Tool Options
- Toolbox
- Default Image
- Default Grid
- Image Windows
  - Appearance
  - Title & Status
- Display
- Colour Management
- Input Devices
  - Input Controllers
- Window Management
- Folders

Theme

Select Theme

Theme	Folder
Default	/usr/share/gimp/2.0/themes/Default
Small	/usr/share/gimp/2.0/themes/Small

Figure 5. *Use a smaller theme to increase desktop real estate*



Preferences

- Environment
- Interface
- Theme
- Help System
- Tool Options
- Toolbox
- Default Image
- Default Grid
- Image Windows
  - Appearance
  - Title & Status
- Display
- Colour Management
- Input Devices
  - Input Controllers
- Window Management
- Folders

Toolbox

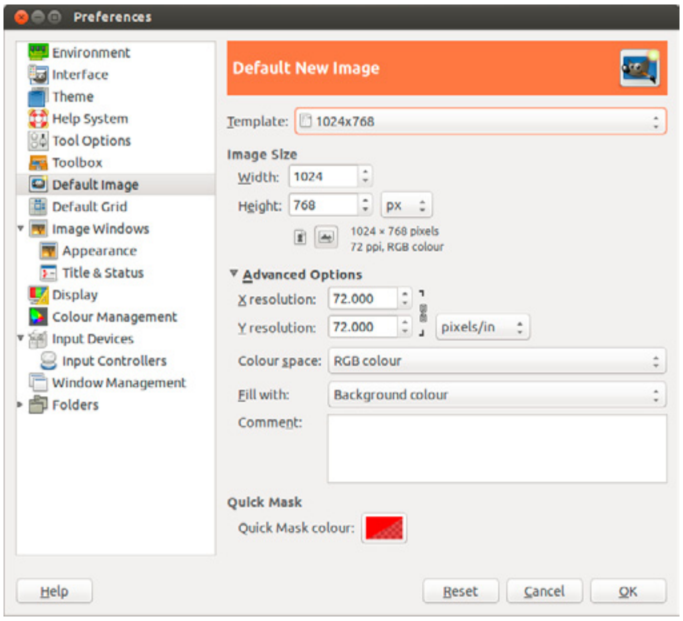
Appearance

- ✓ Show foreground & background colour
- ✓ Show active brush, pattern & gradient
- ✓ Show active image

Tools configuration

- Blend
- Pencil
- Paintbrush
- Eraser
- Airbrush
- Ink
- Clone
- Heal
- Perspective Clone
- Blur / Sharpen

Figure 6. *Show brushes and images*



Preferences

- Environment
- Interface
- Theme
- Help System
- Tool Options
- Toolbox
- Default Image
- Default Grid
- Image Windows
  - Appearance
  - Title & Status
- Display
- Colour Management
- Input Devices
  - Input Controllers
- Window Management
- Folders

Default New Image

Template: 1024x768

Image Size

Width: 1024

Height: 768 px

1024 × 768 pixels
72 ppi, RGB colour

Advanced Options

X resolution: 72.000

Y resolution: 72.000 pixels/in

Colour space: RGB colour

Fill with: Background colour

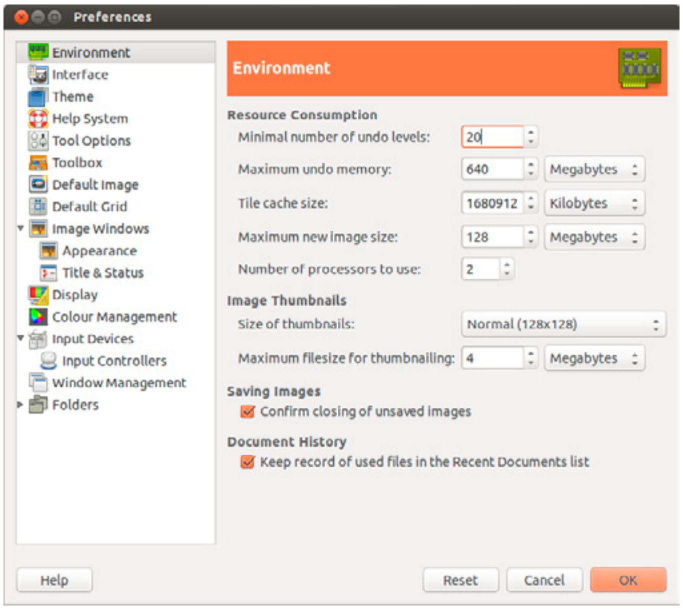
Comment:

Quick Mask

Quick Mask colour:

Help Reset Cancel OK

Figure 7. *Set the default template size*



Preferences

- Environment
- Interface
- Theme
- Help System
- Tool Options
- Toolbox
- Default Image
- Default Grid
- Image Windows
  - Appearance
  - Title & Status
- Display
- Colour Management
- Input Devices
  - Input Controllers
- Window Management
- Folders

Environment

Resource Consumption

Minimal number of undo levels: 20

Maximum undo memory: 640 Megabytes

Tile cache size: 1680912 Kilobytes

Maximum new image size: 128 Megabytes

Number of processors to use: 2

Image Thumbnails

Size of thumbnails: Normal (128x128)

Maximum filesize for thumbnailing: 4 Megabytes

Saving Images

✓ Confirm closing of unsaved images

Document History

✓ Keep record of used files in the Recent Documents list

Help Reset Cancel OK

Figure 8. *Increase undo levels and undo memory*

Editing an image

A list of the major tools and functions is listed in Table 1. In the belated spirit of St Valentines day, we will modify a picture of a rose and add a shadow using a mask and multiple layers to produce the resulting Image 2. These two tools are very powerful, and quickly allow the designer to transform an image with ease.

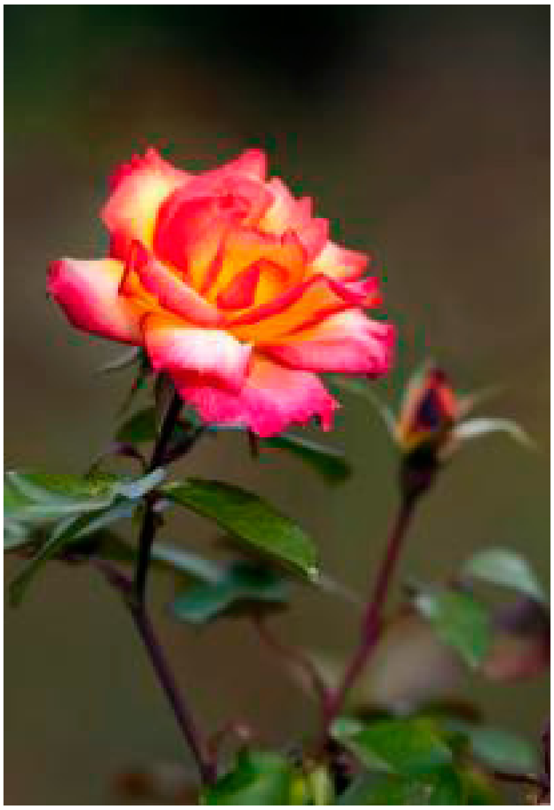


Image 1. *rose-with-bud-ii-1436558-m.jpg*

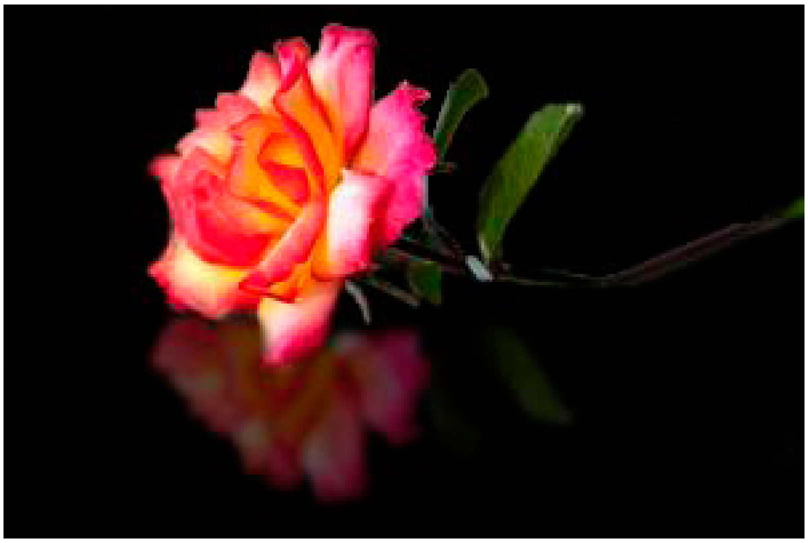


Image 2. *The final picture*

Step 1
Download rose-with-bud-ii-1436558-m.jpg (Image 1) from the website listed in Table 2. Open in the Gimp using *File → Open*

Step 2
Rotate the image with *Image → Transform → Rotate 90 Degrees anti-clockwise*. Zoom in by pressing + a couple of times or click on the image with the Zoom tool [Figure 9].

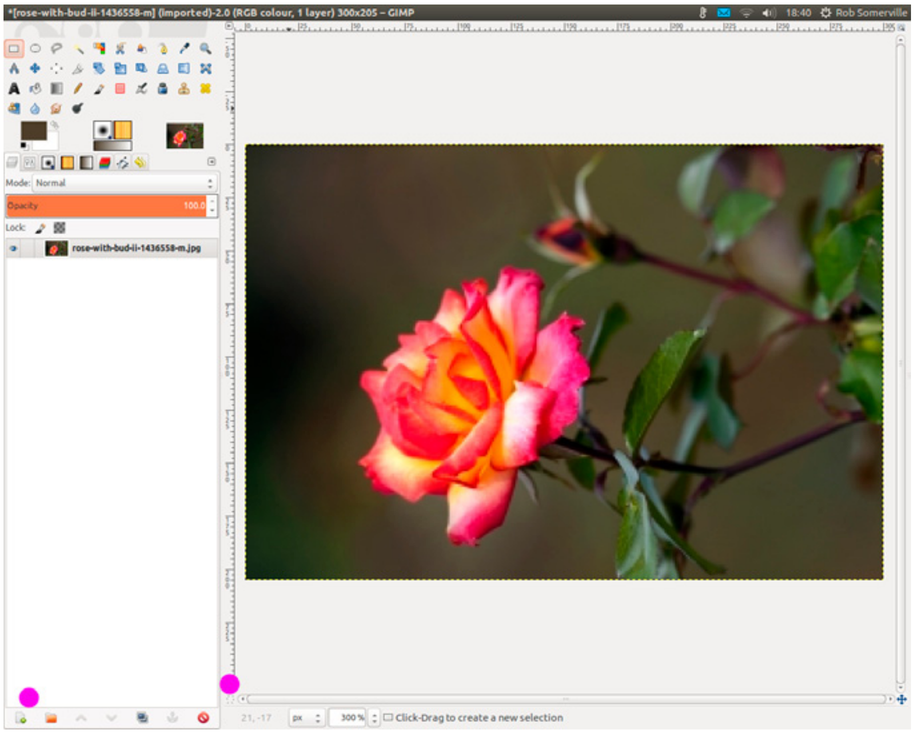

*[rose-with-bud-ii-1436558-m] (imported)-2.0 (RGB colour, 1 layer) 300x205 – GIMP
18:40
Rob Somerville
Mode: Normal
Opacity 100.0
Lock:
rose-with-bud-ii-1436558-m.jpg
21, -17
px
300 %
Click-Drag to create a new selection

Figure 9. *Image loaded into the Gimp. New layer and mask icons highlighted*

Step 3
Using the fuzzy select tool, click on the image at position 100px x 50px to make a selection. You will see a boundary of "marching worms" [Figure 10].

Step 4
Click on the *Toggle quick Mask* icon just to the bottom Left Hand Side of the image or press *Shift Q*. A red mask will cover the areas that will not be affected by our changes [Figure 10].

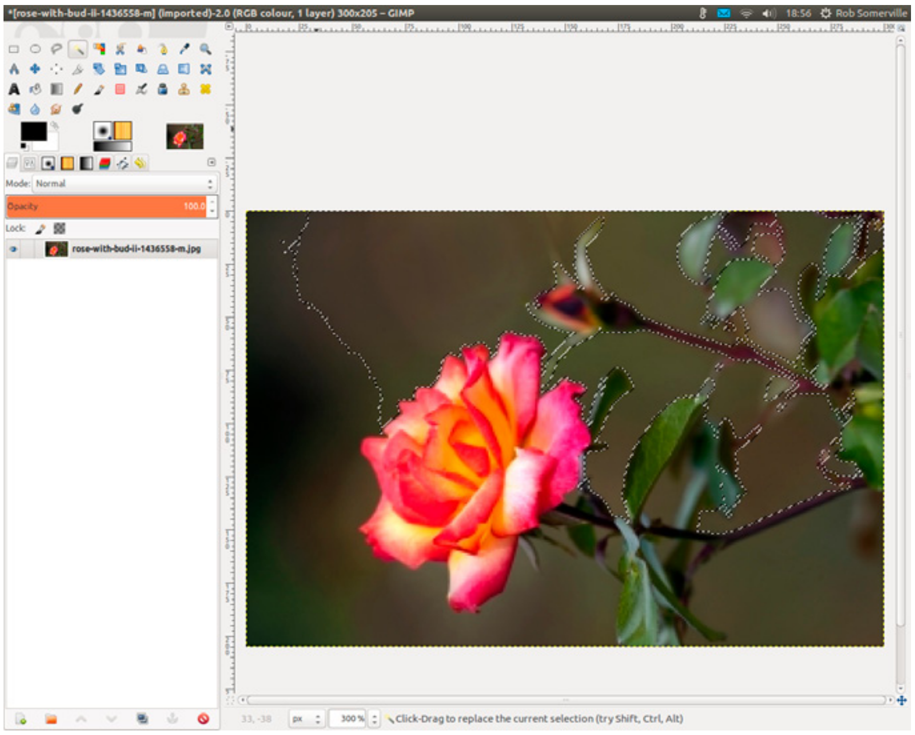
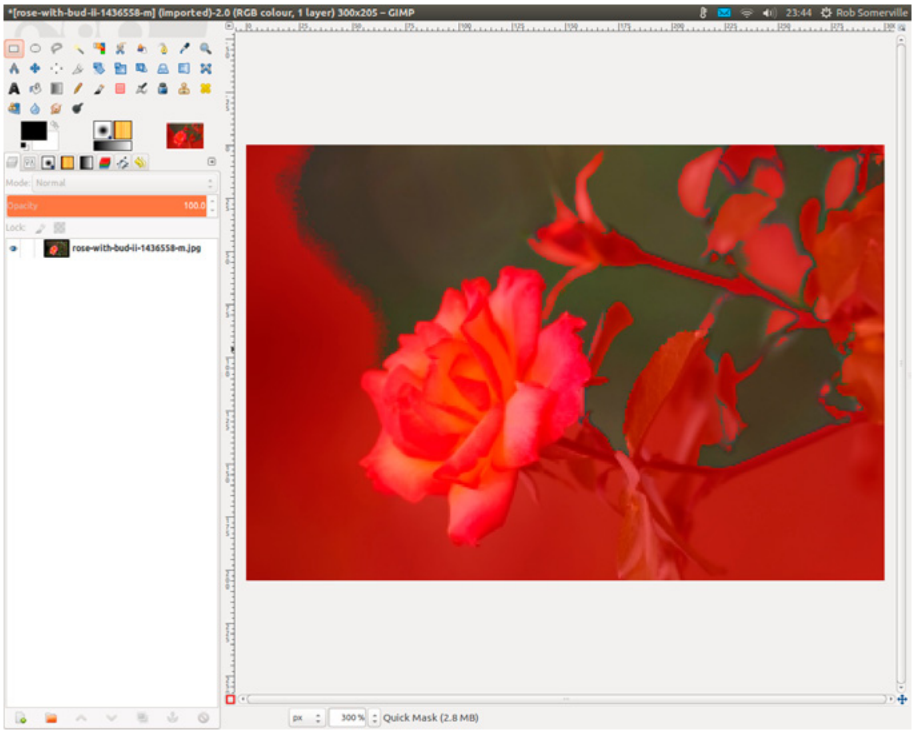

*[rose-with-bud-ii-1436558-m] (imported)-2.0 (RGB colour, 1 layer) 300x205 – GIMP
18:56
Rob Somerville
Mode: Normal
Opacity 100.0
Lock:
rose-with-bud-ii-1436558-m.jpg
33, -38
px
300 %
Click-Drag to replace the current selection (try Shift, Ctrl, Alt)

Figure 10. *Fuzzy select*

Step 5

Using the erase tool, and increasing / decreasing the size of the brush as required, remove the mask from the background to leave the rose, the stem and a few leaves. Zoom in and out as required (+ / –), and don't worry if you overshoot slightly. Either press *Ctrl Z* to undo, or retouch with the paintbrush tool. I used the 2. Hardness 025 brush circular, but choose a brush you feel comfortable with. The final result should look like Figure 11. [Figure 11 – 12].


*[rose-with-bud-ii-1436558-m] (imported)-2.0 (RGB colour, 1 layer) 300x205 – GIMP

23:44 Rob Somerville

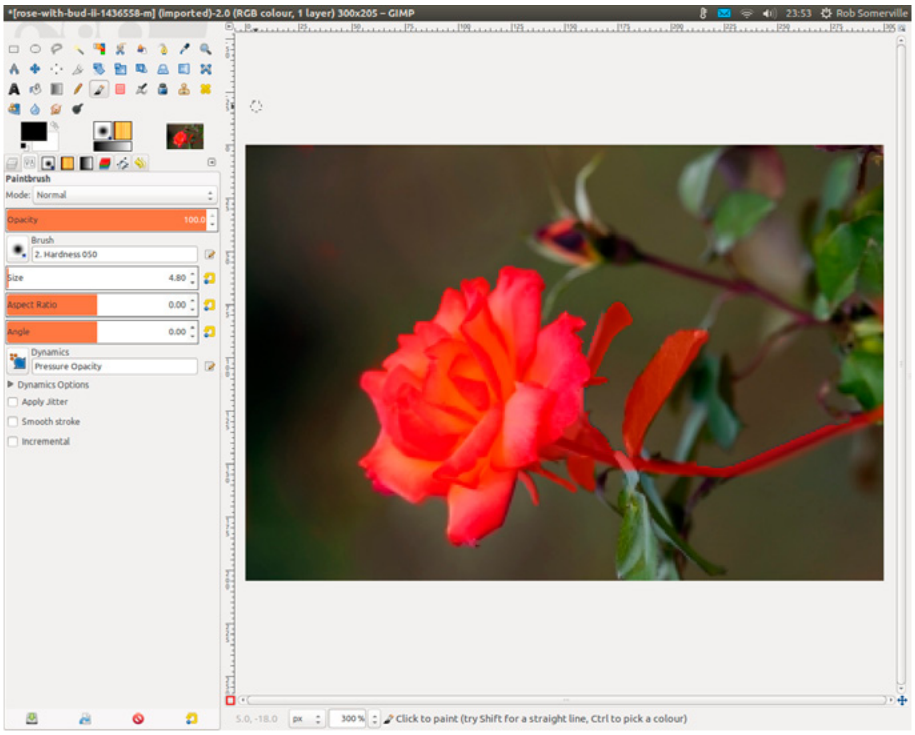
Mode: Normal

Opacity 100.0

rose-with-bud-ii-1436558-m.jpg

px 300 % Quick Mask (2.8 MB)

Figure 11. *Mask toggled on*


*[rose-with-bud-ii-1436558-m] (imported)-2.0 (RGB colour, 1 layer) 300x205 – GIMP

23:53 Rob Somerville

Paintbrush

Mode: Normal

Opacity 100.0

Brush 2. Hardness 050

Size 4.80

Aspect Ratio 0.00

Angle 0.00

Dynamics Pressure Opacity

Dynamics Options

☐ Apply Jitter

☐ Smooth stroke

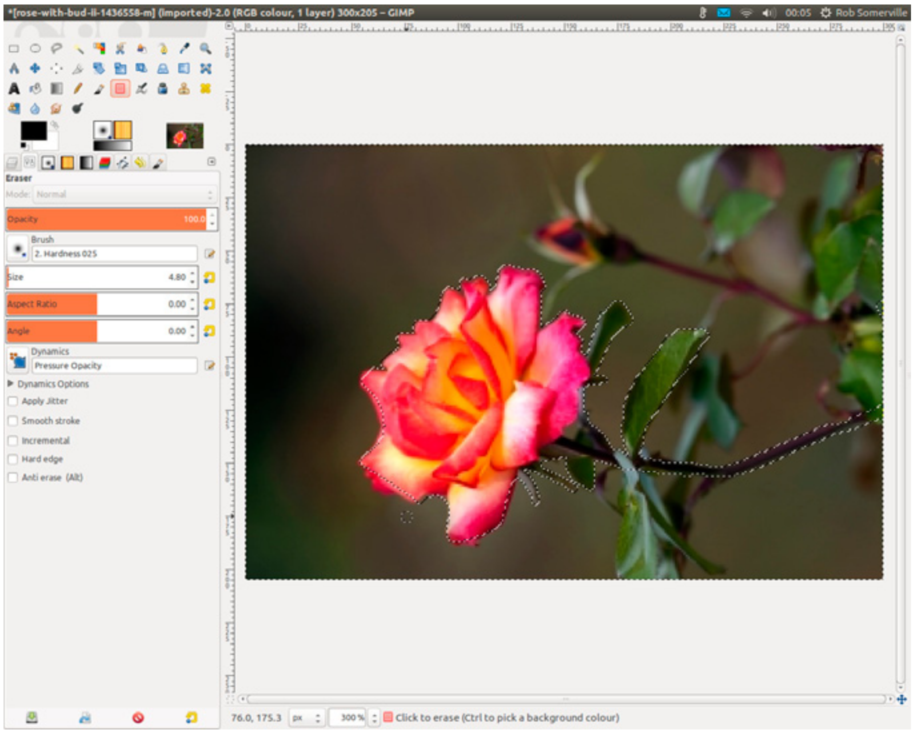
☐ Incremental

5.0, -18.0 px 300 % Click to paint (try Shift for a straight line, Ctrl to pick a colour)

Figure 12. *Final masked area*

Step 6

Un-toggle the Quick Mask and the flower with leaves should be selected [Figure 13].


*[rose-with-bud-ii-1436558-m] (imported)-2.0 (RGB colour, 1 layer) 300x205 – GIMP

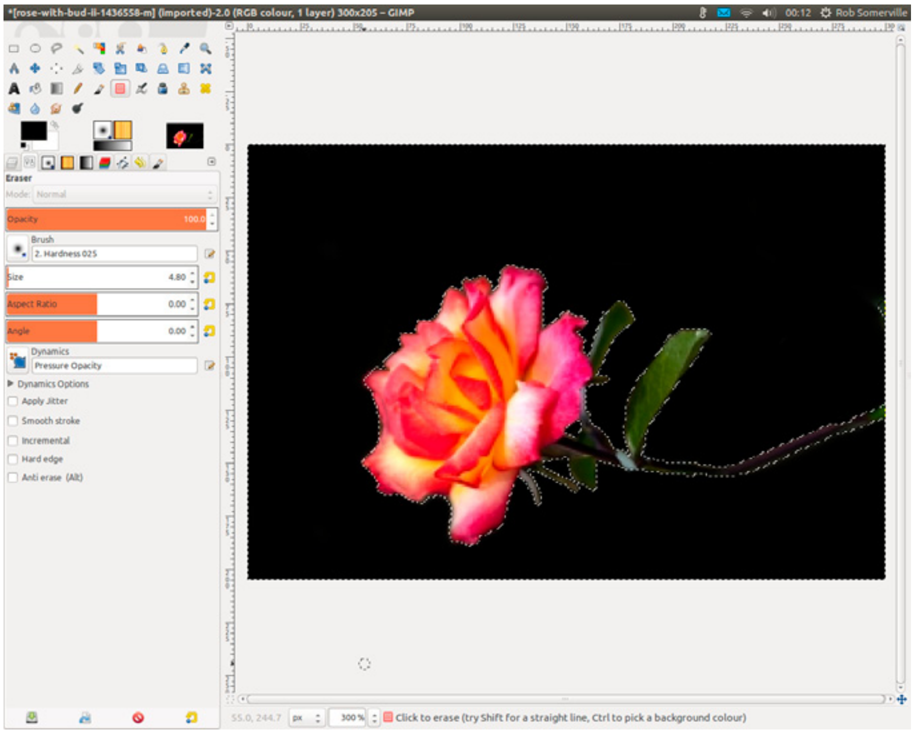
Eraser
Mode: Normal
Opacity 100.0
Brush 2. Hardness 025
Size 4.80
Aspect Ratio 0.00
Angle 0.00
Dynamics Pressure Opacity
Dynamics Options
Apply Jitter
Smooth stroke
Incremental
Hard edge
Anti erase (Alt)

76.0, 175.3 px 300 % Click to erase (Ctrl to pick a background colour)

Figure 13. *Selected area with "marching worms"*

Step 7

Press *Ctrl*, and the background will be filled with a black background. Press *Shift Ctrl A* to deselect the background and zoom out to 100% [Figure 14].


*[rose-with-bud-ii-1436558-m] (imported)-2.0 (RGB colour, 1 layer) 300x205 – GIMP

Eraser
Mode: Normal
Opacity 100.0
Brush 2. Hardness 025
Size 4.80
Aspect Ratio 0.00
Angle 0.00
Dynamics Pressure Opacity
Dynamics Options
Apply Jitter
Smooth stroke
Incremental
Hard edge
Anti erase (Alt)

55.0, 244.7 px 300 % Click to erase (try Shift for a straight line, Ctrl to pick a background colour)

Figure 14. *Rose on black background*

Step 8

From the menu *Image → Canvas size* resize the image to 300px x 410px. Ensure the chain between width and height is broken and that *Resize layers → All layers* is selected. Click on the *layers icon* and add a new black layer. Drag this new layer down so the rose is the top layer. Right click on the rose layer and add transparency by adding a new *Alpha channel*, then using the rectangular select tool, highlight the white area beneath the rose. Press *Del* to delete this selection, then press *Ctrl I* to select the upper part of the image. Press *Ctrl C* to copy, click on the lower black layer and press *Ctrl V* to paste the selection. Using the move tool, adjust the copy of the rose so that it is roughly below the first top rose, then select *Layer → Transform → Flip* vertically. Use the move tool to adjust the position of the lower layer so that approximately 1/3rd of the inverted rose is showing. When satisfied, right click on the floating selection and choose *Anchor layer*. [Figure 15].

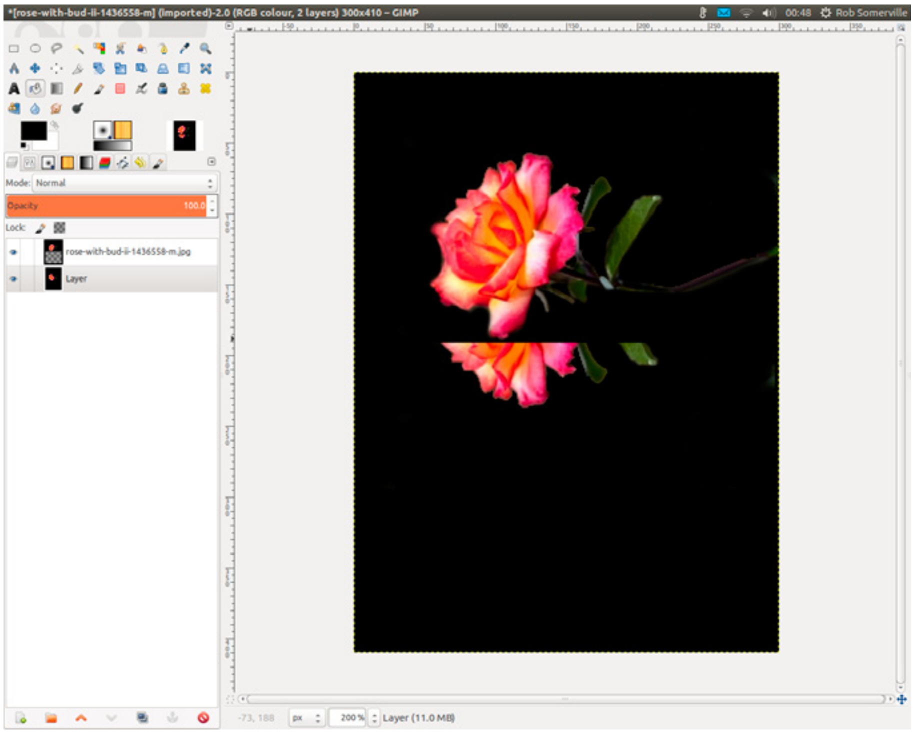

*[rose-with-bud-ii-1436558-m] (imported)-2.0 (RGB colour, 2 layers) 300x410 – GIMP
Mode: Normal
Opacity 100.0
Lock:
rose-with-bud-ii-1436558-m.jpg
Layer
px
200 %
Layer (11.0 MB)

Figure 15. *Rose with inverted reflection before top layer erased and transparency / blur applied*

Step 9

Click on the top rose layer. Using the erase tool, remove just enough of the top black area to make the reflection look convincing. Add a new black layer with 65% transparency between the rose and the reflection. Select the bottom layer and blur by 6px using *Filters → Blur → Gaussian blur*. Crop the image using the crop tool and the finished result can be seen in Image 2.

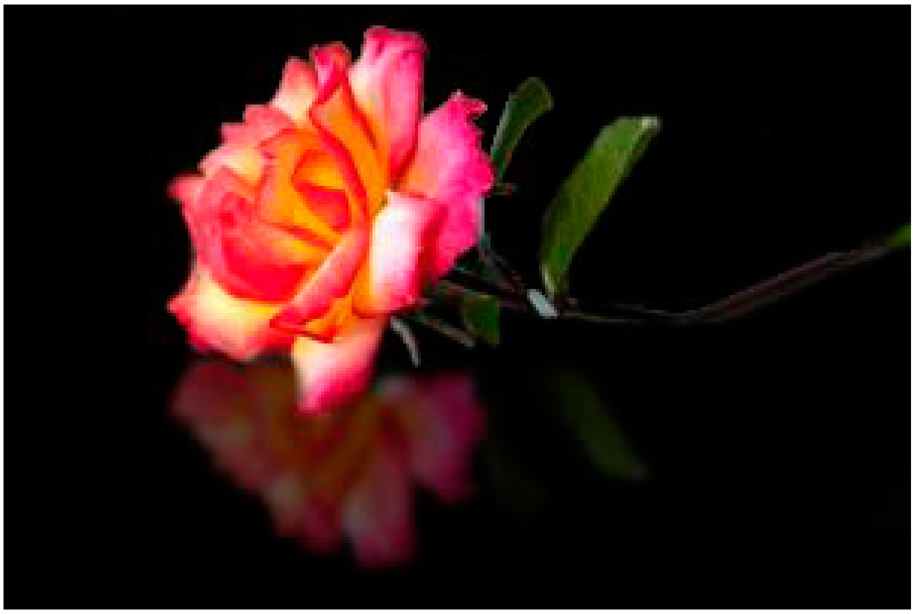


Table 1. *Major tools and functions*

Tool	Description and usage
	Rectangle select.
	Ellipse select
	Free select
	Fuzzy select
	Colour select
	Scissors select
	Foreground select
	Paths tool
	Colour picker
	Zoom
	Measure
	Move
	Alignment
	Crop
	Rotate
	Scale
	Shear
	Perspective
	Flip
	Cage transform
	Text
	Bucket fill
	Blend
	Pencil
	Paintbrush
	Eraser
	Airbrush
	Ink
	Clone
	Healing
	Perspective clone
	Blur / sharpen
	Smudge
	Dodge / burn
	Foreground / background colours
	Layers
	Tool options
	Brushes
	Patterns
	Gradients
	Channels
	Paths
	Undo history
	Configure tab

Table 2. *Details and credits*

Image	URL	Details and credits
Image 1	http://www.sxc.hu/photo/1436558	ROSE with BUD II Rose blossom and nearby bud in vibrant color hues. Uploaded by lance1

Resources

The Gimp website – *http://www.gimp.org*
Search Creative commons – *http://search.creativecommons.org*
Deviant art – *http://www.deviantart.com*
Stock.xchng – *http://www.sxc.hu*

In the next article

We will look at improving our reflected image and lighting, shade and dark.

ROB SOMERVILLE

Rob Somerville has been passionate about technology since his early teens. A keen advocate of open systems since the mid-eighties, he has worked in many corporate sectors including finance, automotive, airlines, government and media in a variety of roles from technical support, system administrator, developer, systems integrator and IT manager. He has moved on from CP/M and nixie tubes but keeps a soldering iron handy just in case.

a d v e r t i s e m e n t

better safe than sorry
www.demyo.com

Securing CentOS and Solaris 11 with Puppet

Puppet is system administration automation software from Puppet Labs (http://puppetlabs.com). It has gained a lot of popularity, and rivals other automation/orchestration software such as Chef and Ansible.

What you will learn…

- How security can be managed on CentOS and Solaris with Puppet.
- How to configure Puppet.
- How to deploy a set of security configurations to the hosts.

What you should know…

- Basic security knowledge.

In this article, I will detail how security can be managed on CentOS 6.x and Solaris 11.1 hosts with Puppet 3.x. Some familiarity with Puppet or some other automation software, as well as a Linux/UNIX system administrator audience, is assumed.

The topology being used for the examples given in this article is shown in Figure 1.

As you can see, centosa is the Puppet master. Four hosts will contact it for configuration, including itself. There are three CentOS hosts in total (`centos[a-c]`) and a single Solaris host (`sol11test`). We will start with server and agent installation, then move on to cover various Puppet configuration tasks, and develop our own security module to deploy a set of security configurations to the hosts.

Whilst this article has been written with CentOS 6.x and Solaris 11.1 in mind, the techniques utilised should translate to RHEL/OEL 6.x and Solaris 10 without many changes. In case of doubt, consult the relevant security guide for your operating system at *http://cisecurity.org*.

Server Installation

The Puppet server is installed on host centosa. Start by installing the latest repository RPM from *http://docs.puppetlabs.com/guides/puppetlabs_package_repositories.html#for-red-hat-enterprise-linux-and-derivatives.* At the time of writing, this was `puppetlabs-release-6-7.noarch.rpm`.

```
# rpm -ivh https://yum.puppetlabs.com/el/6/products/
   x86_64/puppetlabs-release-6-7.noarch.rpm
```

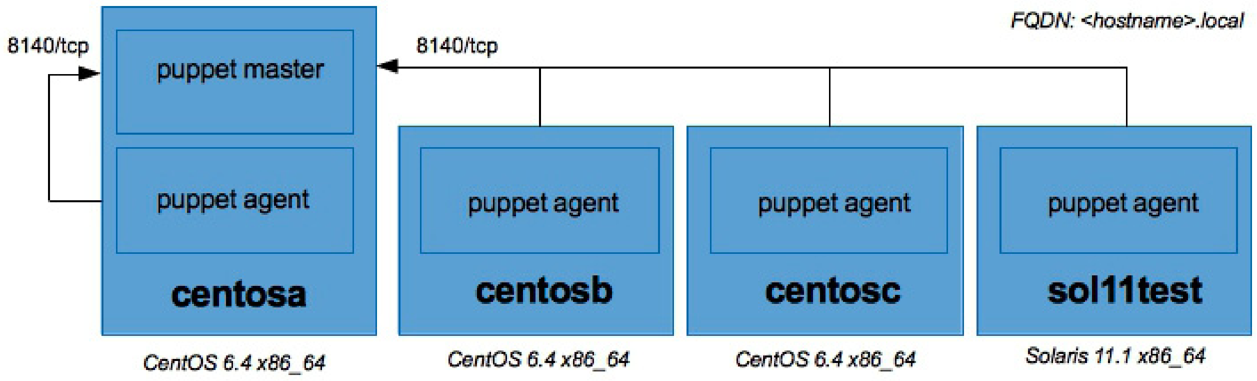


Figure 1. *Example Puppet topology*

Let's see what was just installed:

```
# rpm -ql puppetlabs-release
/etc/pki/rpm-gpg/RPM-GPG-KEY-puppetlabs
/etc/yum.repos.d/puppetlabs.repo
```

The appropriate repositories are enabled by default (check `/etc/yum.repos.d/puppetlabs.repo` for details):

```
[puppetlabs-products]
name=Puppet Labs Products El 6 - $basearch
baseurl=http://yum.puppetlabs.com/el/6/products/$basearch
gpgkey=file:///etc/pki/rpm-gpg/RPM-GPG-KEY-puppetlabs
enabled=1
gpgcheck=1
[puppetlabs-deps]
name=Puppet Labs Dependencies El 6 - $basearch
baseurl=http://yum.puppetlabs.com/el/6/
   dependencies/$basearch
gpgkey=file:///etc/pki/rpm-gpg/RPM-GPG-KEY-puppetlabs
enabled=1
gpgcheck=1
...
```

Next, install the Puppet server and agent packages, and their dependencies. This will install various required packages such as `ruby`, `facter`, `hiera`, and others.

```
# yum -y install puppet-server puppet
```

The packages installed on a minimal CentOS installation are as shown in Listing 1.

Once the packages are installed, the Puppet master can be started. We will use the init scripts supplied with the Puppet master to control the daemon, and `chkconfig` to have it run at the appropriate runlevels.

First, start the Puppet master service:

```
# service puppetmaster start
Starting puppetmaster:                           [  OK  ]
```

Next, use `chkconfig` to enable the service:

```
# chkconfig puppetmaster on
```

Confirm that the service is configured to start as intended:

Listing 1. *The Packages*

```
==========================================================================================
 Package                Arch        Version                 Repository              Size
==========================================================================================
Installing:
 puppet                 noarch      3.3.2-1.el6             puppetlabs-products    1.1 M
 puppet-server          noarch      3.3.2-1.el6             puppetlabs-products     23 k
Installing for dependencies:
 augeas-libs            x86_64      1.0.0-5.el6             base                   308 k
 compat-readline5       x86_64      5.2-17.1.el6            base                   130 k
 dmidecode              x86_64      1:2.11-2.el6            base                    71 k
 facter                 x86_64      1:1.7.3-1.el6           puppetlabs-products     85 k
 hiera                  noarch      1.3.0-1.el6             puppetlabs-products     23 k
 libselinux-ruby        x86_64      2.0.94-5.3.el6_4.1      base                    99 k
 pciutils               x86_64      3.1.10-2.el6            base                    85 k
 ruby                   x86_64      1.8.7.352-13.el6        updates                534 k
 ruby-augeas            x86_64      0.4.1-1.el6             puppetlabs-deps         21 k
 ruby-irb               x86_64      1.8.7.352-13.el6        updates                314 k
 ruby-libs              x86_64      1.8.7.352-13.el6        updates                1.6 M
 ruby-rdoc              x86_64      1.8.7.352-13.el6        updates                377 k
 ruby-rgen              noarch      0.6.5-1.el6             puppetlabs-deps         87 k
 ruby-shadow            x86_64      1.4.1-13.el6            puppetlabs-deps         11 k
 rubygem-json           x86_64      1.5.5-1.el6             puppetlabs-deps        763 k
 rubygems               noarch      1.3.7-5.el6             base                   207 k
 virt-what              x86_64      1.11-1.2.el6            base                    24 k
```

```
# chkconfig puppetmaster --list
puppetmaster    0:off   1:off   2:on    3:on    4:on
   5:on    6:off
```

Now we need to update the local firewall (`iptables` is enabled by default on a minimal CentOS install). The default ruleset is as follows:

```
# iptables -L -n --line-numbers
Chain INPUT (policy ACCEPT)
num  target     prot opt source               destination
1    ACCEPT     all  --  0.0.0.0/0            0.0.0.0/0
   state RELATED,ESTABLISHED
2    ACCEPT     icmp --  0.0.0.0/0            0.0.0.0/0
3    ACCEPT     all  --  0.0.0.0/0            0.0.0.0/0
4    ACCEPT     tcp  --  0.0.0.0/0            0.0.0.0/0
   state NEW tcp dpt:22
5    REJECT     all  --  0.0.0.0/0            0.0.0.0/0
   reject-with icmp-host-prohibited

Chain FORWARD (policy ACCEPT)
num  target     prot opt source               destination
1    REJECT     all  --  0.0.0.0/0            0.0.0.0/0
   reject-with icmp-host-prohibited

Chain OUTPUT (policy ACCEPT)
num  target     prot opt source               destination
```

All of my test hosts are on the 10.1.1.0/24 network, and the Puppet master listens on port 8140. I therefore insert the rule as follows:

```
# iptables -I INPUT 5 -m state --state NEW \
>    -p tcp --dport 8140 -s 10.1.1.0/24 -j ACCEPT
```

And verify:

```
# iptables -L -n --line-numbers
Chain INPUT (policy ACCEPT)
...
5    ACCEPT     tcp  --  10.1.1.0/24          0.0.0.0/0
   state NEW tcp dpt:8140
...
```

If the ruleset looks good, save it:

```
# service iptables save
iptables: Saving firewall rules to /etc/sysconfig/iptables:[OK]
```

From another host on the network, try using the `openssl s _ client` to connect to the Puppet master:

```
# openssl s_client -connect localhost:8140 -showcerts 2>&1
   </dev/null |\
>    egrep -i '(issuer|subject)'
subject=/CN=centosa.local
issuer=/CN=Puppet CA: centosa.local
```

All Puppet traffic is encrypted over SSL.

The Puppet server is now configured. We will use the common name shown above, `centosa.local`, in the `server` values in the `[agent]` section of `puppet.conf`, so take a note of yours. To avoid issues later on, this should match the FQDN of your host.

CentOS Agent Installation

On each server you wish to install the agent on (in our case, `centos{a,b,c}.local`), perform the following steps. Note that you don't need to reinstall the packages on your Puppet master as you already did them during the Server Installation phase above.

Install the repository RPM:

```
# rpm -ivh https://yum.puppetlabs.com/el/6/products/
   x86_64/puppetlabs-release-6-7.noarch.rpm
```

Next, install Puppet and all dependencies. There is no need to install the `puppet-server` package on the other client nodes.

```
# yum -y install puppet
```

Once complete, on all client nodes, update `/etc/puppet/puppet.conf`. Edit (or add if it doesn't exist) the `[agent]` section and add the following:

```
server = centosa.local
```

Change the value of the `server` variable to suit your environment. This should be the FQDN of the host, and should match the CN of your SSL certificate.

Next, a client certificate needs to be generated and signed by the Puppet master to authorize the addition of each node to the orchestration topology. Issue the `puppet agent` command with the `--test` option. `--test` includes many options useful for testing, including `--debug` and `--no-daemonize` and `--show_diff`.

```
# puppet agent --test
Info: Creating a new SSL key for centosb.local
Info: Caching certificate for ca
Info: Creating a new SSL certificate request for centosb.
   local
```

```
Info: Certificate Request fingerprint (SHA256): 5D:45:98:F1:
   3C:49:3A:A7:04:76:4D:96:FB:97:38:BB:FB:42:EB:65:EF:24:8
   4:AB:6C:FF:90:0C:29:C0:54:9F
Exiting; no certificate found and waitforcert is disabled
```

We didn't use `--waitforcert` (another option to `puppet agent`), so the agent will terminate after sending its CSR to the Puppet master for signing.

On the Puppet master, sign the outstanding request:

```
# puppet cert sign centosb.local
Notice: Signed certificate request for centosb.local
Notice: Removing file Puppet::SSL::CertificateRequest
   centosb.local at '/var/lib/puppet/ssl/ca/requests/
   centosb.local.pem'
```

And verify:

```
# puppet cert list --all
+ "centosa.local" (SHA256) E8:7C:E0:DF:6E:19:24:A1:35:
   09:9D:A4:93:60:BD:3A:CA:1C:B0:37:2C:32:3F:BF:5B:41:
   19:CD:4F:38:51:D9 (alt names: "DNS:centosa.local",
   "DNS:puppet", "DNS:puppet.local")
+ "centosb.local" (SHA256) 3D:13:8B:9C:F7:25:73:77:61:DC:4
   B:E1:10:04:B8:3A:C1:FD:21:F7:2F:B7:4C:AD:53:94:87:A4:E
   8:FF:0E:94
```

Listing 2. *Installation*

```
root@sol11test:~# pkgadd -d http://get.opencsw.org/now

## Downloading...
..............25%..............50%..............75%.....
   .........100%
## Download Complete

The following packages are available:
  1  CSWpkgutil     pkgutil - Installs Solaris packages
   easily
                    (all) 2.6.6,REV=2013.11.12

Select package(s) you wish to process (or 'all' to
   process
all packages). (default: all) [?,??,q]: all

Processing package instance <CSWpkgutil> from <http://
   get.opencsw.org/now>

pkgutil - Installs Solaris packages easily(all)
   2.6.6,REV=2013.11.12
Please see /opt/csw/share/doc/pkgutil/license for
   license information.
## Processing package information.
## Processing system information.
## Verifying package dependencies.
## Verifying disk space requirements.
## Checking for conflicts with packages already
   installed.
## Checking for setuid/setgid programs.

This package contains scripts which will be executed
   with super-user
permission during the process of installing this
   package.

Do you want to continue with the installation of
   <CSWpkgutil> [y,n,?] y

Installing pkgutil - Installs Solaris packages easily as
   <CSWpkgutil>

## Installing part 1 of 1.
/etc/opt/csw/pkgutil.conf.CSW
/etc/opt/csw <implied directory>
/opt/csw/bin/pkgutil
/opt/csw <implied directory>
/opt/csw/bin <implied directory>
/opt/csw/etc/pkgutil.conf.CSW
/opt/csw/etc <implied directory>
/opt/csw/libexec/pkgutil/wget-i386
/opt/csw/libexec/pkgutil/wget-sparc
/opt/csw/share/doc/pkgutil/license
/opt/csw/share/doc/pkgutil/readme
/opt/csw/share/man/man1/pkgutil.1
/opt/csw/var/pkgutil/admin.CSW
[ verifying class <none> ]
## Executing postinstall script.

Copying sample pkgutil.conf to /opt/csw/etc.
Copying sample pkgutil.conf to /etc/opt/csw.
Copying sample admin from /opt/csw/var/pkgutil to /var/
   opt/csw/pkgutil.
NOTE!
NOTE! Make sure to check out any changes in /etc/opt/
   csw/pkgutil.conf.CSW.
NOTE!

Installation of <CSWpkgutil> was successful.
```

Note above that a signed certificate already exists for `centosa.local`. It's also noteworthy that the certificate has alternate DNS names of `puppet` and `puppet.local` – so we could reference `centosa.local` by a CNAME of `puppet.local`, and update the `server` variable in `puppet.conf` appropriately. Repeat the process for all nodes. You should get a clean run once the certificate has been signed:

```
# puppet agent --test
Info: Caching certificate for centosc.local
Info: Caching certificate_revocation_list for ca
Info: Retrieving plugin
Info: Caching catalog for centosc.local
Info: Applying configuration version '1386191583'
Info: Creating state file /var/lib/puppet/state/state.yaml
Notice: Finished catalog run in 0.04 seconds
```

Solaris Agent Installation

The easiest way to install Puppet on Solaris is to obtain the packages from *http://OpenCSW.org*. OpenCSW uses a tool called **`pkgutil`** on top of the existing Solaris toolset to obtain, install and maintain OpenCSW packages. Start by installing the latest version of `CSWpkgutil`: Listing 2.

The first step is to configure `pkgutil` to use PGP cryptographic verification. Issue the following command to install the `CSWpki` package via `pkgutil`:

```
# pkgutil -y -i cswpki
```

Next, import the keys with `cswpki`:

```
# cswpki --import
Do you want to import the key used for: catalog signing
   2011-09?
Yes/No: Yes

Importing the key used for: catalog signing 2011-09

gpg: keyring `/var/opt/csw/pki//secring.gpg' created
gpg: keyring `/var/opt/csw/pki//pubring.gpg' created
gpg: /var/opt/csw/pki//trustdb.gpg: trustdb created
gpg: key 9306CC77: public key "OpenCSW catalog signing
   <board@opencsw.org>" imported
gpg: Total number processed: 1
gpg:               imported: 1
gpg: no ultimately trusted keys found


Do you want to import the key used for: legacy catalog
   verification?
Yes/No: Yes
Importing the key used for: legacy catalog verification

gpg: key E12E9D2F: public key "Distribution Manager <dm@
   blastwave.org>" imported
gpg: Total number processed: 1
gpg:               imported: 1
gpg: no ultimately trusted keys found
```

The current fingerprint is available at *http://www.opencsw.org/manual/for-administrators/getting-started.html*, and currently looks like this:

```
# gpg --homedir=/var/opt/csw/pki --fingerprint board@
   opencsw.org
pub   1024D/9306CC77 2011-08-31
      Key fingerprint = 4DCE 3C80 AAB2 CAB1 E60C  9A3C 05F4
   2D66 9306 CC77
uid                  OpenCSW catalog signing <board@
   opencsw.org>
sub   2048g/971EDE93 2011-08-31
```

With the key imported, edit `/etc/opt/csw/pkgutil.conf` and uncomment the following values, thus setting them to `true` from their defaults of `false`:

```
use_gpg=true
use_md5=true
```

Now, run a `pkgutil` catalog update. You should see the GPG verification taking place:

```
# pkgutil -U
=> Fetching new catalog and descriptions (http://mirror.
   opencsw.org/opencsw/testing/i386/5.11) if available ...
Checking integrity of /var/opt/csw/pkgutil/catalog.mirror.
   opencsw.org_opencsw_testing_i386_5.11 with gpg.
gpg: Signature made Wed Dec 18 10:43:20 2013 EST using DSA
   key ID 9306CC77
gpg: Good signature from "OpenCSW catalog signing <board@
   opencsw.org>"
gpg: WARNING: This key is not certified with a trusted
   signature!
gpg:          There is no indication that the signature
   belongs to the owner.
Primary key fingerprint: 4DCE 3C80 AAB2 CAB1 E60C  9A3C
   05F4 2D66 9306 CC77
==> 3807 packages loaded from /var/opt/csw/pkgutil/
   catalog.mirror.opencsw.org_opencsw_testing_i386_5.11
```

Now, we can search for the appropriate Puppet package using `pkgutil -a`:

```
# pkgutil -a puppet
common        package          catalog              size
puppet        CSWpuppet    2.7.21,REV=2013.03.15   709.8 KB
puppet3       CSWpuppet3  3.1.1,REV=2013.03.15    780.4 KB
puppetmaster  CSWpuppetmaster 2.7.21,REV=2013.03.15 3.4 KB
puppetmaster3 CSWpuppetmaster3  3.1.1,REV=2013.03.15 2.2 KB
```

As this is only a client, we will need the `puppet3` package, and any dependencies. `pkgutil` takes care of dependency resolution for us with respect to other *OpenCSW.org* packages. For the sake of convenience, at this point you should update your `$PATH` accordingly to find binaries under `/opt/csw/bin`:

```
# vi ~/.profile
...
export PATH=$PATH:/opt/csw/bin
...
# . .profile
# which pkgutil
/opt/csw/bin/pkgutil
```

Install the `puppet3` package and its dependencies:

```
# pkgutil -i -y puppet3
```

By default, an SMF service is created to run the Puppet agent daemonised. This is not something that we want – the updates will be run out of `cron` for more control and granularity (more on this later). For now, check the status of the service:

```
# svcs -xv cswpuppetd
svc:/network/cswpuppetd:default (?)
 State: online since November 26, 2013 08:44:35 AM EST
   See: /var/svc/log/network-cswpuppetd:default.log
Impact: None.
```

Disable it, thus stopping it also:

```
# svcadm disable svc:/network/cswpuppetd
```

Copy the supplied sample `puppet.conf` into place:

```
# cp /etc/puppet/puppet.conf.example-CSW /etc/puppet/puppet.conf
```

Update the `puppet.conf` `server` variable in the `[agent]` section as appropriate:

```
# vi /etc/puppet/puppet.conf
[agent]
...
   server = centosa.local
```

Try a test run; the certificate request will be sent to the Puppet master, and can be signed as shown in the CentOS instructions above.

```
# puppet agent --test
Info: Creating a new SSL key for sol11test.local
Info: Caching certificate for ca
Info: Creating a new SSL certificate request for sol11test.
   local
Info: Certificate Request fingerprint (SHA256): 96:B2:AB:E8:
   E7:6C:DE:98:DD:3F:AA:29:3C:B7:97:C4:FD:DB:41:0D:F7:04:B
   F:3D:03:41:D9:76:95:84:76:23
Exiting; failed to retrieve certificate and waitforcert is
   disabled
```

Once the certificate is signed, a clean run should be observed:

```
# puppet agent --test
Info: Caching certificate_revocation_list for ca
Info: Retrieving plugin
Notice: /File[/var/opt/csw/puppet/lib]/mode: mode changed
   '0750' to '0755'
Info: Caching catalog for sol11test.local
Info: Applying configuration version '1386191583'
Info: Creating state file /var/opt/csw/puppet/state/state.
   yaml
Notice: Finished catalog run in 0.05 seconds
```

A quick check of some of the `facter` variables on each type of host confirms that things are ready to go:

```
root@sol11test:~# facter operatingsystem
Solaris
root@sol11test:~# facter operatingsystemrelease
5.11
[root@centosa ~]# facter operatingsystem
CentOS
[root@centosa ~]# facter operatingsystemrelease
6.4
```

You can run **`facter -p`** to get a listing of all facts known to Puppet.

Puppet Configuration

The bulk of this article will now highlight some of the features of the Puppet configuration language, and how Puppet can be used to deploy security configuration to hosts.

Listing 3. */etc/puppet/manifests/site.pp*

```
# site.pp - puppetmaster base configuration
# configure centralised backups on the puppetmaster

filebucket { main:
  path => false,
  server => 'centosa.local'
}
File {
  backup => 'main',
  ignore => ['.svn', '.git']
}
import "nodes.pp"
```

Listing 4. */etc/puppet/manifests/nodes.pp*

```
# nodes.pp - base node configuration
# This file accomplishes two things. First, it
# forces the definition of nodes, and secondly
# it imports separate node files for each environment

node default {
  fail( "You must add a node definition for this host,
   not use the default" )
}

# node functionality broken out into separate files
import "nodes-test.pp"
```

Listing 5. */etc/puppet/manifests/nodes-test.pp*

```
# nodes-test.pp
# Node definition file for test nodes

# Puppetmaster
node "centosa.local" {
   include security
   include security::logging::server
}

# CentOS nodes
node "centosb.local", "centosc.local" {
   include security
   include security::logging::client
}

# Solaris nodes
node "sol11test.local" {
   include security
   include security::logging::client
}
```

Within an article there is an obvious limit to what can be covered, so the official Puppet documentation at *http://docs.puppetlabs.com/references/latest* should be consulted for authoritative information, as well as the appropriate security benchmarks for your operating system.

Before starting, it's worth looking at the directory structure of the Puppet master installation. There are two subdirectories under `/etc/puppet` of note – `manifests` which contains Puppet manifests, and `modules` which contains Puppet modules. Each module is within its own subdirectory, e.g. `/etc/puppet/modules/foomodule`. Beneath the module subdirectory are three more directories – `files` (contains files you wish to serve to clients), `manifests` (manifests that comprise the module) and `templates` (any ERB templates your module uses). The entry point manifest is, by default, `/etc/puppet/manifests/site.pp`. Other subdirectories may exist under `/etc/puppet` if other features are being used (for example, `hiera`). Start by configuring `site.pp`. In this file, include any site-wide defaults. `/etc/puppet/manifests/site.pp` is shown in Listing 3.

A few things to notice about this example. Centralised backups to the Puppet master are configured using the `filebucket` type with name `main` and a server of **`centosa.local`** – our Puppet master. A default `File` object is then created causing all file modifications across all manifests and modules to be backed up to the filebucket `main`. `.svn` and `.git` files are ignored. We then go on to include `nodes.pp` via an `import` statement. The node declarations could go into `site.pp`, but we want to break things down for manageability and maintainability. `nodes.pp` is shown in Listing 4.

Using this format, you could import `nodes-www.pp`, `nodes-mysql.pp`, `nodes-oracle.pp` and so on. Each of these files will contain actual node definitions.

Listing 5 presents `nodes-test.pp`, the node definition file for our test hosts.

As you can see, three node definitions are present. Within these statements are included which will call the classes of configuration that will be applied. The first matches hostname `centosa.local` and includes two classes – the security base class (`/etc/puppet/modules/security/manifests/init.pp` – which we will meet again later), and the `security::logging::server` class. The second definition matches two CentOS nodes – `centosb.local` and **`centosc.local`**. We could also have used a regular expression to match these. The third declaration is for the Solaris 11 node. Both of these definitions include the base security class and the `security::logging::client` class.

The various classes that comprise the configuration of the nodes is defined in a Puppet module called `security`. Puppet looks for modules in `/etc/puppet/modules` by default.

Listing 6. */etc/puppet/modules/security/manifests/init.pp*

```
# class: security
# This is the base security class and acts as a
# wrapper around the various sub-classes.

class security {
  include security::base::files
  include security::services
  include security::tcpwrappers
  include security::kerneltuning
  include security::networktuning
  include security::sshd
  # Operating system specific
  case $::operatingsystem {
    'CentOS' : {
      security::base::filesystem { '/home' : fs => '/
   home' }
      security::base::filesystem { '/tmp' : fs => '/tmp'
   }
      security::base::filesystem { '/var/tmp' : fs => '/
   var/tmp' }
      security::base::filesystem { '/dev/shm' : fs => '/
   dev/shm' }
      include security::selinux
    }
    'Solaris' : {
      include security::coreadm
      include security::strong_iss
      include security::routeadm
    }
    default : { fail( 'OS is unsupported by security
   class' ) }
  }
}
```

Listing 7. */etc/puppet/modules/security/manifests/base/files.pp*

```
# class security::base::files
# Copy several base files to each node - current
# - /etc/issue
# - /etc/motd (created from template)
# - /etc/cron.* or /etc/cron.d/* depending on OS

class security::base::files {
  case $::operatingsystem {
    'CentOS' : {
      file { '/etc/motd' :
        ensure => 'present',
        owner  => 'root',
        group  => 'root',
        mode   => '0644',
        content => template( 'security/motd.erb' )
      }
      file { '/etc/issue' :
        ensure => 'present',
        owner  => 'root',
        group  => 'root',
        mode   => '0644',
        source => 'puppet:///modules/security/etc/issue'
      }
      file { '/etc/cron.allow' :
        ensure => 'present',
        owner  => 'root',
        group  => 'root',
        mode   => '0644',
        source => 'puppet:///modules/security/etc/cron.
allow'
      }
      file { '/etc/cron.deny' :
        ensure => 'present',
        owner  => 'root',
        group  => 'root',
        mode   => '0644',
        source => 'puppet:///modules/security/etc/cron.
deny'
      }
      file { '/etc/at.allow' :
        ensure => 'present',
        owner  => 'root',
        group  => 'root',
        mode   => '0644',
        source => 'puppet:///modules/security/etc/
at.allow'
      }
      file { '/etc/at.deny' :
        ensure => 'present',
        owner  => 'root',
        group  => 'root',
        mode   => '0644',
        source => 'puppet:///modules/security/etc/
at.deny'
      }
    }
    'Solaris' : {
      file { '/etc/motd' :
        ensure => 'present',
        owner  => 'root',
        group  => 'sys',
        mode   => '0644',
        content => template( 'security/motd.erb' )
      }
      file { '/etc/issue' :
        ensure => 'present',
        owner  => 'root',
        group  => 'root',
        mode   => '0640',
        source => 'puppet:///modules/security/etc/
   issue'
      }
      file { '/etc/cron.d/cron.allow' :
        ensure => 'present',
        owner  => 'root',
        group  => 'sys',
        mode   => '0644',
        source => 'puppet:///modules/security/etc/
   cron.d/cron.allow'
      }
      file { '/etc/cron.d/cron.deny' :
        ensure => 'present',
        owner  => 'root',
        group  => 'sys',
        mode   => '0644',
        source => 'puppet:///modules/security/etc/
   cron.d/cron.deny'
      }
      file { '/etc/cron.d/at.allow' :
        ensure => 'present',
        owner  => 'root',
        group  => 'sys',
        mode   => '0644',
        source => 'puppet:///modules/security/etc/
   cron.d/at.allow'
      }
      file { '/etc/cron.d/at.deny' :
        ensure => 'present',
        owner  => 'root',
        group  => 'sys',
        mode   => '0644',
        source => 'puppet:///modules/security/etc/
   cron.d/at.deny'
      }
    }
    default : { fail( 'OS not supported by the
   security::base::files class' ) }
  }
}
```

Creating a module first requires the appropriate directory structure to be in place.

```
# mkdir -p /etc/puppet/modules/security/
   {files,manifests,templates}
```

When the bare module name is included, as is the case in our example above (`include security`), there should be an `init.pp` file at `/etc/puppet/modules/<modulename>/manifests/init.pp` containing the corresponding class (in our case, this would be a definition of the `security` class).

Let's take a look at `init.pp` for the security module in Listing 6. There is a lot going on here. `init.pp` is merely a wrapper class in this case, farming off the work to various worker classes. The first six calls (include `security::base::files` through to include `security::sshd`) are applied to all hosts. Then, a `case` statement evaluates the `operatingsystem` **`facter`** variable. Facter is installed as a Puppet prerequisite and enables Puppet to query the host for "facts" about its configuration. One such variable is `operatingsystem`, and this and other top-level variables can be accessed via the `$::<variable_name>` syntax.

Depending on whether `$::operatingsystem` evaluates to CentOS or Solaris will dictate what further action is taken. You can see that in the CentOS case, there are four calls to the defined type `security::base::filesystem`, and the inclusion of the `security::selinux` class. For Solaris, three additional classes are included. The `default` case would be evaluated should the `$::operatingsystem` variable contain some other value. The first included class is `security::base::files`. Let's take a look at the class in Listing 7. It can be found at `/etc/puppet/modules/security/manifests/base/files.pp`. Note that the subdirectory `base` has been created and this matches the class name (using `::` as a path separator).

Again, the content of the `$::operatingsystem` variable is evaluated and the appropriate `file` types are defined. Let's break down a couple of the entries. First, `/etc/issue`. On a CentOS host, the configuration applied is as follows:

```
file { '/etc/issue' :
  ensure => 'present',
  owner  => 'root',
  group  => 'root',
  mode   => '0644',
  source => 'puppet:///modules/security/etc/issue'
}
```

Here, the file `/etc/issue` will be created if it doesn't exist (we `ensure` that it's `present`), and the owner will be set to `root`, the group to `root`, and the permissions to 0644. The source of the file is on the Puppet master at `puppet:///modules/security/etc/issue` (which corresponds to a physical file path of `/etc/puppet/modules/security/files/etc/issue`). There are many more configuration attributes for the `file` type; consult the type reference (*http://docs.puppetlabs.com/references/latest/type.html*) for further detail.

Another type of entry is shown below, making use of ERB templates, here for Solaris hosts:

```
file { '/etc/motd' :
  ensure => 'present',
  owner  => 'root',
```

Listing 8. */etc/puppet/modules/security/manifests/services.pp*

```
# class: security::services
# Takes care of ensuring unneeded services are
# not running and are disabled

class security::services {
  case $::operatingsystem {
    'CentOS' : {
      # services netconsole, rdisc and saslauthd are
   shipped
      # disabled with CentOS 6.x minimal, let's keep
   them that
      # way
      service { 'netconsole' :
        enable => false,
        ensure => stopped
      }
      service { 'rdisc' :
        enable => false,
        ensure => stopped
      }
      service { 'saslauthd' :
        enable => false,
        ensure => stopped
      }
    }
    'Solaris' : {
      # GDM not fully installed on a text-mode
   installation of
      # Solaris 11, so we can comment it here to save
   puppet
      # complaining about an unmanageable service state
      # service { 'svc:/application/graphical-login/gdm'
   :
      #   enable => false,
      #   ensure => stopped
      # }
       service { 'svc:/network/rpc/keyserv' :
         enable => false,
         ensure => stopped
       }
       service { 'svc:/network/nis/server' :
         enable => false,
         ensure => stopped
       }
       service { 'svc:/network/nis/domain' :
         enable => false,
         ensure => stopped
       }
       service { 'svc:/network/nis/client' :
         enable => false,
         ensure => stopped
       }
       service { 'svc:/network/security/ktkt_warn' :
         enable => false,
         ensure => stopped
       }
       service { 'svc:/network/rpc/gss' :
         enable => false,
         ensure => stopped
       }
       service { 'svc:/system/filesystem/rmvolmgr' :
         enable => false,
         ensure => stopped
       }
       service { 'svc:/network/rpc/smserver' :
         enable => false,
         ensure => stopped
       }
       service { 'svc:/network/http:apache22' :
         enable => false,
         ensure => stopped
       }
       service { 'svc:/network/telnet' :
         enable => false,
         ensure => stopped
       }
    }
    default : {
      fail( 'OS unsupported by security::services class'
   )
    }
  }
}
```

```
      group   => 'sys',
      mode    => '0644',
      content => template( 'security/motd.erb' )
    }
```

As you can see, the `security/motd.erb` template is being used to populate the file (the `content` attribute). The physical path to the file is `/etc/puppet/modules/security/templates/motd.erb`. Here is the ERB file:

```
Welcome to <%= fqdn %>.
Authorised users only. All activity may be monitored and
   reported.
```

`fqdn` is a `facter` variable, but we could equally reference any variable that's defined in the appropriate scope, for example in the calling class.

A more complete example using ERB templates to configure Apache `VirtualHosts` can be found on my website (*http://www.tokiwinter.com/puppet-module-apache2-virtualhost-templates*). We can now look at the next class – `security::services` – in Listing 8.

This class takes care of stopping any unnecessary services, and disabling them via whatever OS-specific mechanism is required (which Puppet hides from us, whether the provider is `init.d` scripts or SMF, we have a consistent interface via the service type).

The next class, `security::tcpwrappers`, is quite complex. It uses Hiera to look up variable values in a hierarchical database, in our case stored as plain text in YAML format. Hiera used to be an additional tool, but has been integrated fully with Puppet since version 3.0. Let's start with the class definition – take note of the positional parameters `$hostsallow` and `$hostsdeny`. These two variables will be populated via a Hiera lookup. Since version 3.x, automatic parameter lookup in Hiera is enabled by default (see *http://docs.puppetlabs.com/hiera/1/puppet.html#automatic-parameter-lookup* for more details).

Listing 9. */etc/puppet/modules/security/manifests/tcpwrappers.pp*

```
# class security::tcpwrappers
# Set up tcpwrappers on Solaris and CentOS hosts

class security::tcpwrappers ( $hostsallow = "",
    $hostsdeny = "" ) {
  file { '/etc/hosts.allow' :
    owner  => 'root',
    group  => 'root',
    mode   => '0644',
    source => $hostsallow
  }
  file { '/etc/hosts.deny' :
    owner  => 'root',
    group  => 'root',
    mode   => '0644',
    source => $hostsdeny
  }
  case $::operatingsystem {
    'CentOS' : {
      # nothing else to do, files are in place
    }
    'Solaris' : {
      # set up inetd-controlled services for tcp_
   wrappers
      exec { '/usr/sbin/inetadm -M tcp_wrappers=TRUE' :
        unless => '/usr/sbin/inetadm -p | /bin/grep tcp_
   wrappers=TRUE'
      }
      # enable TCP wrappers for RPC portmapping service
      exec { '/usr/sbin/svccfg -s svc:/network/rpc/bind
   setprop config/enable_tcpwrappers=true' :
        unless => '/usr/sbin/svccfg -s svc:/network/rpc/
   bind listprop config/enable_tcpwrappers | /bin/grep
   true',
        notify => Service['svc:/network/rpc/bind']
      }
      # need the service defined here so we can notify it
      service { 'svc:/network/rpc/bind' :
        ensure => running,
        enable => true
      }
    }
    default : { fail( 'OS unsupported by security::tcp_
   wrappers class' ) }
  }
}
```

Listing 10. */etc/puppet/hiera.yaml*

```
---
:backends:
   - yaml
:yaml:
   :datadir: /etc/puppet/hieradata
:hierarchy:
   - %{::clientcert}
   - %{::operatingsystem}
   - common
```

Therefore, the values of `security::tcpwrappers::hostsallow` and `security::tcpwrappers::hostsdeny` will be looked up in Hiera.

The Hiera configuration is defined on the Puppet master at `/etc/puppet/hiera.yaml` as a plain text YAML file. Its contents are shown in Listing 10.

So that the `hiera` command-line utility works as expected, remove the installed `/etc/hiera.yaml` and symlink:

```
# rm -f /etc/hiera.yaml
# ln -s /etc/puppet/hiera.yaml /etc
```

The Hiera configuration above does several important things. Firstly, it defines the available `:backends:` – here we use the `yaml` backend. The `:datadir:` of `/etc/puppet/hieradata` for the `:yaml:` files is defined next, followed by the `:hierarchy:` we wish to use. Our `:hierarchy:` is as follows:

```
:hierarchy:
   - %{::clientcert}
   - %{::operatingsystem}
   - common
```

First, the `clientcert` **`facter`** variable is checked, which will return the common name of the client certificate – generally the fully-qualified domain name of the host. If the file `/etc/puppet/hieradata/%{::clientcert}.yaml` exists, the `security::tcpwrappers::hostsallow` and `security::tcpwrappers::hostsdeny` variables looked up within them. If that file doesn't exist, the `operatingsystem` variable is checked. If `/etc/puppet/hieradata/%{::operatingsystem}.yaml` exists, the variables are looked up there, and finally the catch all – if the granular tests fail, `common.yaml` will be used.

The contents of the YAML files are as follows:

```
# cat centosa.local.yaml
---
security::tcpwrappers::hostsallow: "puppet:///modules/
   security/etc/hosts.allow-centosa.local"
security::tcpwrappers::hostsdeny: "puppet:///modules/
   security/etc/hosts.deny-centosa.local"
# cat common.yaml
---
security::tcpwrappers::hostsallow: "puppet:///modules/
   security/etc/hosts.allow-common"
security::tcpwrappers::hostsdeny: "puppet:///modules/
   security/etc/hosts.deny-common"
# cat Solaris.yaml
---
```

```
security::tcpwrappers::hostsallow: "puppet:///modules/
   security/etc/hosts.allow-solaris"
security::tcpwrappers::hostsdeny: "puppet:///modules/
   security/etc/hosts.deny-solaris"
```

Host `centosa.local` would use `centosa.local.yaml` (due to `%{::clientcert}` in the hierarchy) and pull the values in for `security::tcpwrappers::hostsallow` and `security::tcpwrappers::hostsdeny` from that file. Host **`centosb.local`** would fall through to `common.yaml` (unless there was a `%{::clientcert}.yaml` or `CentOS.yaml`), and a Solaris host would use `Solaris.yaml`. Looking back at the `security::tcpwrappers` class, you can see that this substitution occurs during class instantiation as positional parameters:

```
class security::tcpwrappers ( $hostsallow = "", $hostsdeny
   = "" ) {
...
```

These variables are then referenced in the file type definitions:

```
    source => $hostsallow
```

These variables will contain the output of the `hiera` lookup and thus the source attribute will reference the correct

Listing 11. */etc/puppet/modules/security/manifests/ipadm.pp*

```
# defined type: security::ipadm
# Use ipadm to check the value of an ipadm-controlled
   variable
# and update it if required.
#
# Parameters:
#  - $variable => the ipadm variable we want to check/
   change
#  - $co       => should be set to "current"
#  - $protocol => the protocol (ip, tcp, etc.)
#  - $value    => the value to check and/or set

define security::ipadm( $variable = '', $co = '',
   $protocol = '', $value = '' ) {
  exec { "/usr/sbin/ipadm set-prop -p
   ${variable}=${value} ${protocol}" :
    unless => "/usr/sbin/ipadm show-prop -p ${variable}
   -co ${co} ${protocol} | /bin/grep '^${value}$'"
  }
}
```

Listing 12. */etc/puppet/modules/security/manifests/kerneltuning.pp*

```
# class: security::kerneltuning
# Updates the following files:
# CentOS
#  - /etc/security/limits.conf
#  - /etc/sysctl.conf (and calls sysctl -p if required)
# Solaris
#  - /etc/system

class security::kerneltuning {
  case $::operatingsystem {
    'CentOS' : {
      file { "/etc/security/limits.conf" :
        ensure => 'present',
        owner  => 'root',
        group  => 'root',
        mode   => '0644',
        source => 'puppet:///modules/security/etc/
security/limits.conf'
      }
      file { "/etc/sysctl.conf" :
        ensure => 'present',
        owner  => 'root',
        group  => 'root',
        mode   => '0644',
        source => 'puppet:///modules/security/etc/
sysctl.conf'
      }
      exec { "/sbin/sysctl -e -p" :
        refreshonly => 'true',
        subscribe => File["/etc/sysctl.conf"]
      }
    }
    'Solaris' : {
      file { "/etc/system" :
        ensure => 'present',
        owner  => 'root',
        group  => 'sys',
        mode   => '0644',
        source => 'puppet:///modules/security/etc/
system'
      }
    }
    default : { fail( 'OS unsupported by
security::kerneltuning class' ) }
  }
}
```

version of the file for the node we are deploying to. After the files are deployed as appropriate, Solaris has some additional checks and/or configuration performed. First, `inetadm -p` is checked for `tcp_wrappers=TRUE` to verify whether **`inetd`**-controlled services are configured to use TCP Wrappers. If not set to TRUE, `inetadm -M` is used to update the configuration. Next, TCP Wrappers is enabled for the RPC portmapping service if it isn't already via a call to **`svccfg`**. The `service` type definition is required to give us something to notify from the `exec`. Defined types are pieces of code you want to call repeatedly with different parameters, akin to functions. `security::ipadm` is a defined type to check and set properties on Solaris hosts with **`ipadm`**. Its contents are shown in Listing 11.

This can then be called from classes. The commented documentation in the listing explains each of the parameters. They default to empty, which would cause the commands to syntax error. You should add checks that sanitise input via conditionals. We will call this a defined type in later manifests.

Next, we deploy kernel tuning changes – again the file is well commented. On Solaris, a change to `/etc/system`

Listing 13. */etc/puppet/modules/security/manifests/networktuning.pp*

```
# class: security::networktuning
# Configure Solaris IP stack via ipadm
# Requires the security::ipadm defined type.

class security::networktuning {
  case $::operatingsystem {
    'CentOS' : {
      # On CentOS, this is all taken care of in
    kerneltuning.pp
    }
    'Solaris' : {
      security::ipadm{ '_respond_to_timestamp' :
        variable => '_respond_to_timestamp', co =>
    'current', protocol => 'ip', value => '0' }
      security::ipadm{ '_forward_directed_broadcasts' :
        variable => '_forward_directed_broadcasts', co
    => 'current', protocol => 'ip', value => '0' }
      security::ipadm{ '_respond_to_timestamp_broadcast'
    :
        variable => '_respond_to_timestamp_broadcast',
    co => 'current', protocol => 'ip', value => '0' }
      security::ipadm{ '_respond_to_address_mask_
    broadcast' :
        variable => '_respond_to_address_mask_broadcast',
    co => 'current', protocol => 'ip', value => '0' }
      security::ipadm{ '_respond_to_echo_broadcast' :
        variable => '_respond_to_echo_broadcast', co =>
    'current', protocol => 'ip', value => '0' }
    }
    default : { fail( 'OS unsupported by
    security::kerneltuning class' ) }
  }
}
```

Listing 14. */etc/puppet/modules/security/manifests/sshd.pp*

```
class security::sshd {
  case $::operatingsystem {
    'CentOS' : {
      package { [ 'openssh', 'openssh-clients',
    'openssh-server' ] :
        ensure => 'latest'
      }
      file { '/etc/ssh/sshd_config' :
        owner  => 'root',
        group  => 'root',
        mode   => '0600',
        source => 'puppet:///modules/security/etc/ssh/
    sshd_config-centos',
        require => Package[ "openssh-server" ],
        notify => Service[ "sshd" ]
      }
      service { 'sshd' :
        require => File[ "/etc/ssh/sshd_config" ],
        ensure => 'running',
        enable => 'true'
      }
    }
    'Solaris' : {
      file { '/etc/ssh/sshd_config' :
        owner  => 'root',
        group  => 'sys',
        mode   => '0644',
        source => 'puppet:///modules/security/etc/ssh/
    sshd_config-solaris',
        notify => Service[ "svc:/network/ssh" ]
      }
      service { 'svc:/network/ssh' :
        enable => 'true',
        ensure => 'running'
      }
    }
  }
}
```

requires a reboot – obviously we don't orchestrate that ... For suggested values for these files, see my previous articles published in PenTest Magazine on Securing the Linux and Solaris 11 Operating Systems.

All is very straightforward in the above class. Files are copied for both hosts, and on CentOS, the `sysctl -p` command is run only if the `/etc/sysctl.conf` file changes (`refreshonly=true` makes the `exec` respond to events, and for that we use a file subscription to `/etc/sysctl.conf`). `security::networktuning` is the next class, and it shows how the `security::ipadm` defined type can be called: Listing 12 and Listing 13.

Listing 15. */etc/puppet/modules/security/manifests/base/filesystem.pp*

```
# Defined type: security::base::filesystem
# Parameters
#  - $fs => Filesystem to check/modify

define security::base::filesystem ( $fs = '' ) {
  case $::operatingsystem {
    'CentOS' : { }
    default : { fail( 'OS not supported by the
   security::base::filesystem class' ) }
  }
  if $fs == '' {
    fail( 'No FS passed' )
  } else {
    case $fs {
      '/tmp', '/var/tmp', '/dev/shm' : {
        case $fs {
          '/tmp' : { $lv = "\/dev\/mapper\/vg_sys-lv_
   tmp" }
          '/var/tmp' : { $lv = "\/dev\/mapper\/vg_
   sys-lv_var_tmp" }
          '/dev/shm' : { $lv = "tmpfs" }
          default : { fail( "$fs not implemented in
   security::base::filesystem" ) }
        }
        $mountopts = "noexec,nosuid,nodev"
        exec { "/bin/sed -i '/^$lv/ s/defaults/
   defaults,$mountopts/' /etc/fstab" :
          unless => "/bin/grep '^$lv[[:space:]].*default
   s,$mountopts' /etc/fstab"
        }
        $mountcommand = "/bin/mount -o
   remount,$mountopts $fs"
        exec { "$mountcommand" :
          unless => "/bin/grep
   '^$lv[[:space:]].*$mountopts' /etc/mtab"
        }
      }
      '/home' : {
        $mountopts = "nodev"
        $lv = '\/dev\/mapper\/vg_sys-lv_home'
        exec { "/bin/sed -i '/^$lv/ s/defaults/
   defaults,$mountopts/' /etc/fstab" :
          unless => "/bin/grep '^$lv[[:space:]].*default
   s,$mountopts' /etc/fstab"
        }
        $mountcommand = "/bin/mount -o remount,$mountopts
   $fs"
        exec { "$mountcommand" :
          unless => "/bin/grep
   '^$lv[[:space:]].*$mountopts' /etc/mtab"
        }
      }
      default : {
       fail( 'FS not supported by security::base::filesystem' )
      }
    }
  }
}
```

Listing 16. */etc/puppet/modules/security/manifests/selinux.pp*

```
# class: security::selinux
# Ensure SELinux is configured and enforcing

class security::selinux {
  case $::operatingsystem {
    'CentOS' : {
      file { '/etc/selinux/config' :
        owner  => 'root',
        group  => 'root',
        mode   => '0644',
        source => 'puppet:///modules/security/etc/
   selinux/config'
      }
      exec { '/usr/sbin/setenforce Enforcing' :
        unless =>'/usr/sbin/getenforce | /bin/grep
   Enforcing'
      }
    }
    default : { fail( 'OS unsupported by
   security::selinux class' ) }
  }
}
```

Listing 17. */etc/puppet/modules/security/manifests/coreadm.pp*

```
# class: security::coreadm
# Ensure core dumps are disabled on Solaris hosts

class security::coreadm {
  case $::operatingsystem {
    'Solaris' : {
      exec { '/usr/bin/coreadm -d global -d process -d
   global-setid -d proc-setid -d log' :
         onlyif => '/usr/bin/coreadm | /bin/grep enabled'
      }
    }
    default : { fail( 'OS unsupported by
   security::coreadm class' ) }
  }
}
```

Listing 18. */etc/puppet/modules/security/manifests/coreadm.pp*

```
# class: security::routeadm
# Ensure routing is disabled on our Solaris hosts - we
# don't use them for routing

class security::routeadm {
  case $::operatingsystem {
    'Solaris' : {
      exec { '/usr/sbin/routeadm -d ipv4-routing -d
   ipv6-routing -d ipv4-forwarding -d ipv6-forwarding; /
   usr/sbin/routeadm -u' :
         onlyif => '/usr/sbin/routeadm -p | /bin/grep
   enabled'
      }
    }
    default : { fail( 'OS unsupported by
   security::coreadm class' ) }
  }
}
```

Listing 19. */etc/puppet/modules/security/manifests/strong_iss.pp*

```
# class: security::strong_iss
# Enforce strong TCP initial sequence number generation

class security::strong_iss {
  case $::operatingsystem {
    'Solaris' : {
      file { "/etc/default/inetinit" :
         ensure => 'present',
         owner  => 'root',
         group  => 'sys',
         mode   => '0644',
         source => 'puppet:///modules/security/etc/
   default/inetinit'
      }
      security::ipadm{ "strong_iss" : variable => '_
   strong_iss', co => 'current', protocol => 'tcp',
   value => '2' }
    }
    default : { fail( 'OS unsupported by
   security::coreadm class' ) }
  }
}
```

Listing 20. *Running the Puppet Agent*

```
# puppet agent --test
Info: Retrieving plugin
Info: Caching catalog for centosa.local
Info: Applying configuration version '1387232042'
Notice: /File[/etc/ssh/sshd_config]/content:
--- /etc/ssh/sshd_config   2013-12-05 21:29:51.886986435
   +1100
+++ /tmp/puppet-file20131217-48343-1hbek4h-0       2013-
   12-17 09:15:08.874975252 +1100
@@ -128,7 +128,7 @@
 #ChrootDirectory none

 # no default banner path
-#Banner none
+Banner /etc/issue

 # override default of no subsystems
 Subsystem   sftp   /usr/libexec/openssh/sftp-server

Info: /File[/etc/ssh/sshd_config]: Filebucketed /
   etc/ssh/sshd_config to main with sum
   226c398f540ca2322ffa01e4cf2c3646
Notice: /File[/etc/ssh/sshd_config]/content: content
   changed '{md5}226c398f540ca2322ffa01e4cf2c3646' to
   '{md5}29a87b64a0f815035a8bde658bc01504'
Info: /File[/etc/ssh/sshd_config]: Scheduling refresh of
   Service[sshd]
Notice: /Stage[main]/Security::Sshd/Service[sshd]:
   Triggered 'refresh' from 1 events
Notice: /File[/var/syslog]/seltype: seltype changed
   'var_log_t' to 'var_t'
Notice: /Stage[main]/Security::Logging::Server/Exec[/
   usr/bin/chcon --reference=/var/log /var/syslog]/
   returns: executed successfully
Notice: Finished catalog run in 41.36 seconds
```

`security::sshd` is shown in Listing 14. On CentOS hosts, it checks that the appropriate packages are installed and up-to-date. For both OSes, it then copies an appropriate `sshd_config` into place, before enabling and starting the service. If the configuration file is changed, the service is notified and refreshed. Going back to `init.pp`, we have now discussed all of the OS-generic classes. Next, the OS-specific classes are considered:

```
case $::operatingsystem {
  'CentOS' : {
    security::base::filesystem { '/home' : fs => '/home' }
    security::base::filesystem { '/tmp' : fs => '/tmp' }
    security::base::filesystem { '/var/tmp' : fs => '/
 var/tmp' }
    security::base::filesystem { '/dev/shm' : fs => '/
 dev/shm' }
    include security::selinux
  }
  'Solaris' : {
    include security::coreadm
    include security::strong_iss
    include security::routeadm
  }
```

You'll note another defined type – `security::base::filesystem`. It is shown in Listing 15. This code will ensure that appropriate secure mount options are used in both `/etc/fstab`, and for any current live mounts via a call to `mount -o remount` where necessary. The final CentOS specific class is `security::selinux`, which checks that SELinux is configured and enforcing. It is shown in Listing 16. There are three final classes to discuss – the Solaris-specific classes. The first two, `security::coreadm` (Listing 17) and `security::routeadm` (Listing 18) are very straightforward. They check whether core dumps and routing are enabled, respectively, and disable the functionality if it is. You may need to adjust this to suit your purposes and site policy. The final class, `security::strong_tss` is shown in Listing 19. You'll note it calls the `security::ipadm` defined type. This has only scratched the surface of what Puppet can achieve and I encourage you to read the documentation as it really is very good.

Running the Puppet Agent

Now that all the configuration is in place, the Puppet agent can be run:

```
# puppet agent --test
```

You'll see a lot of changes take place. For the sake of brevity, here is a brief excerpt from a run: Listing 20.

Run again and you should have a clean run as the configuration is up-to-date. You can daemonise the Puppet agent, however I prefer to run out of `cron`. You can provide granular timing via `cron`, and control which hosts fetch their configuration at which times to balance load. I prefer to run `puppet agent --test` and have that output to a log file which is then managed by `logrotate` so that we have logs of verbose agent output. You may need to adjust this to suit your needs. Add a cron job for root such as the following:

```
06,36 * * * * /path/to/puppet agent --test >>/var/log/
   puppet.log 2>&1
```

This would run the agent at 06 and 36 past the hour, outputting both STDOUT and STDERR to `/var/log/puppet.log`. You can then manage this log via **`logrotate`**. Read the manual page for `logrotate.conf` for details.

As a final noteworthy point, you can view a log file of all HTTP requests made to the server by checking the masterhttp log, which is located at `/var/log/puppet/masterhttp.log` by default.

Conclusion

This has only scratched the surface of what Puppet can do. There are further examples of Puppet modules and configuration on my website, as well as articles on adding robustness to your Puppet master (replacing the built-in webserver with Apache and Passenger), and integrating Puppet with a git workflow. This article does not cover all security aspects of hardening CentOS and Solaris hosts. It serves as a guide to show you the power of Puppet, and set you writing your own modules and custom defined types.

TOKI WINTER

Toki Winter is an experienced UNIX/Linux System Administrator with over a decade of experience managing large enterprises and running many thousands of services. His website, http://www.tokiwinter.com, contains many useful articles, HOWTOs and tips for the advanced UNIX administrator.

NET OPEN SERVICES IS AN APPLICATION HOSTING COMPANY FOCUSED ON OPEN SOURCE APPLICATIONS MANAGEMENT IN HIGH AVAILABILITY ENVIRONMENT.

NET OPEN SERVICES IS PROUD TO PROVIDE A HIGH QUALITY SERVICE TO OUR CUSTOMERS SINCE 10 YEARS.

OUR EXPERTISE INCLUDES:

- **CLOUD COMPUTING, PUBLIC, PRIVATE AND HYBRID CLOUD MANAGEMENT (OPENSTACK, CLOUDSTACK, RED HAT ENTERPRISE VIRTUALIZATION)**
- **REMOTE MONITORING AND MANAGEMENT 24/7**
- **NETWORKING AND SECURITY (OPEN BSD, IP TABLE, CHECKPOINT, CISCO,...)**
- **OS AND APPLICATION MANAGEMENT (FREE BSD, OPEN BSD, SOLARIS, UNIX, LINUX, AIX, MS WINDOWS)**
- **DATABASE MANAGEMENT (ORACLE, MYSQL, CASSANDRA, NOSQL, MS SQL, SYBASE...)**
- **MANAGED HOSTING IN CARRIER CLASS DATA CENTERS**
- **DISASTER RECOVERY**

Net Open SERVICES

WE PROVIDE SERVICES IN EVERY STEP OF THE PROJECT LIFE, DESIGN, DEPLOYMENT, MANAGEMENT AND EVOLUTIONS. **NETOPENSERVICES** TEAM INCLUDES EXPERIENCED LEADERS AND ENGINEERS IN THE INTERNET SERVER INDUSTRY.

OUR TEAM HAS **15 YEARS OF EXPERIENCE** IN DEVELOPING INTERNET INFRASTRUCTURE-GRADE SOLUTIONS AND PROVISIONING INTERNET DATACENTERS AND GLOBAL SERVICE NETWORKS TOGETHER.

WE OFFER EXCEPTIONAL HARDWARE SUPPORT AS SOFTWARE SUPPORT ON UNIX/LINUX AND OPEN SOURCE APPLICATION. **NETOPENSERVICES** DELIVERS THESE CUSTOM-BUILT LINUX AND UNIX SERVERS, AS WELL AS PRECONFIGURED SERVERS AND SCALABLE STORAGE SOLUTIONS, TO OUR CUSTOMERS. WE ALSO OFFER CUSTOM DEVELOPMENT AND ADVANCED-LEVEL UNIX/LINUX CONSULTING SOLUTIONS.

WWW.NETOPENSERVICES.COM • CONTACT@NETOPENSERVICES.COM

User, Group and Password Management on Linux and Solaris

This article will cover the user, group and password management tools available on the Linux and Solaris Operating Systems. The specific versions covered here are CentOS 6.4 and Solaris 11.1, though the commands will transfer to many other distributions without modifications (especially RHEL and its clones), or with slight alterations to command options. Check your system documentation and manual pages for further information.

What you will learn…

- How to manage users effectively and securely

What you should know…

- Basic Unix knowledge.

Knowing how to manage users effectively and securely is a requirement of financial standards such as PCI-DSS, and information security management systems such as ISO 27001.

In this article, I will consider local users and groups – coverage of naming services such as NIS and LDAP is beyond its scope but may be covered in a future article. This article also presumes some prior basic system administration exposure with a UNIX-like operating system.

Users and Groups

Users and groups make up a fundamental part of any multi-user operating system. On UNIX and Linux systems, every user has a UID (User ID) and a primary GID (Group ID). Users can own files, use resources and execute processes. The System Administrator can grant access to resources and data based upon the UID of the user, as well as the groups a user is a member of. Some additional features such as RBAC in Solaris take things a step further and allow very fine-grained control of what a user can and cannot do/access. The OS takes care of mapping usernames and group names to UIDs and GIDs and vice versa by using a naming service, such as file-based (described next), LDAP or NIS.

Using the standard file-based naming service, the main user database is `/etc/passwd`. The group database is at `/etc/group`, and the shadow password file at `/etc/shadow`. Linux systems also have a group shadow database at `/etc/gshadow`.

```
# ls -l /etc/passwd /etc/shadow
-rw-r--r--. 1 root root 958 Dec  3 01:29 /etc/passwd
----------. 1 root root 736 Dec  3 01:29 /etc/shadow
# ls -l /etc/group /etc/gshadow
-rw-r--r--. 1 root root 471 Dec  3 01:29 /etc/group
----------. 1 root root 383 Dec  3 01:29 /etc/gshadow
```

Why do we need a shadow password file? `/etc/passwd` needs to be readable by every user on the system, as some applications depend on being able to map UIDs to usernames (`ls`, for example) and thus need to be able to read the password database. Therefore, the encoded password is moved to the `/etc/shadow` file, which need only be readable by `root`. Commands such as `/usr/bin/passwd` are SUID (Set UID) root so they can be executed by normal users with `root` privileges, thus being able to update the shadow file.

```
# ls -l /usr/bin/passwd
-rwsr-xr-x. 1 root root 30768 Feb 22  2012 /usr/bin/passwd
```

UIDs and GIDs can be duplicated, but it is bad practice, as it makes auditing harder and could lead to data being revealed inadvertently.

Let's start by taking a look at the format of the various password database files.

`/etc/passwd`

The format of this file is:

```
username:x:uid:gid:GECOS:home:shell
```

The first field contains the user's username. The second field contains an "x" which indicates that the shadow password suite is in use. The third is the UID, which, as discussed, should be unique. The fourth is the users' primary group's GID. The fifth field is known as the GECOS field, after the GE operating system of the same name, and typically contains the user's full name, and perhaps other identifying information; this is the only field in the file that may contain a space. The sixth field is the user's home directory – an absolute path. The final field is the absolute path to the user's login shell – which should be specified in `/etc/shells` on a Linux system. Solaris doesn't use `/etc/shells`.

```
# cat /etc/redhat-release
CentOS release 6.4 (Final)
# cat /etc/shells
/bin/sh
/bin/bash
/sbin/nologin
/bin/dash

# cat /etc/release
                             Oracle Solaris 11.1 X86
  Copyright (c) 1983, 2012, Oracle and/or its affiliates.
   All rights reserved.
                           Assembled 19 September 2012
# cat /etc/shells
cat: cannot open /etc/shells: No such file or directory
```

Let's look at a sample entry from `/etc/passwd`:

```
# fgrep "toki" /etc/passwd
toki:x:333:333:Toki Winter:/home/toki:/bin/bash
```

Here, we can see that my username is `toki`, shadow password is in use, UID is 333, GID is 333, my GECOS information is my full name, my home directory is `/home/toki` and my login shell is `/bin/bash`.

`/etc/shadow`

The format of this file is:

```
username:encoded_password:last_changed:mindays:maxdays:war
   n:inactive:expire:reserved
```

The first field is the username and should correspond to an entry in `/etc/passwd`. The encoded password comes next. `last _ changed` is the number of days after Jan 1, 1970 that the password was last changed – set to 0 it will force a user to change their password upon next login. `mindays` is the minimum password age, which is the number of days the user will have to wait before they will be allowed to change their password again. `maxdays` is the maximum password age, which is the number of days after which the user will have to change their password. `warn` is the password warning period, which is the number of days before a password is going to expire during which the user should be warned. `inactive` is the password inactivity period – the number of days after a password has expired during which the password will still be accepted. `expire` is the account expiration date – the date of expiration of the account, expressed as the number of days since Jan 1, 1970. The final field is reserved for future use. On an out-of-the-box CentOS install, many fields are empty when users are added via `useradd` without additional password ageing options:

```
# fgrep toki /etc/shadow
toki:encoded_password_here:16041:0:99999:7:::
```

The minimum password age above is 0, which means there are no restrictions in place. On a Solaris system, even more fields are empty:

```
# fgrep toki /etc/shadow
toki:encoded_password_here::::::
```

Again, this is default behaviour that we will learn to configure over the course of this article.

```
/etc/group
```

The format of the file is:

```
group_name:passwd:GID:user_list
```

`group _ name` is the name of the group. `passwd` is the encoded group password. The Solaris manual page for `group(4)` states "Group passwords are antiquated and not often used." The GID is the numerical group ID, and the `user _ list` is a comma-separated list of group members. There could also be users having this group as their primary GID (i.e. the GID specified in `/etc/passwd`), in which case they wouldn't need to appear in `user _ list`. Here are two entries from `/etc/group` on a CentOS machine:

```
# fgrep "toki" /etc/group
wheel:x:10:toki
toki:x:333:
```

and here are two from a Solaris 11 machine:

```
# fgrep "sys" /etc/group
sys::3:root,bin,adm
sysadmin::14:
```

On a Solaris machine, the `passwd` field is empty for all groups out-of-the-box. On a Linux machine, it contains an "x" indicating that the group shadow file is in use. See `man 5 gshadow` for more information on the group shadow file (`/etc/gshadow`), but its format is:

```
username:encoded_password:administrators:members
```

As you can see, I'm a member of the `wheel` group on this machine:

```
# fgrep toki /etc/gshadow
wheel:::toki
toki:!::
```

The user administration tools and group administration tools will take care of updating these files for us, and keeping `/etc/shadow` in sync with `/etc/passwd`, and `/etc/gshadow` with `/etc/group`.

Adding Users

Let's start by taking a look at how the two OSes create users using all default and no additional arguments other than the required username. On CentOS:

```
# useradd testuser1
# fgrep testuser1: /etc/passwd
testuser1:x:334:334::/home/testuser1:/bin/bash
# fgrep testuser1: /etc/group
testuser1:x:334:
```

It took the next available UID on my system, and applied sensible defaults to the other parameters (a home of `/home/<username>`, shell of `/bin/bash`). It also created a group, and set it to be the primary group of the new user. This new-group-per-user policy can be found on all RHEL-derivatives. On Solaris, the behaviour is slightly different:

```
# useradd tstusr01
# fgrep tstusr01 /etc/passwd
tstusr01:x:102:10::/export/home/tstusr01:/usr/bin/bash
# fgrep tstusr01 /etc/group
```

As you can see, the home directories and shell path are different (and are appropriate for this OS) but the account is just added to a group called staff:

```
# awk -F: '$3 == 10 { print $0 }' /etc/group
staff::10:
```

On CentOS, you will note that the user's home directory has been created, the contents of `/etc/skel` copied in, and then appropriate ownership and permissions configured. `/etc/skel` is a good way to push site-wide configuration files out to all new accounts. As an example, here are the contents of `/etc/skel` on a CentOS system. A mail spool file has also been created:

```
# ls -lA /etc/skel
total 12
-rw-r--r--. 1 root root  18 Feb 22  2013 .bash_logout
-rw-r--r--. 1 root root 176 Feb 22  2013 .bash_profile
-rw-r--r--. 1 root root 124 Feb 22  2013 .bashrc
# ls -lA /home/testuser1
total 12
-rw-r--r--. 1 testuser1 testuser1  18 Feb 22  2013 .bash_logout
-rw-r--r--. 1 testuser1 testuser1 176 Feb 22  2013 .bash_profile
-rw-r--r--. 1 testuser1 testuser1 124 Feb 22  2013 .bashrc
# ls -ld /home/testuser1
drwx------. 2 testuser1 testuser1 4096 Dec  4 05:39 /home/
   testuser1
# ls -l /var/spool/mail/testuser1
-rw-rw----. 1 testuser1 mail 0 Dec  4 05:39 /var/spool/
   mail/testuser1
```

On Solaris, by default, the user's home directory is not created, and the contents of `/etc/skel` are not, therefore, copied in. We can either do this manually after running `useradd`, or instead use options available to the `useradd` command to create the user. We can use the `-m` option to cause the home directory to be created, and the -d option to explicitly define the home directory location. We then observe the files being copied in from `/etc/skel`:

```
# useradd -m -d /export/home/tstusr02 tstusr02
80 blocks
# ls -lA /export/home/tstusr02
total 11
-r--r--r--   1 tstusr02 staff    159 Nov 25 11:09 .bashrc
-rw-r--r--   1 tstusr02 staff    568 Nov 25 11:09 .profile
-rw-r--r--   1 tstusr02 staff    166 Nov 25 11:09 local.cshrc
-rw-r--r--   1 tstusr02 staff    170 Nov 25 11:09 local.login
-rw-r--r--   1 tstusr02 staff    131 Nov 25 11:09 local.profile
# ls -lA /etc/skel
total 11
-r--r--r--   1 root    bin   159 Sep 20  2012 .bashrc
-rw-r--r--   1 root   other  568 Sep 20  2012 .profile
-rw-r--r--   1 root    sys   166 Sep 20  2012 local.cshrc
-rw-r--r--   1 root    sys   170 Sep 20  2012 local.login
-rw-r--r--   1 root    sys   131 Sep 20  2012 local.profile
```

The `useradd` command is very rich in terms of options and customisation. The following command adds a user `jsmith` with UID 450, a primary group of `wheel`, a home directory of `/users/jsmith`, and a login shell of **`zsh`**:

```
# useradd -m -d /users/jsmith -u 450 \
>       -g wheel -c "John Smith" -s /bin/zsh jsmith
```

These options can be used to override defaults. All user additions should be logged, and whether that is by using the auditing features available with your operating system, or some other logging process, will depend on your needs.

Defaults

When configuring new user accounts with **`useradd`**, there are some defaults that are used. On a CentOS system, these are by default read from `/etc/login.defs`. Here are the variables in use on a default CentOS 6.4 installation, which will need to be tuned according to the needs of your site or organisation, and any security policies in effect. There are other variables in the file, and the manual page should be consulted for further information. The file itself is also very well commented.

```
# grep '^[^#]' /etc/login.defs
MAIL_DIR  /var/spool/mail
PASS_MAX_DAYS99999
PASS_MIN_DAYS0
PASS_MIN_LEN  5
PASS_WARN_AGE7
UID_MIN            500
UID_MAX          60000
GID_MIN            500
GID_MAX          60000
CREATE_HOME   yes
UMASK           077
USERGROUPS_ENAB yes
ENCRYPT_METHOD SHA512
```

The defined variables are as follows:

- `MAIL _ DIR` – The directory where mailboxes reside.
- `PASS _ MAX _ DAYS` – Maximum number of days a password may be used.
- `PASS _ MIN _ DAYS` – Minimum number of days allowed between password changes (0 to disable).
- `PASS _ MIN _ LEN` – Minimum acceptable password length.
- `PASS _ WARN _ AGE` – Number of days warning given before a password expires.
- `UID _ MIN/MAX` – Min/max values for automatic UID selection in useradd.
- `GID _ MIN/MAX` – Min/max values for automatic GID selection in groupadd.
- `USERDEL _ CMD` – Commented by default. Can be used to set up a customised local userdel, to remove `at/cron/`print jobs, etc.
- `CREATE _ HOME` – Set to yes if useradd should create home directories for users by default.
- `UMASK` – Permission mask to be used.
- `USERGROUPS _ ENAB` – This enables userdel to remove user groups if no members exist.
- `ENCRYPT _ METHOD` – Encryption method used to encrypt passwords – we use SHA512.

User Modification

The `usermod` command is used to modify user accounts. The options are similar to those supplied by the **`useradd`** command.

For example, to move the home directory for user `tstusr02` from `/export/home/tstusr02` to `/users/tstusr02`, we could issue the following command:

```
# usermod -m -d /users/tstusr02 tstusr02
```

To change the UID for the `sometest` user to 1234 we'd issue:

```
# usermod -u 1234 sometest
```

Add the user `toki` to an additional secondary group (-a for "append" – not available on Solaris):

```
# usermod -a -G sysadmin toki
```

User Deletion

Users can be deleted using the `userdel` command. There is an `-r` option that will remove the user's home directory. It is advised that accounts are not deleted, rather just locked (see the Locking Accounts section of this article). This provides auditing capabilities, and stops UID reuse (and inadvertently giving access to an old user's files to a new user). To delete user `toki` from the system, including removal of the user's home directory:

```
# userdel -r toki
```

Group Administration

Groups are administered with the `groupadd`, `groupmod` and `groupdel` commands. To add a new group `tstgrp` to the system, with GID 250, issue:

```
# groupadd -g 250 tstgrp
```

To change the name of `tstgrp` to `testgrp`:

```
# groupmod -n testgrp tstgrp
```

To remove a group:

```
# groupdel testgrp
```

Password Management

Passwords are managed with the `passwd` command. An initial password can be set for a user (or a password reset) via:

```
# passwd <username>
```

A user may reset his own password with a simple:

```
$ passwd
```

which will then prompt them for the old password, followed by the new password, followed by the new password again to verify. `root` can change passwords without being prompted for the old password.

The `passwd` command can also be used to lock accounts (see the Locking Accounts section below).

Password Defaults

On Solaris, `/etc/default/passwd` can be used to configure password-complexity enforcement. Out of the box, the `/etc/default/passwd` file contains the following defined variables:

```
# grep '^[^#]' /etc/default/passwd
MAXWEEKS=
MINWEEKS=
PASSLENGTH=6
```

And the following commented variables:

```
# grep '^#[A-Z]' /etc/default/passwd
#NAMECHECK=NO
#HISTORY=0
#MINDIFF=3
#MINALPHA=2
#MINNONALPHA=1
#MINUPPER=0
#MINLOWER=0
#MAXREPEATS=0
#MINSPECIAL=0
#MINDIGIT=0
#WHITESPACE=YES
#DICTIONLIST=
#DICTIONDBDIR=/var/passwd
```

These values can be modified according to your site's security policy and affect the way that the `passwd` command works, and how it enforces password complexity and reuse. Again, the `/etc/default/passwd` file is well commented and the variable names themselves are self-explanatory.

Locking Accounts

The `passwd` command is used to lock accounts on both Linux and Solaris. To lock the password for `tstusr01` on Solaris:

```
# passwd -l tstusr01
Password information changed for tstusr01
```

Looking at `/etc/shadow`, you'll see that the string `*LK*` has been prepended to the encrypted password field in the second field:

```
# fgrep tstusr01 /etc/shadow
tstusr01:*LK*<encrypted password>:16034::::::4320
```

Doing the same on CentOS 6.4 for user `testuser1`:

```
# passwd -l testuser1
Locking password for user testuser1.
passwd: Success
# fgrep testuser1 /etc/shadow
testuser1:!!<encrypted password>:16043:0:99999:7:::
```

You can see that `!!` has been prepended. To unlock the account on Solaris, use `passwd -u`:

```
# passwd -u tstusr01
passwd: password information changed for tstusr01
# fgrep tstusr01 /etc/shadow
tstusr01:<encrypted password>:16034::::::4768
```

The same applies to Linux:

```
# passwd -u testuser1
Unlocking password for user testuser1.
passwd: Success
# fgrep testuser1 /etc/shadow
testuser1:<encrypted password>:16043:0:99999:7:::
```

Configuring Password Ageing

In the following example, I'll bring everything together. A group called `testusrs` with members `test01` and `test02` will be created, and various operations performed with respect to password configuration.

We'll start with Solaris. Create the group, followed by the two users:

```
# groupadd -g 1010 testgrp
# useradd -m -d /export/home/test01 -s /bin/bash \
>    -c "Test User 01" -u 1010 -g testgrp test01
80 blocks
# useradd -m -d /export/home/test02 -s /bin/bash \
>    -c "Test User 02" -u 1011 -g testgrp test02
80 blocks
```

Set an initial password on the two accounts:

```
# passwd test01
New Password:
Re-enter new Password:
passwd: password successfully changed for test01
# passwd test02
New Password:
Re-enter new Password:
passwd: password successfully changed for test02
```

Next, use `passwd -f` to force the users to change their passwords at login time:

```
# passwd -f test01
# passwd -f test02
```

Let's implement some password ageing controls. Suppose the site-wide password policy is as follows:

- The minimum number of days required between password changes is 7
- The maximum number of days the password is valid for is 28
- The user will receive warnings 7 days before expiry
- Passwords will be 8 characters or more long
- A history of 5 passwords will be kept and prevented from reuse

To do this, edit `/etc/default/password` and update the following variables:

```
# vi /etc/default/password
# grep '^[^#]' /etc/default/passwd
MAXWEEKS=1
MINWEEKS=4
PASSLENGTH=8
HISTORY=5
```

And update any already existing user accounts:

```
# passwd -n 7 -x 28 -w 7 test01
passwd: password information changed for test01
# passwd -n 7 -x 28 -w 7 test02
passwd: password information changed for test02
```

Looking at `/etc/shadow` we can see the password ageing fields updated:

```
# grep '^test0[12]:' /etc/shadow
test01:<encrypted password>:16034:7:28:7:::4976
test02:<encrypted password>:16034:7:28:7:::4976
```

Let's perform the same steps on a CentOS system. Start with the group and user creation:

```
# groupadd -g 1010 testgrp
# useradd -m -d /home/test01 -s /bin/bash \
>    -c "Test User 01" -u 1010 -g testgrp test01
# useradd -m -d /home/test02 -s /bin/bash \
>    -c "Test User 02" -u 1011 -g testgrp test02
```

Set the initial passwords:

```
# passwd test01
```

```
Changing password for user test01.
New password:
Retype new password:

passwd: all authentication tokens updated successfully.
# passwd test02
Changing password for user test02.
New password:
Retype new password:
passwd: all authentication tokens updated successfully.
```

On Linux, password ageing is the domain of the `chage` command. Setting the number of days since January 1st, 1970 when the password was last changed to 0 has the same effect as `passwd -f` on Solaris.

```
# chage -d 0 test01
# chage -d 0 test02
```

To configure the same password ageing policy as the Solaris example, use `chage` as follows:

```
# chage -m 7 -M 28 -W 7 test01
# chage -m 7 -M 28 -W 7 test02
# grep '^test0[12]:' /etc/shadow
test01:<encrypted password>:0:7:28:7:::
test02:<encrypted password>:0:7:28:7:::
```

The defaults for new user accounts can be changed in `/etc/login.defs`:

```
PASS_MAX_DAYS   28
PASS_MIN_DAYS   7
PASS_MIN_LEN    8
PASS_WARN_AGE   7
```

Here we also see the `PASS_MIN_LEN` option, which has been increased to 8 as per the Solaris example.

To implement the equivalent of `HISTORY=5` on Solaris, PAM (Pluggable Authentication Module) configuration must take place.

Edit `/etc/pam.d/system-auth-ac` and update the following line:

```
password    sufficient    pam_unix.so sha512 shadow nullok
   try_first_pass use_authtok
```

Append `remember=5` to the line:

```
password    sufficient    pam_unix.so sha512 shadow nullok
   try_first_pass use_authtok remember=5
```

Now, if a user attempts to reuse a recent password, they'll see a message such as the following:

```
$ passwd
Changing password for user toki.
Changing password for toki.
(current) UNIX password:
New password:
Retype new password:
Password has been already used. Choose another.
passwd: Authentication token manipulation error
```

This will create the file `/etc/security/opasswd` to track the password history of all system users.

Further configuration akin to `/etc/default/passwd` on Solaris can be configured via pam_cracklib.

```
# fgrep pam_cracklib /etc/pam.d/system-auth-ac
password    requisite     pam_cracklib.so try_first_pass
   retry=3 type=
# man 8 pam_cracklib
```

You can read more via the section 8 manual page on `pam_cracklib`.

Logging

Linux does a very good job at logging via the `authpriv` syslog facility – for example, there will be messages in `/var/log/secure` such as:

```
Dec  4 16:13:39 centosb groupadd[8177]: group added to /
   etc/group: name=testgrp, GID=1010
Dec  4 16:13:39 centosb groupadd[8177]: group added to /
   etc/gshadow: name=testgrp
Dec  4 16:13:39 centosb groupadd[8177]: new group:
   name=testgrp, GID=1010
Dec  4 16:13:55 centosb useradd[8183]: new user:
   name=test01, UID=1010, GID=1010, home=/h
ome/test01, shell=/bin/bash
Dec  4 16:14:05 centosb useradd[8189]: new user:
   name=test02, UID=1011, GID=1010, home=/h
ome/test02, shell=/bin/bash
Dec  4 16:14:42 centosb passwd: pam_
   unix(passwd:chauthtok): password changed for test01
Dec  4 16:14:49 centosb passwd: pam_
   unix(passwd:chauthtok): password changed for test02
Dec  4 16:17:50 centosb chage[8255]: changed password
   expiry for test01
Dec  4 16:17:51 centosb chage[8258]: changed password
   expiry for test02
Dec  4 16:30:38 centosb chage[8282]: changed password
```

```
   expiry for test01
Dec  4 16:30:39 centosb chage[8285]: changed password
   expiry for test02
```

This makes for an excellent audit trail (as long as logs are regularly rotated and backed up, of course).

The Solaris audit tool does not currently log these actions (even via the audit daemon, but it will log password changes), but simple wrapper scripts could be written around the existing tools to perform appropriate logging.

Other Tools

Solaris provides the `logins` command which displays a variety of information on currently configured user accounts. An example:

```
# logins -xo
root:0:root:0:Super-User:/root:/usr/bin/
   bash:PS:112413:-1:-1:-1
daemon:1:other:1::/:/usr/sbin/sh:NL:082587:-1:-1:-1
bin:2:bin:2::/usr/bin:/usr/sbin/sh:NL:082587:-1:-1:-1
sys:3:sys:3::/:/usr/sbin/sh:NL:082587:-1:-1:-1
adm:4:adm:4:Admin:/var/adm:/usr/sbin/sh:NL:082587:-1:-1:-1
uucp:5:uucp:5:uucp Admin:/usr/lib/uucp:/usr/sbin/
   sh:NL:082587:-1:-1:-1
nuucp:9:nuucp:9:uucp Admin:/var/spool/uucppublic:/usr/lib/
   uucp/uucico:NL:082587:-1:-1:-1
dladm:15:netadm:65:Datalink Admin:/:/usr/sbin/
   sh:LK:000000:-1:-1:-1
netadm:16:netadm:65:Network Admin:/:/usr/sbin/
   sh:LK:000000:-1:-1:-1
```

More information (including password expiration fields) can be added with `-a`. Other reports can also be generated, such as logins with duplicate UIDs (the `-d` option). Another very useful option is the `-m` option which acts like the `groups` command and displays all groups that the user (specified with the `-l` option) is a member of:

```
# logins -m -l root
root            0       root            0       Super-User
                        other           1
                        bin             2
                        sys             3
                        adm             4
                        uucp            5
                        mail            6
                        tty             7
                        lp              8
                        nuucp           9
                        daemon          12
```

Security Considerations

User access should also be limited with regards to system access and service availability. For example, we can limit access to `cron` and `at` by using `/etc/{cron,at}.{allow,deny}` files. By default, all users have access to **cron** and **at**. This may or may not be what you want. From a security standpoint, all users should be denied access by default. Therefore, have an empty `/etc/cron.deny` and `/etc/at.deny`, and a single line in `/etc/cron.allow` and `/etc/at.allow` of `root`. Then, grant access as necessary by appending usernames to the files. For example, if you enable system profiling via `sa1` and `sa2` on Solaris, you'll need to add `sys` to the `*.allow` files.

Remote SSH access to the system can be managed via the `AllowUsers` parameter, amongst others. From `sshd_config(5)`:

```
     AllowUsers
             This keyword can be followed by a list of
   user name patterns, sepa-
             rated by spaces.  If specified, login is
   allowed only for user names
             that match one of the patterns.  Only user
   names are valid; a numer-
             ical user ID is not recognized.  By default,
   login is allowed for
             all users.  If the pattern takes the form
   USER@HOST then USER and
             HOST are separately checked, restricting
   logins to particular users
             from particular hosts.  The allow/deny
   directives are processed in
             the following order: DenyUsers, AllowUsers,
   DenyGroups, and finally
             AllowGroups.
```

`/etc/security/access.conf` is another access control mechanism on RHEL-derivatives and other distributions. An excerpt from the well-commented example:

```
# User "john" should get access from ipv6 net/mask
#+ : john : 2001:4ca0:0:101::/64
#
# All other users should be denied to get access from all
   sources.
#- : ALL : ALL
```

Simple `<flag>:<username or groupname>:<ip_address>` ACLs can be defined in this way, although it could become cumbersome to manage for large sites. Remember that you'll need to ensure that `pam_access.so` is required in any files under /etc/pam.d as appropriate if you do decide to use pam _ access.

On CentOS, we can also configure /etc/security/limits.conf, and limit the following resources to specific users or groups:

```
#        - core - limits the core file size (KB)
#        - data - max data size (KB)
#        - fsize - maximum filesize (KB)
#       - memlock - max locked-in-memory address space (KB)
#        - nofile - max number of open files
#        - rss - max resident set size (KB)
#        - stack - max stack size (KB)
#        - cpu - max CPU time (MIN)
#        - nproc - max number of processes
#        - as - address space limit (KB)
#        - maxlogins - max number of logins for this user
#        - maxsyslogins - max number of logins on the
   system
#        - priority - the priority to run user process
   with
#        - locks - max number of file locks the user can
   hold
#        - sigpending - max number of pending signals
#        - msgqueue - max memory used by POSIX message
   queues (bytes)
#        - nice - max nice priority allowed to raise to
   values: [-20, 19]
#        - rtprio - max realtime priority
```

The format of entries in this file are:

```
#<domain>      <type>  <item>         <value>
#
#*               soft    core            0
#*               hard    rss             10000
#@student        hard    nproc           20
#@faculty        soft    nproc           20
#@faculty        hard    nproc           50
#ftp             hard    nproc           0
#@student        -       maxlogins       4
```

These restrictions will also affect what users can do with invocations of ulimit, when hard limits are imposed. For example, to limit test01 to having a soft limit of 20 processes, and a hard limit of 30, we can add the following to limits.conf (or a separate file under /etc/security/limits.d):

```
test01    soft   nproc     20
test01    hard   nproc     30
```

As test01, we can see the new restrictions in place:

```
[test01@centoshost ~]$ ulimit -Su
20
[test01@centoshost ~]$ ulimit -Hu
30
```

pam _ tally2.so can be used to keep a tally of failed logins per-account, and deny access once the number reaches a certain value. Add the following to /etc/pam.d/login and /etc/pam.d/sshd

```
auth     required       pam_tally2.so deny=4 unlock_
   time=1200
```

This would deny access to an account after 4 bad attempts, but will allow access again after 1200 seconds. The tally information is written to /var/log/tallylog. The pam _ tally2 command is used to administer the tallied accounts. For example, suppose user toki was denied access. First, check the tally:

```
# pam_tally2 --user toki
Login           Failures Latest failure     From
toki                7    12/04/13 18:25:36  localhost
```

Once verified that these failures are not caused by malicious means, unlock the account by resetting the tally:

```
# pam_tally2 --user toki --reset
Login           Failures Latest failure     From
toki                7    12/04/13 18:25:36  localhost
# pam_tally2 --user toki
Login           Failures Latest failure     From
toki                0
```

pam _ faillock.so also provides similar functionality.

Privileges

Rather than giving everyone the root password, which is obviously an extremely poor security practice, if elevated privileges are required, sudo should be configured. Sudo is installed by default on both CentOS 6.4 and Solaris 11.1 and provides a mechanism to define ACLs as to which users and groups can perform privileged actions on a server, with or without passwords. Again, the default file is very well commented, for example from /etc/sudoers:

```
## Allows people in group wheel to run all commands
# %wheel  ALL=(ALL) ALL
```

```
## Same thing without a password
# %wheel  ALL=(ALL) NOPASSWD: ALL

## Allows members of the users group to mount and unmount
   the
## cdrom as root
# %users  ALL=/sbin/mount /mnt/cdrom, /sbin/umount /mnt/
   cdrom

## Allows members of the users group to shutdown this
   system
# %users  localhost=/sbin/shutdown -h now
```

You should use the **`visudo`** command to edit the `/etc/sudoers` file, as it performs sanity checks before saving the file and possibly corrupting the live `sudoers` file if there are errors in your syntax.

If there is an insistence on sharing a root password, then the number of people knowing that password should be limited. All access to the root account should be made via **`su`** and not via direct root login, which should be limited to the system console only. This will provide logging and an audit trail.

Conclusion

This article has described some of the major aspects of user, group and password management on the CentOS 6.4 and Solaris 11.1 Operating Systems. User account management is a complex subject, so only the core aspects have been covered. The manual pages and system documentation should be consulted for further information.

ABOUT THE AUTHOR

Toki Winter is an experienced UNIX/Linux System Administrator with over a decade of experience managing large enterprises and running many thousands of services. His website, http://www.tokiwinter.com, contains many useful articles, HOWTOs and tips for the advanced UNIX administrator.

Interview with Peter N. M. Hansteen

Peter N. M. Hansteen is a consultant, writer and sysadmin from Bergen, Norway. A longtime freenix advocate and during recent years a frequent lecturer and tutor with emphasis on FreeBSD and OpenBSD, author of several articles and The Book of PF (No Starch Press 2007, 2nd edition November 2010). He writes a frequently slashdotted blog at http://bsdly.blogspot.com/.

How did you get your start in the information security field?

Peter N.M. Hansteen: I'll risk sounding a little blunt here, and say that it was really a matter of a series of accidents that led to, well, a known result. Early on I had what you might call a rather meandering career path before I finally started pointing myself in a generally IT-ish direction. Fortunately while I was taking night classes in IT subjects and working a day job in a very junior clerical position at the Norwegian School of Economics here in Bergen, I got an early introduction to the Internet as it was then in the mid to late 1980s. I remember distinctly that a fair number of the machines we encountered at the other side of telnet, archie, ftp and other services ran something slightly exotic called *BSD Unix*.

A few job changes later and I found myself in a position where I was the person in charge of information security and everything IT-ish for myself and about a dozen colleagues. As the inevitable Internet commercialization came around I had a slight edge after some early exposure and hanging around BBSes in the meantime. But then again we had some wonderful security failures too, as far as I can tell not too dangerous and never really breaking anything important, but well, the stories are out there in some form if you poke around USENET archives. Enterprising readers will know where to look.

What drove you to pursue information security?

PNMH: Information security, again, is part of the bigger picture. You want to provide a convenient working environment as well as making sure you keep your colleagues safe from harm, all the while doing your best to implement a regime that protects whatever the organization's assets are. For my own part it all grew out of that motivation. The process was quite gradual. And of course gradually you build up a toolchest. There are invariably applications or entire environments that you would dearly like to take out of the equation that also happens to be something your client can not be moved to do without. For my own part I ended up with a preference for open source tools in general and OpenBSD in particular. That position evolved in part from various less pleasant experiences with the various proprietary systems, and partly from the rather obvious insight that with open source tools, you actually can check what the tools do and change or enhance any part of the toolchain if you want to.

Then again, whatever you do and how ever you choose to run your security efforts, the security bits have to be integrated into your environment. Basically the tools and procedures need to be part of the normal, ordinary way of going about your business. If your strictly enforced security regime with tools and procedures gets in the way of how the organization needs to run its business, your users will find ways to subvert your goals and you may find yourself exposed. It's the *you made the thing foolproof, so they went ahead and created a bigger fool* problem coming back at you.

What do you see as the biggest challenge to information security five years down the road?

PNMH: Well, to start with there are four things we can be absolutely sure will be as problematic five years from now as they are today: Bad design decisions, needlessly growing complexity, implementation bugs, and your trusted users' actions, including your own. For the first three the constant, ongoing code audit of the type the OpenBSD project practices and preaches will give you a head start. But apart from stating the obvious, there are a few other worrying developments that have been happening for a while and have only recently started to come to the general public's at\tention.

One such development is the growing tendency of governments, even Western ones, to demand the right to peek ever more closely into people's private information, with little or no accountability. The European Union's Data Retention Directive is one such piece of legislation, which mandates that any traffic logs you may be generating for your own needs have to be kept around for longer than any sane techie would think of, just in case law enforcement wants to take a peek. You could of course say that the original intentions were good and point to the so-called war on terror. But we have already seen the motivation morph into the need to catch child molesters, then it got tweaked a little more to be included as a weapon in the decades-old war on drugs and recently it's been found to be vital in the struggle to catch traffic offenders, beaten to the punch only by a very misguided chunk of the media publishing industry, which for good measure seems to be intent on running its own little branch of law enforcement in their very own style.

The same ugly picture includes various national laws that codify warrantless wiretapping and other forms of fine grained surveillance, and there is even legislation on the way that mandates various forms of censorship that may lead to serious technical issues in the name of copyright enforcement. All taken together it looks like a fairly thorny path ahead, and it's worth keeping in mind that all of those things that sound scary enough for individuals pose a real risk for companies too. To some extent we've always had industrial espionage, but to West Europeans at least the idea that your own government could realistically be the ones trying to pry into your confidential information is somewhat new and quite unpleasant.

At the end of the day, bugs of any kind and social engineering will return to bite us, and we won't be rid of either any time soon. Our adversaries will continue to rely on those techniques. Well designed tools and good code, validated and audited in full public view will help, as will educating your users. Keep in mind too that in this context you, the security professional, are very much a user yourself, with access to elevated privileges that may mean when you do screw up, the situation could escalate into something far more dangerous than run of the mill user's goofs.

Does the OpenBSD version numbering approach confuse people?

PNMH: I suppose it does confuse people that in OpenBSD, the version number is just another identifier, and it gets incremented by exactly 0.1 every six months.

The reason OpenBSD does it that way is that the project has chosen to live by a strict six month development cycle. The development cycle is itself split into roughly four months of introducing new or improved features followed by two months of stabilization leading up to cutting a release and sending it off to production at some never-preannounced date. For the development team this means that large reworks of code will have to be split into chunks that will realistically fit within that timeframe.

The much-ballyhooed and very useful syntax changes that appeared in PF over the OpenBSD 4.6 and 4.7 releases had in fact been works in progress for some years when they hit the tree for general use. For last November's release, 5.0 just happened to be the next increment in line. The release did have some major new features, for PF the prio keyword is the first part of a new traffic shaping engine that will eventually replace the venerable ALTQ when the time comes.

There is kind of a roadmap in place, but the developers have not officially committed to a timetable or specific release when ALTQ is supposed to be replaced. It will happen when the new code is ready and clearly better than the older one. When something new and exciting is committed, I hope to be one of the first to write a blog post about it. My PF tutorials tend to include at least some mention of recent developments, too.

Do you believe all the regulations set forth regarding information security have helped or hindered information security growth?

PNMH: First of all, there is more legislation that's relevant to information security today than there was earlier, and security professionals need to be aware of what rules apply to them. Some legislation may have been beneficial, if for example it was needed in order to codify clear standards of ethical conduct. Basically you need a working knowledge of what rules apply. So the various rules and regulations have made life anything from slightly more complicated to somewhat painful in recent years, depending on where you are and what you do.

If you work in several jurisdictions, you may need to get a lawyer or even a judge to affirm which set of rules apply in each case, and if the precendence of rules is unclear or worse the rules are even slightly incompatible or unclear, your legal fees could become substantial.

Again it's important to be aware that recent legislation in the US and elsewhere written with the intention of short-circuiting the normal due process rules in certain types of criminal cases, notably those labeled 'terrorist' by the prosecution. Unless those rules are found unconstitutional in a hurry, we should expect to see information security professionals behind bars for indefinite periods soon enough.

Is there a better way to allow root access for remote admins?

PNMH: Heh. There has been a lot of discussion on just what level of immediate access is appropriate for admins when they are in a hurry, but realistically the question boils down to this: What level of exposure to the various threats, including the risk of your own mistakes, is appropriate in your context?

I don't believe there is an easy one size fits all option available. Your analysis of the specific context, with its own set of risks and probabilities and anticipated threat factors dictates what is appropriate.

But reeling back a bit, your question is really about the basic conflict or tradeoff that admins see between convenience on the one hand and security on the other when they need to access critical devices. It's so very convenient to go directly to the maximally permissive settings so you can do anything you like without getting caught up in red tape.

When it comes to what constitutes acceptable risk, it really is up to you. If you, after appropriate risk analysis, are confident that logging in to a remote device with the highest possible privilege is appropriate, if you are equally confident that you can effortlessly recover from any mistakes you make while running with maximum privilege and you consider the risk that anyone not formally authorized to reach that level will manage to do so is negligible to non-existent, you are at liberty to go directly to root.

I tend to advocate disallowing direct login to any privileged account, to encourage use of encryption of the strongest practical kind and when appropriate and available, key based authentication or some sort of two factor authentication system. Mainly because I know that I am not infallible, and in some contexts I need a reasonable assurance that anyone attempting unauthorized access would need to expend enough effort that my systems would detect the attempt.

I dislike running with elevated privileges whenever it isn't strictly necessary, mainly because I know that I'm human and will make mistakes, and that configurations can break in unexpected ways. There are, for example, failure modes on some Unix-ish systems that would land you with / as your home directory and no warning that's where you are other than – if you're lucky – a command line prompt that looks subtly different from what you are used to seeing. In those contexts, it's essential to do the right things, and your confidence that you will have *grace under pressure* will be sorely tested.

A large part of the problem is to ensure that any task in the system runs with an appropriate level of privilege. In the OpenBSD project, a lot of work has gone into properly implementing privilege separation in the various daemons. In effect, making sure only those parts of the system that need elevated privilege ever achieve that privilege, and in most cases the program gives up the privilege once the task such as binding to a port below 1024 has been achieved. The most immediately user-visible consequence is that you will find the OpenBSD password database pre-populated with a number of special-purpose users (most of them with names that start with an underscore character '_'), defined specifically to run services at their appropriate privilege levels.

The privilege separated OpenBSD system is out there and available for daily use, and I would encourage your readers to try it out. There are interesting efforts going on in other projects as well, with the main keywords being RBAC or *Role Based Access Control* – essentially a deconstruction of the user authentication and authorization (implemented among other places in the most recent Solaris releases), and from the opposite end of the table, fine grained capabilities models for process privilege separation, with the FreeBSD project's Capsicum project (if I understand correctly to hit mainstream in FreeBSD 9) on my short list of things to look into in the near future.

But the increased complexity that grows naturally from these approaches also means the code and configuration needed to fit the code to your purposes is harder to do correctly, and so we are almost certainly entering dangerous territory for that reason alone. It will take significant development effort to rein in those concepts into something manageable for the average sysadmin, assuming we're also able to squash enough bugs in the process to make the effort worthwhile.

What new concepts or applications are available, or coming available soon, for firewalls?

PNMH: The firewalls concept in its simplest form – and that's what people get hung up on – is rather simplistic. The main decision is to block or pass. Modern firewalls do a lot more of course, including but not restricted to failover and redundancy with CARP and pfsync or VRRP, network address translation and even IPv4 to IPv6 conversion, redirections, load balancing and traffic shaping. The good ones even adapt to network conditions via adaptive state timeouts or can be configured with state tracking tricks that fend off excessive traffic of specific kinds.

And of course there is more, but there is a tendency for news about interesting technical development to drown in marketing hype, so I may be ignoring important work that's going on out there. Personally I think the authpf system – OpenBSD's and PF's non-interactive shell that loads rules on a per user basis – is one type of feature that I think will see a lot more attention and wider use in the future. It's so obviously a good thing to tie what the network lets you do to your user or group identity or to a set of role based criteria.

Come to think of it, most of these advanced firewall features are seriously under-used and not as well understood in the community at large as we would have liked. But perhaps the identity or role centric setups are the ones with the most scope for interesting development over the next few years, if the added complexity can be managed somehow.

How does BSD pf compare to iptables, ipfw, ipfilter or other firewalls? What is its strength or weakness?

PNMH: The short answer, coming as it would from the author of The Book of PF, is obvously that the other ones suck. But seriously, since I kind of abandoned the other ones in favor of PF at some point, I think it's better to at least start answering the question by describing some of the features that attracted me to PF over the other ones. Then we'll get around to any weak points if we can still remember them after a while.

It's important to remember that PF is developed as an integrated part of OpenBSD, and one of the important design goals has always been that it should be very usable for OpenBSD users. This means that all the features I've touched on earlier are within easy reach directly from your pf.conf configuration file or somewhere equally accessible.

One usability feature I appreciate a lot is called *atomic ruleset load*. It's perhaps easier to explain why this is important if we look at the other ones: iptables and ipfw configurations are actually shell scripts, where each rule is loaded as a separate command. This means that if you press [Ctrl-C] while the script is executing, you have very little control over what rules are actually enabled. More likely than not, some lines of your script were never executed, meaning that your configuration did not load completely, with unpredictable results. IPfilter's developer apparently did not trust the software to keep track of loaded rules by itself and recommended *flushing* previous rules before loading a new configuration.

None of this is necessary with PF – if your rule set is syntactically valid, it will load, completely replacing the previous one. There is no need to flush existing rules, unless you want to make sure you have a a period of 'pass all' to give miscreants a break until you load the next valid rule set, and running a real risk of disrupting valid traffic (think timeouts due to disappearing redirections) that would have seen no trouble on a clean ruleset load.

If you think this means that PF configurations are totally static, you're wrong. If you need to adjust the contents of your rule set on the fly, your best bet is to create what PF calls an anchor – essentially a named sub-ruleset, and yes, you can have several – where you or applications you write can insert and manipulate rules dynamically, something Apple appears to have used to great effect in their port to MacOS. Apple even wrote some enhancements to the anchor loading code, but unfortunately they wrapped their new bits in #ifdefs with a separate license, so the extended functionality will not easily make it back into the mainstream PF code. You can look up my Call for testing article (see the references at the end) for more details.

And of course for simpler operations like singling out hosts that need special treatment, you can manipulate tables of IP addresses even outside anchors, or you can use state tracking options magic to move IP addresses into tables, and use the tables in your filtering criteria.

From my experience, PF and related tools on OpenBSD provide you with the sanest working environment available for interacting with the TCP/IP stack so you can make your equipment perform the way it's supposed to. None of the other tools come even close, in my opinion, in either admin friendliness or performance.

Will the next intrusion platform be mobile devices?

PNMH: To some extent, or possibly even to a large extent, I think the shift has already happened, in the sense that the focus of would-be intruders is changing more or less in step with the mainstream user and the perceived high-value targets. I'm not suggesting that the installed base of PCs will be going away anytime soon, most of those are well past their use by date anyway, but rather that the Windows PCs that today still make up the largest part of the installed base are destined to become less important over time if current trends continue more or less as we see them today.

Mobile devices are getting a lot of attention these days, and malware targeted at them is of course getting some too. The situation for mobile devices designers today is somewhat parallel to the situation when PCs were introduced to the Internet, but there are important differences.

One such difference between back then and now is that a large part of the PC related business is still aimed squarely at patching or working around security bugs in the most common desktop operating environment. That, and the fact that there are more network-savvy developers out there today than at any time earlier makes me a little hopeful that at least some of the grosser mistakes of PC networking history will not be repeated by mobile device developers. Also, so far we have avoided the monoculture that helped make PCs on the Internet such easy marks. Mobile devices vendors have a real choice in software stacks, and at least the two dominant operating environments in the smartphone space (Apple and Android) are both vaguely Unix-based and use open source components to some degree, which seems to me like their designers are capable of making intelligent decisions.

That said, I'm fairly sure that even in those environments, users and miscreants will find ways to exploit bugs, and some subset of users will always be willing to do things that are simply not smart things to do. One example comes to mind – users of Apple phones decided that their phones ran a system that was unix-like enough that it should be able to accommodate a Secure Shell (ssh) server, and somebody managed to port the software. Only that developer decided to provide a setup with a default password, and there were several reports of phones that were taken over via ssh, thanks to the known default password that the user never bothered to change.

Now I'm geek enough to appreciate the attraction of having a shell login to the phone you carry in your pocket, but (as I noted in a slashdotted blog post at the time) the point here is not that sshd is an insecure piece of software. It isn't. The lack of security comes from not bothering to change your password from a well-known default value.

Something similar is bound to happen again, where a user makes a stupid mistake that has security implications. If we're lucky the damage will be limited to the users's own equipment, but if that user is also a developer and by design or accident inserts exploitable code in other users's mobile devices, the damage could become more widespread.

It's also worth keeping in mind that even if mobile devices seem relatively boring by modern PC standards and may or may not contain useful data, they may still be useful to botnet herders. A typical smartphone today has general processing power at least on par with a run of the mill PC at the time the network dependent malware started turning up on the Microsoft platform, and it's almost certainly on a better network connection than most PCs were back then. If your smartphone doubles as your wallet, all the more reason to pay attention.

How can these mobile devices be protected?

PNMH: If the mobile devices industry indeed manages to avoid making the same mistakes as the PC industry before it, I think we have something of a head start. Over the years what passes for IT security has focused on *enumerating badness* (do read Marcus Ranum's essay linked to in the references for more on that) and in the process diverting attention from the root cause issue that a certain software marketer was, for quite some time, reluctant to even acknowledge that there were bugs to be found in their software.

It may not have been obvious at the time Marcus was writing that essay, but history has taught us that the approach the PC industry took to security at the time – heaping another level of complexity on top of buggy software in the name of security – is not necessarily an improvement in real terms, even if the new layer somehow provides a

References

The references are listed in roughly the order they're mentioned in the text, read them for further treatment of some of the issues I mentioned here.

- The OpenBSD project *http://www.openbsd.org/*
- The FreeSBD project *http://www.freebsd.org/*
- PF tutorial home page *http://home.nuug.no/~peter/pf/*
- The Capsicum Project at Cambridge University, *http://www.cl.cam.ac.uk/research/security/capsicum/*
- How Apple Treats The Gift Of Open Source: The OpenBSD PF Example *http://callfortesting.org/macpf/*
- The Book of PF (second edition) *http://nostarch.com/pf2.htm* or from good bookstores everywhere
- Rickrolled? Get Ready for the Hail Mary Cloud! *http://bsdly.blogspot.com/2009/11/rickrolled-get-ready-for-hail-mary.html* (slashdotted as The Hail Mary Cloud is Growing, Nov 15 2009, *http://linux.slashdot.org/story/09/11/15/1653228/the-hail-mary-cloud-is-growing*)
- Marcus Ranum: The Six Dumbest Ideas in Computer Security, *http://www.ranum.com/security/computer_security/editorials/dumb/index.html*

workaround for the nasties you know about in the original code. The added complexity most likely means that your debugging gets harder for the next round of problems.

In a way it would be nice if mobile device designers started basing their systems on OpenBSD, which is probably the general purpose system that has been developed and maintained with the most attention to security. I want a phone I can trust, and preferably one that's open enough for qualified developers to hack on. And the same applies to tablets and other devices too, of course.

Regardless of what technology the devices are based on, I think a combination of user education and operators paying attention to end user equipment is the way forward. If operators are able to take some of the system administration workload off their end users' hands for a nominal fee, it could turn into a profit center.

It really boils down to a sane system administration regime – don't run any services that are not required for your use case, log properly and pay attention to what your logs say, update your systems at intervals and definitely when security relevant bugs have been fixed.

On the other hand, in addition to user education and the offer of handholding we may need a measure of negative reinforcement – one approach is to mimic the way we treat pets or livestock and their owners. Dogs and computers both are capable of autonomous actions to some extent, so it might be a useful parallel. Dog owners are used to cleaning up the messes their pets make on sidewalks, and if the animal bites somebody, the owner is usually responsible for paying for the damage. Sufficiently stupid behavior with regard to your pet can sometimes earn you a charge of reckless endangerment. I think you can validly argue that a similar regime should apply to owners of fairly damage-capable computing devices.

How can these mobile devices be firewalled?

PNMH: On a technical level, I think that problem is very close to being solved. The existing tools could be adapted fairly easily to fit a roving user scenario (some people are already paying attention), and some of the anticipated developments I mentioned earlier may make the devices even easier to use. But once again, operators and service providers could play a significant role if they manage to come up with useful ways to interact with users' devices. And of course we need to stomp out the snake oil salesmen, if we can't scare them off right away by building sanely constructed devices with trustworthy software.

How do you even know if someone is attempting to access your mobile device or using it to run ssh login attempts against remote systems?

PNMH: On the current crop of devices, I think you'd be blissfully ignorant of any such attempts until either your phone starts doing something unexpected or your next bill turns up with a lot more traffic to pay for than you had expected.

With any of the devices that are vaguely unix-based it shouldn't be very hard to log properly, and once again I think operators should be looking seriously into offering their users some kind of log monitoring and other admin services in order to help run mobile devices sanely. Intelligently designed mobile device management services could become the real differentiator in the telecom operator market. I hope the operators are paying attention.

And finally, for penetration testers out there, there will always be bugs out there to hunt for and exploit, and if you have a hard time finding those, you can always go for layer 8 or 9 techniques :)

Happy hacking!

By BSD Team

With the Collapse of Red Flag Software (the World's Second-largest Linux Distributor) is the Dream of Linux on the Desktop Even Further out of Reach?

When Red Flag Linux was launched in 2007, there was much fanfare in the Open Source community. The most populated country in the world had embraced the vision, backed by government, and even a grudging olive branch had been thrown towards Microsoft in developing a Windows XP like interface. What could possibly go wrong? At time of writing it is unclear exactly why the project collapsed so spectacularly; some cite the Chinese Academy of Sciences' removal of funding due to the competition from Red Hat and SUSE Linux. What is clear however, is that another large government backed computer project has fallen by the wayside.

This is a sad day for the Open Source movement. While the cynical amongst us may suspect back doors and all sorts of underhanded compromises that go hand in hand with government surveillance and not shed a tear over the demise of Red Flag from an ethical perspective, the fact remains that domination of the world's largest marketplace is back in the hands of commercial interests, other than the enlightened few stalwarts that decide to download their own software – that is, of course, if it is available via government controlled firewalls or via a DVD from a friend. Under the circumstances it would be hard to accept a score other than Communism 0 – Capitalism 1.

Anyone with a scintilla of commercial reality understands that the desktop is dominated by Microsoft, as the majority of corporations have adopted MSC solutions. This popularity has spread across to the consumer marketplace but with one exception – mobile and tablet devices. In the early age of the motor car, the market was dominated by Ford with their innovative vision of mass production. Everyone else then followed suit and, to this day, very few independent motor manufacturers remain. But where does Ford rank today? Well behind General Motors, Volkswagen and Toyota in terms of production. So the cyclical curse of the capitalist marketplace once again claims another scalp – the innovator, the creative – once on top doesn't always finish first. So maybe MSC isn't in such a strong position after all.

MSC is at a critical juncture in its history. There is a serious move away from the classic in-house desktop / server relationship with the success of tablets and mobile phones. Organisations are thinking more and more along the lines of remote desktops, virtualisation and bring your own device. Maybe the question isn't what Operating System will dominate the desktop, but what method will be used to deliver applications? If the move towards thin-client takes off, MSC will need to morph away from its traditional model for the corporates – Servers, Desktops, Applications, and Developer tools.

There is another issue at stake here, apart from the ethical issues of moving applications and data off to some server farm somewhere. Windows 8, like Ubuntu Unity, has caused consternation amongst the old school by radically re-designing the user interface in an attempt to bring cohesion across devices. It has been a Marmite moment – you either love it or hate it. At the moment, the corporates hate it, and those who are not committed to the change from a Start button or classic menu anchored to the top or bottom of the screen struggle. I recently had to explain to a friend, who had purchased a new consumer-grade laptop with Windows 8 installed, that he was basically stuck with it unless he forked out for a Windows 7 licence – a discussion that involved much swearing and slapping of the forehead. Friends come and go, but enemies accumulate and MSC is building a dedicated following of the latter with its short-sighted "Our way or the highway" mentality.

Microsoft's nemesis on the other hand has it all wrapped up as far as the user interface is concerned. The humble hyper-link is clicked on 1 x 10X per day where X is greater than 10. When it comes to vox populi, or the voice of the people, any computer interface is going to fail on the basis of these statistics. No focus group, design team or engineer on the planet can overcome the intimacy that billions of people have developed with clicking on an HTML link. I would guess that Bob Bemer didn't have a focus group on hand to test efficacy. So Google, the future is yours in terms of statistical dominance.

Yet we still have the problem of the UI bling factor – the pretty, touchy feely effect that Apple has embraced and made almost a religion out of. While the hyper-link is cold and efficient, exploding windows, cute animal sounds and great font rendering bring élan to an emotionally sterile environment. MSC has never quite penetrated this US West Coast paradox, yet we see the same trends with those who love their Android O/S and the touch screen. It is the "wow" factor.

At the end of the day, software interfaces need to be just that – an interface. The same rules apply to the design of a car, a cheese grater or a garlic crusher. Some will be utilitarian, some revolutionary. What goes on underneath the bonnet will be hidden to the majority of users, but first impressions really matter. We all intuitively understand good design – it has that feel about it, an aura, a quality you just cannot put into words. It pulls you into itself, re-enforcing your understanding of the universe yet at the same time challenging you to explore further. It is greater than the sum of its parts. So maybe the demise of Red Flag Software is a mercy killing rather than an assassination. If the move to the cloud and thin client is the next revolution, it matters little what that thin client will be, as the forces of mass adoption will dictate how people interact in cyberspace. The O/S will become less and less important, and the user experience and interface will become more so. And that is where the trojan horse of Open Source will dominate – the power behind the throne.

ROB SOMERVILLE

Rob Somerville has been passionate about technology since his early teens. A keen advocate of open systems since the mid-eighties, he has worked in many corporate sectors including finance, automotive, airlines, government and media in a variety of roles from technical support, system administrator, developer, systems integrator and IT manager. He has moved on from CP/M and nixie tubes but keeps a soldering iron handy just in case.

Dr.Web 9.0
for Windows — the rapid response anti-virus

1. Reliable protection against the threats of tomorrow
2. Reliable protection against data loss
3. Secure communication, data transfer and Internet search

www.drweb.com

Free 30-day trial: https://download.drweb.com

New features in Dr.Web 9.0 for Windows: http://products.drweb.com/9

FREE bonus — Dr.Web Mobile Security: https://download.drweb.com/android

Great Specials

On FreeBSD® & PC-BSD® Merchandise

Give us a call & ask about our **SOFTWARE BUNDLES**

1.925.240.6652

$39.95	$29.95	$49.95 Save a BUNDLE!	$99.95
FreeBSD 9.1 Jewel Case CD Set **or** FreeBSD 9.1 DVD	PC-BSD 9.1 DVD	The PC-BSD 9.0 Users Handbook PC-BSD 9.1 DVD	The FreeBSD CD **or** DVD Bundle

Inside each CD/DVD Bundle, you'll find:
FreeBSD Handbook, 3rd Edition
Users Guide FreeBSD Handbook, 3rd Edition, Admin Guide
FreeBSD 9.1 CD or DVD set
FreeBSD Toolkit DVD

Stylish Dress Attire
Look Your Professional Best

Comfy Apparel
Stay Warm in Zip Ups & Pullovers

T-Shirts
Lots of Styles to Choose From

FreeBSD 9.1 Jewel Case CD/DVD $39.95

CD Set Contains:

- **Disc 1** Installation Boot LiveCD (i386)
- **Disc 2** Essential Packages Xorg (i386)
- **Disc 3** Essential Packages, GNOME2 (i386)
- **Disc 4** Essential Packages (i386)

FreeBSD 9.0 CD $39.95
FreeBSD 9.0 DVD $39.95

FreeBSD Subscriptions

Save time and $$$ by subscribing to regular updates of FreeBSD

FreeBSD Subscription, start with CD 9.1 .... $29.95
FreeBSD Subscription, start with DVD 9.1 .... $29.95
FreeBSD Subscription, start with CD 9.0 .... $29.95
FreeBSD Subscription, start with DVD 9.0 .... $29.95

PC-BSD 9.1 DVD (Isotope Edition)

PC-BSD 9.1 DVD $29.95
PC-BSD Subscription $19.95

The FreeBSD Handbook

The FreeBSD Handbook, Volume 1 (User Guide) $39.95
The FreeBSD Handbook, Volume 2 (Admin Guide) $39.95

The FreeBSD Handbook Specials

The FreeBSD Handbook, Volume 2 (Both Volumes) $59.95
The FreeBSD Handbook, Both Volumes & FreeBSD 9.1 .... $79.95

PC-BSD 9.0 Users Handbook $24.95

BSD Magazine $11.99

The FreeBSD Toolkit DVD $39.95

FreeBSD Mousepad $10.00

FreeBSD & PCBSD Caps $20.00

BSD Daemon Horns $2.00

Bundle Specials!
Save $$$

Just Plain Fun
Mousepads & Novelty Horns

BSD Magazine
Available Monthly

FreeBSD Mall

For even **MORE** items visit our website today!

www.FreeBSDMall.com

Developing for Amazon Web Services?

Attend Cloud DevCon!

Cloud DevCon

June 23-25, 2014

San Francisco

Hyatt Regency Burlingame

www.CloudDevCon.net

Attend Cloud DevCon to get practical training in AWS technologies

- Develop and deploy applications to Amazon's cloud
- Master AWS services such as Management Console, Elastic Beanstalk, OpsWorks, CloudFormation and more!
- Learn how to integrate technologies and languages to leverage the cost savings of cloud computing with the systems you already have
- Take your AWS knowledge to the next level – choose from **more than 55 tutorials and classes,** and put together your own custom program!
- Improve your own skills and your marketability as an AWS expert
- Discover HOW to better leverage AWS to help your organization today

Register Early and SAVE!

A BZ Media Event

CloudDevCon