Building Products with NetBSD part 2:

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Why part 2?

Building Products with NetBSD part 1: ThinIT
presented at:

EuroBSDCon 2007 (Copenhagen)
BSDCan 2009

Background

- Avid Acorn computer user since the BBC B
- Worked for Acorn Computers and Xemplar, its education joint-venture with Apple, from 1996 to 1999
- Founded Precedence Technologies in 1999 to continue the work done at Acorn and Xemplar
- NetBSD and pkgsrc developer since 2007

Background

- First encountered Unix in 1993 on a 68000-based MASSCOMP real-time system while working on PhD in psychoacoustics
- Soon afterwards, lab got SGI Indys running IRIX
- Learned C, shell-scripting and networking
- Had only user privileges, but was a small lab so could discuss sysadmin tasks with root users

Acorn Archimedes

- Archimedes A3x0 and A4x0 released June 1987
- ARM2 8MHz (26-bit)
- 800kB floppy
- Optional ST506 HDD
- Single MEMC (memory controller) – max 4MB

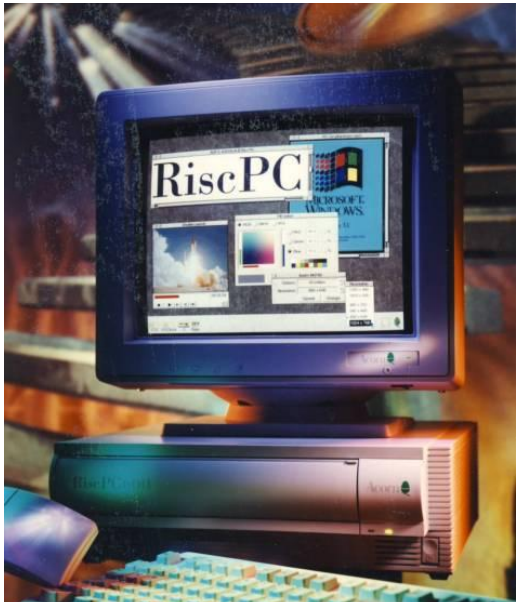
Acorn A5000

Credit: https://www.retro-kit.co.uk/

- Released 1991
- ARM3 25MHz (26-bit)
- IDE HDD
- 1.6MB floppy
- Optional 2nd MEMC for max 8MB

Acorn RiscPC

- Released 15th April 1994
- 30MHz ARM610 26/32-bit CPU
- Up to 420MB IDE HDD as standard
- Optional 10Mb Ethernet
- Modular case for expansion
- Could have 486 second CPU
- Up to 256MB RAM and 2MB VRAM



Acorn promotional shot of RiscPC 600

Acorn RiscPC

- I get a top-spec RiscPC in Sep 1994 (via a friend's staff discount)
- Start to research the possibility of running some form of Unix on it soon after

My RiscPC
(26 years old!)

RiscBSD announced

August 15th 1994 post on comp.sys.acorn

The RiscBSD project is about bringing an ARM based UNIX onto the Risc PC platform. We fully support the idea of UNIX on the older machines, and of a UNIX on a second processor in a Risc PC (one of core team members is responsible for the LINUX work for the 486 card!). However, our objective is to produce the best ARM native UNIX we can for the Risc PC.

We have settled on a base of BSD4.4 - probably the NetBSD flavour.

Arc(h)BSD

Follow-up to previous RiscBSD post:

The ArcBSD project is about bringing an ARM based UNIX onto the full range of ARM-based Acorn machines. Although we are primarily working on the older machines at the moment, we are about to start work on getting what we have so far working on a Risc PC.

ArcBSD is based on BSD4.4 code, with no code being introduced from previous versions (i.e. NetBSD, FreeBSD before v2.0, 386BSD, etc). This is the only way to prevent licensing problems.

Linux

- Port to older computers started Spring 1994
- By a single student, Russell King (still main Linux on ARM maintainer)
- Single-man project so slow development

FreeBSD/NetBSD/Linux

October 1st 1994 on comp.sys.acorn:

> There are three Unix ports (that I know of) going on.
> Firstly there is a port of BSD Lite called Arc[h]BSD (being done by Gary Palmer, Simon Proven, Simon Lockhart et al);
> secondly a port of FreeBSD for the Risc PC called RiscBSD (being done by Nut, Manar Hussain et al); and finally a port
> of Linux being done by someone I don't know.

More info here. ArchBSD is using FreeBSD 2.0 pre-alpha (but surprisingly stable) source code. RiscBSD, the last I heard, was using NetBSD 1.0 Beta. Further info available if you want. (Like what's the difference between NetBSD & FreeBSD)

I think I may have commented in the past (and I think that the archbsd-hackers info still does say) that ArchBSD was going to be 4.4BSD-Lite based. Then we dug into the code. USL nicked all the major bits, including bits of the TTY system & some of the more major support for doing disc I/O! It seemed that we will be better off 'leaning' on an existing PC port, and the way things turned out we went with FreeBSD, and some others went with NetBSD (the actual reasons are a lot more complicated and are not at all clear, but this is the most easily understood form!)

Gary Palmer
--
FreeBSD & ArchBSD core member
ArchBSD - 4.4 BSD Unix for the Acorn RISC Platforms

Comparison

RiscBSD (NetBSD 1.0) - now NetBSD/acorn32

- Targeting RiscPC in 32-bit mode
- Big(-ish) development team

Arc(h)BSD (FreeBSD 2.0) - never released

- Mainly A5000 in 26-bit mode

Linux - no longer supports Acorn

- A5000 only at the time

Decision: RiscBSD

- Downloaded onto many, many floppies
- Lab Internet connection 9600 baud serial (so kermit on Windows 3.1)
- Got larger 850MB HDD and partitioned between RiscBSD and RISC OS
- Meant I had root access
- Could connect to lab 10Base2

Getting a job

April 1996 started working for Xemplar Education in Cambridge, UK, in technical support

Xemplar was a joint venture between Acorn Computers and Apple UK targeting primary and secondary schools from April 1996 to April 1999

Acorn NetStation released

- Released August 1996
- Implementation of Network Computer (NC) Reference Design as commissioned by Oracle
- 10BaseT Ethernet or 28.8k modem
- Cut-down RISC OS in ROM with TCP/IP, web-browser, word processor and NFS

An Acorn NetStation

Ethernet version

I get a NetStation

- Xemplar given two NetStations in October 1996
- No-one knows what to do with them
- I get a spare RiscPC and install RiscBSD (now officially NetBSD/arm32 1.2)
- Write a RISC OS boot sequence to run over NFS and BOOTP
- Demonstrate to public January 1997 at Olympia

NCManager

- RiscPC running NetBSD becomes a real product
- Preinstalled with NetBSD and NC boot sequence
- Apache for NC HTML UI, intranet and web proxy
- NFS, Samba, bootp, DNS and NAT
- Webadmin as CGI for user management, etc.
- Webmail IMAP client as CGI written in C

Xemplar Matrix Ecosystem

- First installed in summer 1997
- Now I’m working full-time on Network Computers
- Design and develop NCWorks: an integrated desktop environment including productivity tools (C, ARM assembler, BBC Basic)
- Become Citrix-certified for Windows virtual desktops

Big sales in 1998

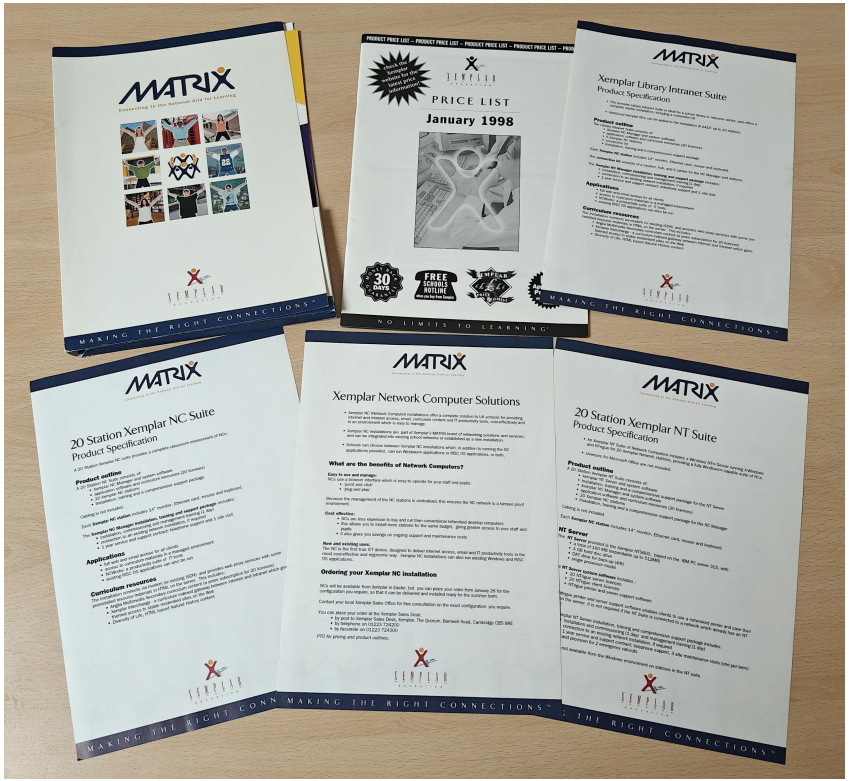
Product bundles launched January 1998 at BETT

- NCManager, 20 NCs = £11499
- NCManager, 5 NCs = £5499
- NCManager, NT Server, 20 NCs = £23499

All include installation, training, annual support, learning resources, NCWorks

Sold throughout the UK with a lot of summer installs

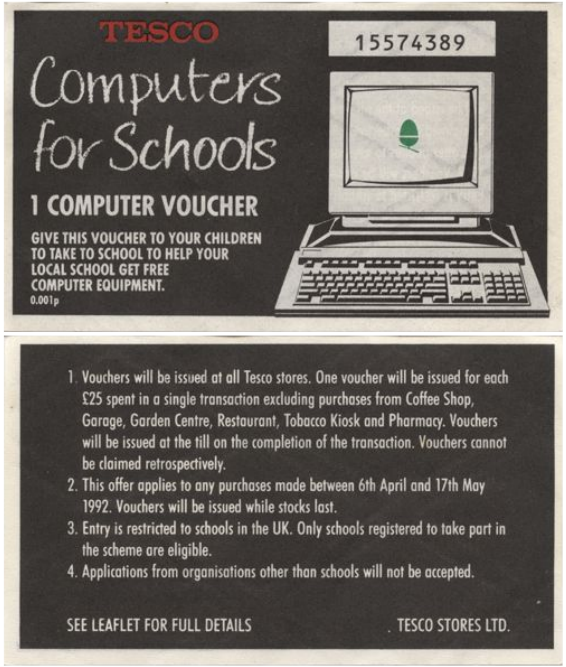
Marketing


MATRIX
PRICE LIST
January 1998
Xemplar Library Intranet Suite
Product Specification
20 Station Xemplar NC Suite
Product Specification
Xemplar Network Computer Solutions
20 Station Xemplar NT Suite
Product Specification
MAKING THE RIGHT CONNECTIONS
NO LIMITS TO LEARNING

Tesco Computers for Schools

You could even get them by collecting supermarket vouchers!

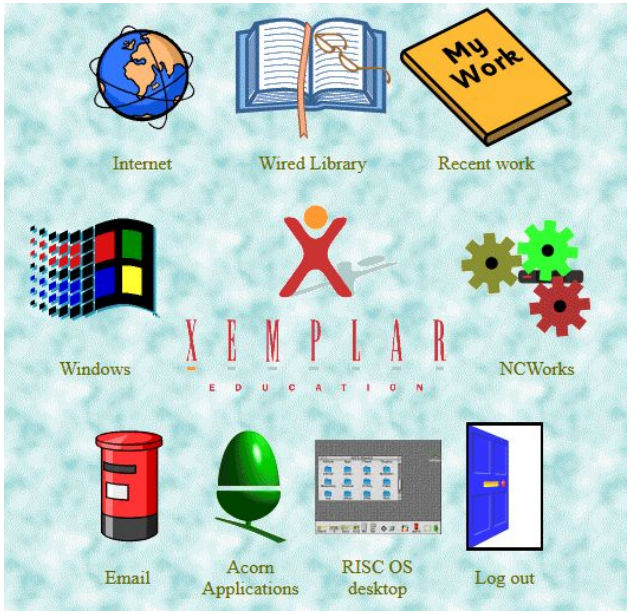
(exchange rate so poor, I'm not sure anyone ever did)

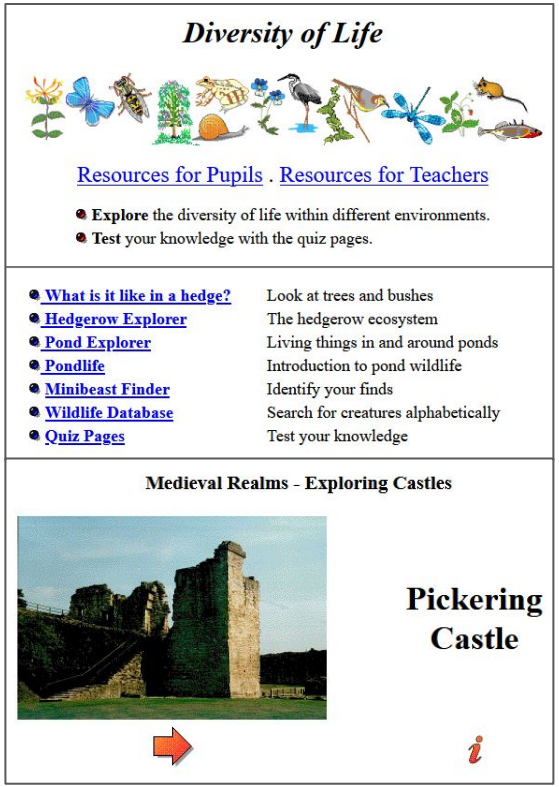


NCManager web resources

Login page

Home page





The End of the Beginning

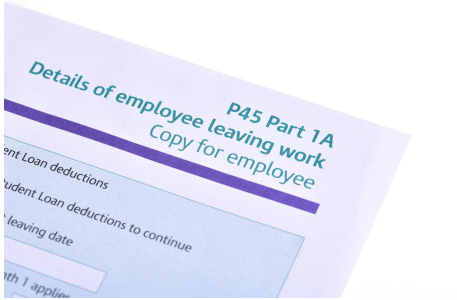
Press release 14th Jan 1999:

Acorn Sells Xemplar Stake

Acorn Group plc, the technology holding company, today announced that its wholly-owned subsidiary, Acorn Computers Limited (ACL), has sold its 50% interest in educational IT supplier, Xemplar Education Limited, to its joint venture partner, Apple Computer. The transaction values Xemplar at £6m and ACL's cash proceeds are £3m.

Redundancy

- Made redundant end March 1999
- Remember those sales summer 1998 with pre-paid annual support contracts?
- They’d just made tech support and the guy who designed it all redundant



Precedence Technologies

CERTIFICATE OF INCORPORATION
OF A PRIVATE LIMITED COMPANY

Company No. 3725626

The Registrar of Companies for England and Wales hereby certifies that
PRECEDENCE TECHNOLOGIES LTD

is this day incorporated under the Companies Act 1985 as a private company and that the company is limited.

Given at Companies House, Cardiff, the 3rd March 1999

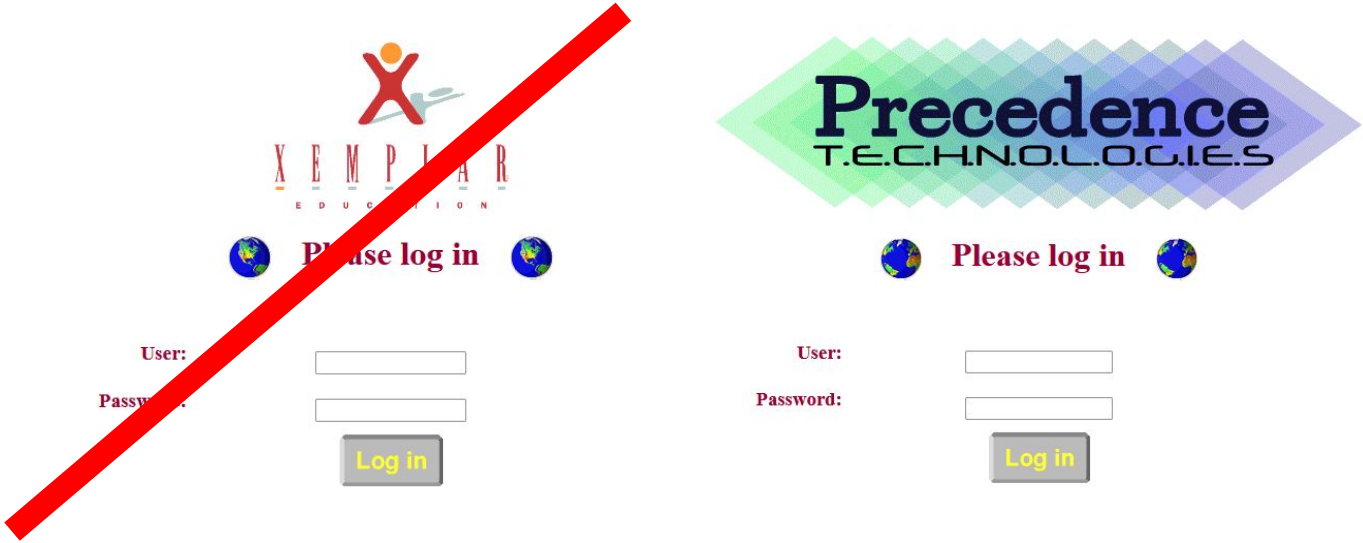
COMPANIES HOUSE

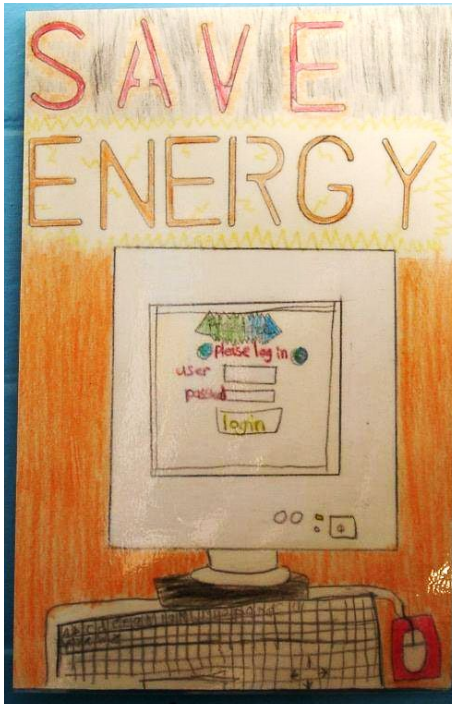
- Founded 3rd March 1999
- Started trading April 1999
- Named after the *Precedence effect* in Psychoacoustics (a.k.a. law of the first wavefront)
  `https://en.wikipedia.org/wiki/Precedence_effect`
- Contracted by Xemplar for 12 months to provide ongoing support
- Granted all Intellectual Property and source code

Hit the ground running

- Rebrand NCManager to NetManager
- Rebrand HTML UI to Precedence
- Buy all remaining stock of NCs from Xemplar (purchase order #1)
- Contact customers to suggest upgrades

Rebrand to Precedence





NetManager 2 = CATS

- RiscPC too slow and now EOL
  - Limited to 10Mb Ethernet
  - Onboard IDE limited to PIO Mode 0
  - DMA-capable IDE upgrades available
- CATS developed by Simtec with the RiscBSD developers. NetBSD support from 1997
  - ATX form-factor motherboard
  - PCI slots

CATS (middle) between a Sun Netra and SGI Indigo 2. Just some of my retro NetBSD kit

The inevitable switch to x86

- Last CATS installed November 1999
- Started to install NetBSD/i386 1.4 in Jan 2000
- NetBSD/i386 1.4 was still a.out (ELF from 1.5)

Adverts

NetManager

Take Control of your School Network

One Server Many Uses

Scenario
You've got a network. You've got a variety of different computers which you want to use. You require effective Internet and intranet access. You want consistency, reliability and performance. You need ease of use and management.

Solution
The NetManager is a powerful, expandable server which offers high performance, yet is easy to manage and is low in cost. It's flexible nature allows it to fit in with the majority of networks be they NC, PC, Acorn or Mac based. Using the absolute industry standard software used by the majority of Internet services worldwide, you can be certain of its reliability and compatibility.

- Use with any platform
- Low cost (no licences to buy)
- More cost-effective and easier to use than Windows NT
- Remote administration

Internet/Intranet
The NetManager provides transparent Internet access to all the machines on your network even if you only have a modem. It offers email services that integrate with Microsoft® Outlook Express, ANT Marcel® and most other mail clients. Alternatively, the easy-to-use web-based email service offers consistent email access to any machine that is running a tables-capable browser.

The NetManager acts a web proxy for your workstations and also has full web-serving capabilities to allow you to build an effective local intranet. Server management is mainly web-based meaning you can use any web-enabled computer to add, edit and delete users, configure email and Internet services. You can set up mailing lists, aliases and even discussion groups.

- Web-based user management
- Web-based e-mail service with
- URL blocking capability
- E-Mail content filtering
- Absolute industry standard (POP3, IMAP4, SMTP, HTTP, FTP)
- Modem, ISDN TA or routed access to Internet
- Transparent dial-on-demand Internet access

File/Print Serving
The NetManager can serve PCs as though it was an NT server, MacOS computers as though it was an AppleShare server, RISC OS computers as a Level 4 server and also Network Computers/ Thin clients. The simple user management and high performance makes it ideal for networks of all sizes. Creating a user is as simple as entering their name and password; you don't need to manually create shares, volumes or set permissions unlike with other servers. In the same way, the NetManager will act as print server to PC, NC, Acorn and MacOS computers on your network. Print queue management and printer configuration is web-based for ease of use.

NEW NEW **AUN/Level 4 Functionality**
Full AUN/Level 4 functionality allowing older Acorn networks with machines configured to boot and run software from a Level 4 server can now boot from a 100mbps backbone and connect to the Internet* and E-Mail* without the need to load TCP/IP saving limited machine memory.

E-Mail
Full IMAP4.1, POP3, SMTP server. Includes web-based email (including addressbooks, attachments, etc.) configurable on a per-user or per-group basis. Content filtering of inbound and outbound mail. Spam filtering and access control list.

NAT
Gives machines internally transparent secure access to the outside world for things like streaming and video conferencing. Port redirection allows internal services to be mapped to the outside world.

Printing
Print sharing for Acorns, NCs, PCs and Macs to either local or network printers. Web-based queue management and configuration.

Fax
Send faxes simply by printing to a shared printer from any platform.

Proxying
Cache web pages locally to speed up Internet access, including site blocking.

Users
Have an unlimited number of users each with their own email and user area.

Internet
Connect to the Internet with ISDN, modems or a router. Dial-on-demand gives transparent access.

WWW
Full web-server that can serve pages internally and externally including web technologies such as PHP, SQL, cgi-bin, perl.

Support
Full support is given by telephone, our support web site, customer mailing list and remote dial-in management. Software upgrades and patches download via a sophisticated automated upgrade system which identifies which server you have and installs all necessary upgrades, by choosing the upgrade option from the admin menu is all that is required!

Windows
Serve printers, CDs and home areas to Windows computers as though it was an NT server, but without the licence cost or management overheads. Fits in neatly with existing NT networks.

Security
Full kernel level firewalling to define exactly what machine can access what.

Intranet
Each user can have their own personal web pages.

MacOS
Serve printers and home areas to MacOS computers as though it was an AppleShare server.

Storage
Personal home areas and shared resources. With your choice of tape backup.

Management
Simple web-based and menu-driven management of users, printers, network configurations, Internet access, etc.

The NetManager is the official solution for RiscStation Networks.

Includes Acorn ICA support for use with CITRIX

*All trademarks acknowledged. E&OE. © Precedence Technologies Ltd. 2000 *DO 4 required*
Designed on Acorn Network Computer using Impression Publisher, Artworks, Photodisk and Casio DV-2600 Digital Camera with Surfbit DigiFlash reader

The NetManager will work with the oldest Archimedes through to the latest RISC OS machines including the RiscStation and NC!
See our NC advert on page 12

UK Sales
Precedence Technologies

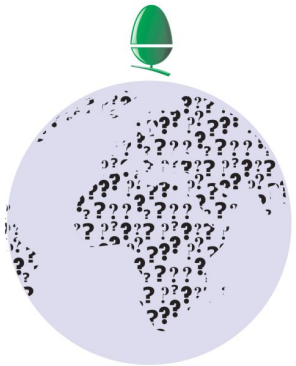
Address: Precedence Technologies Ltd
86 Kings Hedges Road
Cambridge
CB4 2PA
Tel: +44 (0)1223 562500
Fax: +44 (0)1223 563522
E-Mail: sales@precedence.co.uk
WWW: http://www.precedence.co.uk

Pricing
Prices include hi-specification server hardware, 10/100mbps network card and come ready installed with NetManager software.

Web Proxy/E-Mail Server:	£1,199
+ File/Print Server:	£1,399
+ NC and NCWorks suite:	£1,999
+ TotalFiler Site Licence:	£ 70
+ Network Computer System	£ 370

Prices exclude VAT

Are your Acorns confused about the rest of the world?



NetManager
Internet • E-Mail • Server • Solutions

The NetManager server and Citrix expertise from Precedence Technologies will get them talking the same language. Get a copy of our FREE 30-page ICT Planning Guide to find out how.

CITRIX

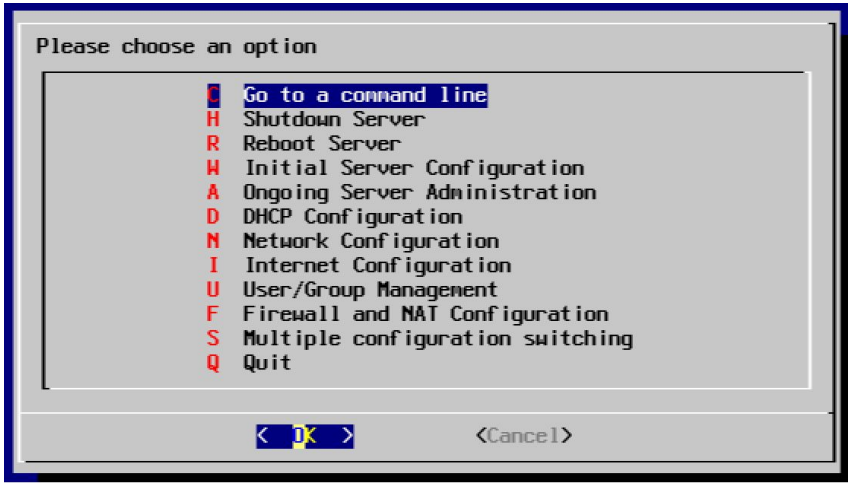
Precedence Technologies

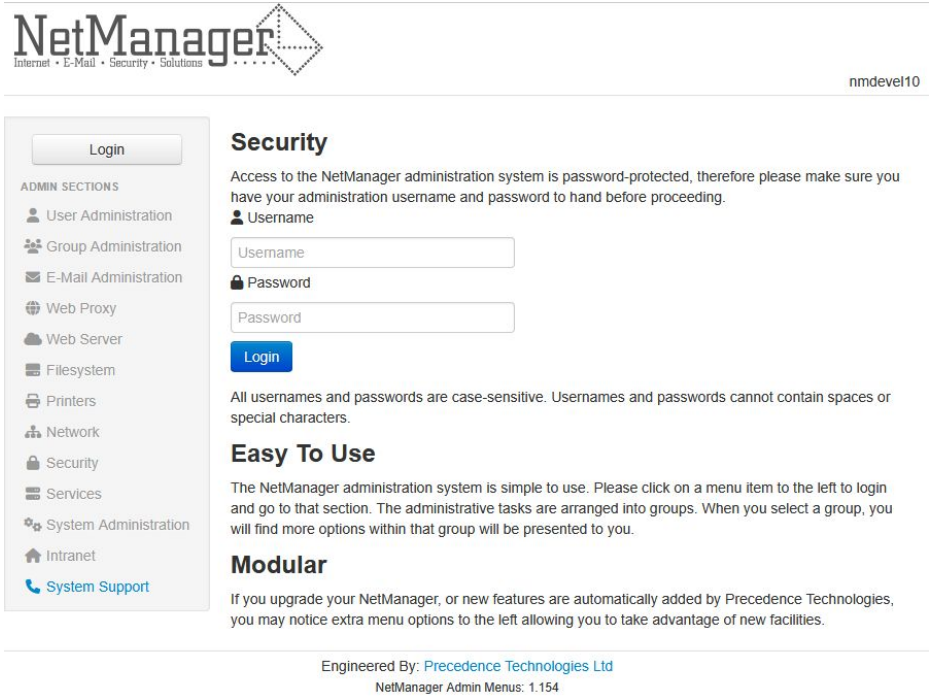
Precedence Technologies Ltd
86 Kings Hedges Road
Cambridge, CB4 2PA
Tel: +44 (0) 1223 562 500
Fax: +44 (0) 1223 563 522
http://www.getthemtalking.co.uk/
Email: info@getthemtalking.co.uk

NetManager NG

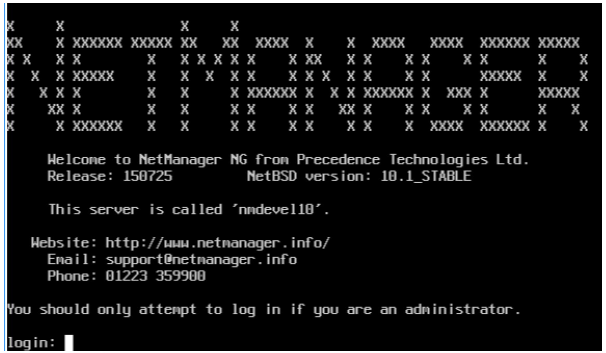
- Redesigned from ground up from Sep 2001 (when I took on my first employee)
- i386-only (but x64 since NetBSD 7)
- Originally design was all hand-configured with very basic web-administration
- NG uses centralised configuration mechanism
- Design still used today

CLI and Web administration





Admin interfaces



Custom Firewall Rules

Key: Edit | Move up | Move down | Delete | Add Above

Action	Direction	Protocol/s	From	To	To Port	Stop checking on match	
Allow	Incoming		10.9.0.0/24	Any	Any port	☐	
Allow	Incoming	TCP	10.0.0.0/16	62.149.33.154	3389 (MS RDP)	☐	
↪ ***Comment:*** *Allow RDP to AET*							
Allow	Incoming	TCP	10.0.0.0/16	194.168.169.156	22 (SSH)	☐	
↪ ***Comment:*** *Allow SFTP to AET*							

Alias Name	Delivery Addresses	Settings		
Jump to: j n p r t w z				
jbloggsnm	jbloggs@netmanager.info external	☑	Delete	Edit
john	jbloggs	☑	Delete	Edit
nonono	doesnotexist alias	☑	Delete	Edit
postmaster	root alias			Edit
root	sborrill vacation	☑	Delete	Edit
ttt	john alias, sborrill vacation	☑	Delete	Edit
webmaster	root alias			Edit
zzz	Will be re-sent from jbloggs@netmanager.info to sborrill@precedence.co.uk and stephen@stomphappy.org.uk external	☑	Delete	Edit

External time servers | Trusted networks | Clients using this server

External Time Servers

NTP server	Status	Last Sample	Action
192.168.1.254	Currently used	+98us	Edit Delete
	0.000050592 seconds fast of NTP time		Set time now
			Add

Main use cases (inc. historic)

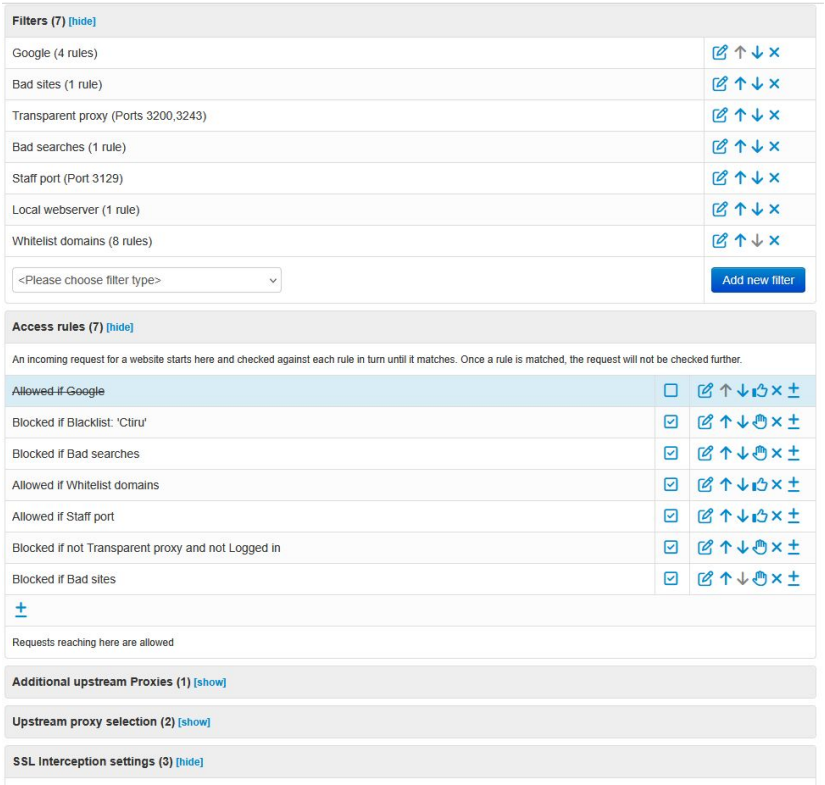
- Cross-platform file serving
- Web-based file access
- VoIP (including PSTN)
- Fax sending/reception
- Virtualisation
- Backups
- Email
- Calendars/contacts
- Remote access/VPN
- Firewall
- Web-filtering
- Intranet (LAMP-alike)

NetManager services

- Files = NFS/Samba/Netatalk
- iSCSI = istgt
- Web/webadmin = Apache
- SMTP = Sendmail
- IMAP/POP3 = Dovecot
- Web-proxy = squid
- Web-filter = e2guardian
- Firewall = IPFilter/NPF
- CalDAV/CardDAV = Radicale
- NTP = chronyd
- XMPP = prosody
- DNS = BIND
- DHCP = ISC dhcpd
- VPN = OpenVPN/IPSec
- Backup = rsync push or pull
- UPS = apcupsd
- Webmail = Roundcube
- Database = MySQL
- Spam filter = spamassassin
- Antivirus = ClamAV

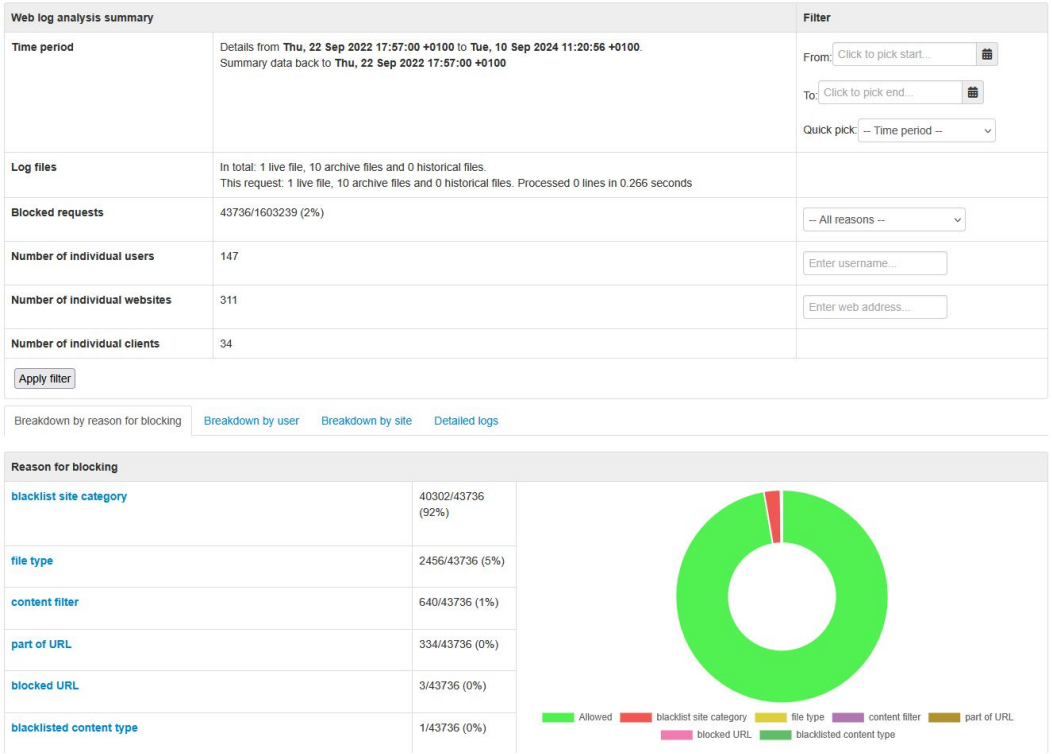
Web-filtering

- SSL interception
- Transparent proxying
- Content-filtering
- Blocklists (maintained)
- User authentication
- WPAD and .pac files



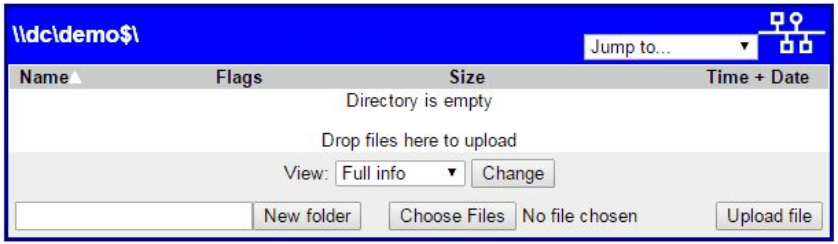
Web analysis

- Email alerts
- Analyse by
  - Site
  - User
  - Reason
  - Category



FileSurfer

- Web-based access to SMB shares
- Fully-aware of Active Directory (e.g. determining home area path)



NetManager architecture

- Base install of relevant NetBSD release with modules on top (some optional, e.g. Xen dom0)
- Curated set of pkgsrc packages
- Build scripts for configuration
- Many custom tools in /usr/local/sbin
- Mostly shell script, some PHP, some C
- Webadmin written in PHP

Lots of management tools

- Bulk user operations, including syncing to AD and password generation
- Email operations, e.g. redirect, vacation
- `runrsync`: Multi-generation backups with rsync (push and pull) and integated ZFS snapshots
- `ssltool`: Manage creation/issuing of SSL certs
- `makevpn`: Manage OpenVPN in bulk

NetManager configuration

- Central configuration file (/etc/netmanager/netman.conf)
- varname=”VALUE”
- Build scripts in /usr/libexec/build implement settings
- Webadmin written in PHP
- CLI configuration wizards

```
servername="netmanager"
domain_internal="mydom.internal"
interface_internal="bnx0"
iface_bnx0_ip="10.4.0.1"
iface_bnx0_sm="255.255.0.0"
iface_bnx0_type="static"
fwall_smtp="y"
iface_bnx1_type="static"
iface_bnx1_ip="80.81.82.220"
iface_bnx1_sm="255.255.255.248"
gateway="80.81.82.217"
domain_internal_master="y"
dns_complete="y"
domain_external="domain.co.uk"
samba_server_type="member"
samba_workgroup="WORKGROUP"
samba_pdc_name="dc01"
interface_vlan="vlan30:wm0:30"
iface_vlan30_type="static"
iface_vlan30_ip="192.168.30.254"
iface_vlan30_sm="255.255.255.0"
```

Build scripts

- One per service (roughly)
- Create configuration files and action the changes (e.g. ifconfig or reload service)
- May rely on other files in `/etc/netmanager` (e.g. dhcp leases or web-filtering rules)

antivirus
apache
appletalk
bootcfg
caldav
chrony
cleanup
crontab
dansguardian
dhcp
dialup
dns
fwall
imap
inetd
iscsi
jabberd
mysqld
nat
openldap
openvpn
pam
php
pine
ras
rsyncd
samba
sendmail
server
services
squid
ssh
ssl
syslog
ups
webadmin
wscons

Build scripts

- Detect installed software version (e.g. Apache/squid/samba) and adjust accordingly
- Support switching service entirely, e.g. imap-uw to dovecot, IPFilter to NPF
- Know all IP addresses, how they relate to the Internet connection, etc. so lock services down to trusted networks

Example


```
iface_bnx0_ip="10.4.0.1"
iface_bnx0_sm="255.255.0.0"
iface_bnx1_ip="80.81.82.220"
iface_bnx1_sm="255.255.255.248"
gateway="80.81.82.217"
nat="y"
firewall="ipf"
```

```
# grep map /etc/ipnat.conf
map bnx1 10.4.0.0/16 -> 80.81.82.220/32 proxy port ftp ftp/tcp
map bnx1 10.4.0.0/16 -> 80.81.82.220/32 portmap tcp/udp 40000:60000
map bnx1 10.4.0.0/16 -> 80.81.82.220/32
# cat /etc/rc.conf.d/npf
npf=NO
# cat /etc/rc.conf.d/ipfilter
ipfilter=YES
```

Example


```
iface_bnx0_ip="10.4.0.1"
iface_bnx0_sm="255.255.0.0"
iface_bnx1_ip="80.81.82.220"
iface_bnx1_sm="255.255.255.248"
gateway="80.81.82.217"
nat="y"
firewall="npf"
```

```
# grep map /etc/npf.conf
map bnx1 dynamic 10.4.0.0/16 -> 80.81.82.220
# cat /etc/rc.conf.d/npf
npf=YES
# cat /etc/rc.conf.d/ipfilter
ipfilter=NO
```

build_server

- Each build script declares what configuration variables and files it is in interested in
- `build_server` compares changed values/files and only runs the relevant build scripts
- `build_server -f` does forced rebuild

Updating NetManager

`updateserver` script does the following

1. Checks whether update scripts are up-to-date
2. Updates NetManager modules that are out-of-date (e.g. kernels, build scripts, webadmin)
3. Updates/removes packages to sync with list (force add/remove) - will also switch to those to match OS version
4. Rebuilds settings with `build_server -f`

Modular

CLI menus and webadmin options are dynamically built based on what modules are installed. A module can install:

- build scripts
- CLI widgets
- pkgsrc packages

e.g. Proxy content filtering installs e2guardian from pkgsrc, a build script to configure it and analysis components for webadmin

Tracking NetBSD

- Very conservative, tend to run only odd-numbered releases (1.6, 3, 5, 7, 9)
- Forced to use 10 because of support for ParaVirtualised (PV) Xen domU removed from XenServer and only 10.x supporting HVM mode
- Follow release branch (and have vested interest as on `releng@NetBSD.org`)

Release cadence

- Roughly quarterly as track pkgsrc branches
- Build for 2 OS releases (usually N and N-2) to cover customers not yet upgraded
- NetBSD and pkgsrc support N and N-1, so our N-2 releases require some backporting
- If pkg won’t build on N-2, build scripts deal with legacy version just fine

Updating operating system

NetBSD uses install sets (e.g. base, comp) with checksums and contents held in `/etc/mtree`

`updateos` uses these to do operations such as:

- Check files on disk have not changed (preen mode)
- Add/remove install sets (e.g. remove X, add debug)
- Download/extract only changed sets from Internet

Challenges

- “It’s proprietary”
  - “It is built on open-source and is an open platform. You have full root access”
- “We have a different firewall now”
  - “There’s plenty of other things it can do such as backup”
- Maintaining compatibility with current servers (Lenovo for choice)
  - Put in PCIe Ethernet
  - Port FreeBSD drivers (aac SCSI, Digium TDP400)

Thank you

References:

- Running Unix/Linux on Acorn computers (London BCS meeting 2019)
- Building products with NetBSD - thin-clients (EuroBSDCon 2007)

Links:

https://www.borrill.org.uk/stephen/presentation/