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**APM**

## **APM Network Administration Procedures**

**Chris Mayers**

### **Abstract**

APM requires a reliable network infrastructure to run its business.

This document describes the procedures for administering the APM network: its cabling, LAN and WAN connections, and network routing. Refer to other APM documents for details of other administration procedures.

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# **APM Network Administration Procedures**





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# 1 Introduction

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## 1.1 Audience

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This document is intended for all those involved in administering the APM data communications network. It is also intended for those who are not primarily responsible for administration, but need a general understanding of its operation.

## 1.2 Scope

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The following are outside the scope of this document:

Note: Add References for each of these as they are written

- APM phone system (voice only) and fax lines
- Machine/OS administration (see [System Administration])
- User administration (see [System Administration])

and also network services and their administration:

- E-mail
- ftp
- WWW
- News
- Printing

Note: Perhaps include the printers themselves in these maps?

- File servers
- Backup and restore (see [Backup/Restore])

and also applications and their administration:

- Document preparation
- Software development

Note: Others TBD

## 1.3 Status

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This is a draft.

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## 2 APM LAN connections

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### 2.1 Overview

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The logical topology is a single interconnected LAN consisting of:

- an insecure 'external' LAN connected to the Internet
- a secure 'internal' LAN

The 'internal' LAN consists of an Ethernet LAN and an Appletalk LAN, which are gatewayed.

The internal Ethernet has connected:

- Unix workstations
- X terminals
- PCs
- some printers
- some Macintoshes

The internal Appletalk has connected:

- some Macintoshes
- some printers

The APM LAN uses only TCP/IP network protocols on Ethernet, and LocalTalk on Appletalk.

Note: Need a diagram of the topology here

Note: More discussion of security policy needed here

Note: Each section, to have a troubleshooting section (known problems)

Note: Add contact names and addresses

Note: Add other sources of information (mailing lists, newsgroups)

### 2.2 Cabling overview

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The APM LANs use only thin-Ethernet and Appletalk cabling. The cabling is run under the false floor. (There is thick-Ethernet cabling remaining under the false floor, but it is not connected, and there is no further reason to use it.)

### 2.3 Ethernet

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The APM internal Ethernet consists of 3 thin-Ethernet segments, connected via a multi-port bridge.

The bridge has 4 thin-Ethernet ports, plus a thick-Ethernet port. The fourth thin-Ethernet port and the thick-Ethernet port are not in use. At some stage

the fourth thin-Ethernet port might be used for a demonstration or training network.

Some workstations are equipped with thick-Ethernet or twisted-pair Ethernet ports. These workstations are connected to the thin-Ethernet LAN via convertors.

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## **2.4 Appletalk**

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To be supplied

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## **2.5 Appletalk to Ethernet gateway**

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To be supplied

Note: Connection of printers to Appletalk and Ethernet?

Note: Need to discuss which facilities are available in which direction?

Note: Known problems?

Note: Functions of Gator box?

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## **2.6 APM LAN Map**

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Note: Don't know if this map is to scale

Note: Ethernet layout may have changed slightly

Note: Should include Appletalk here too

Note: Should include external LAN here too

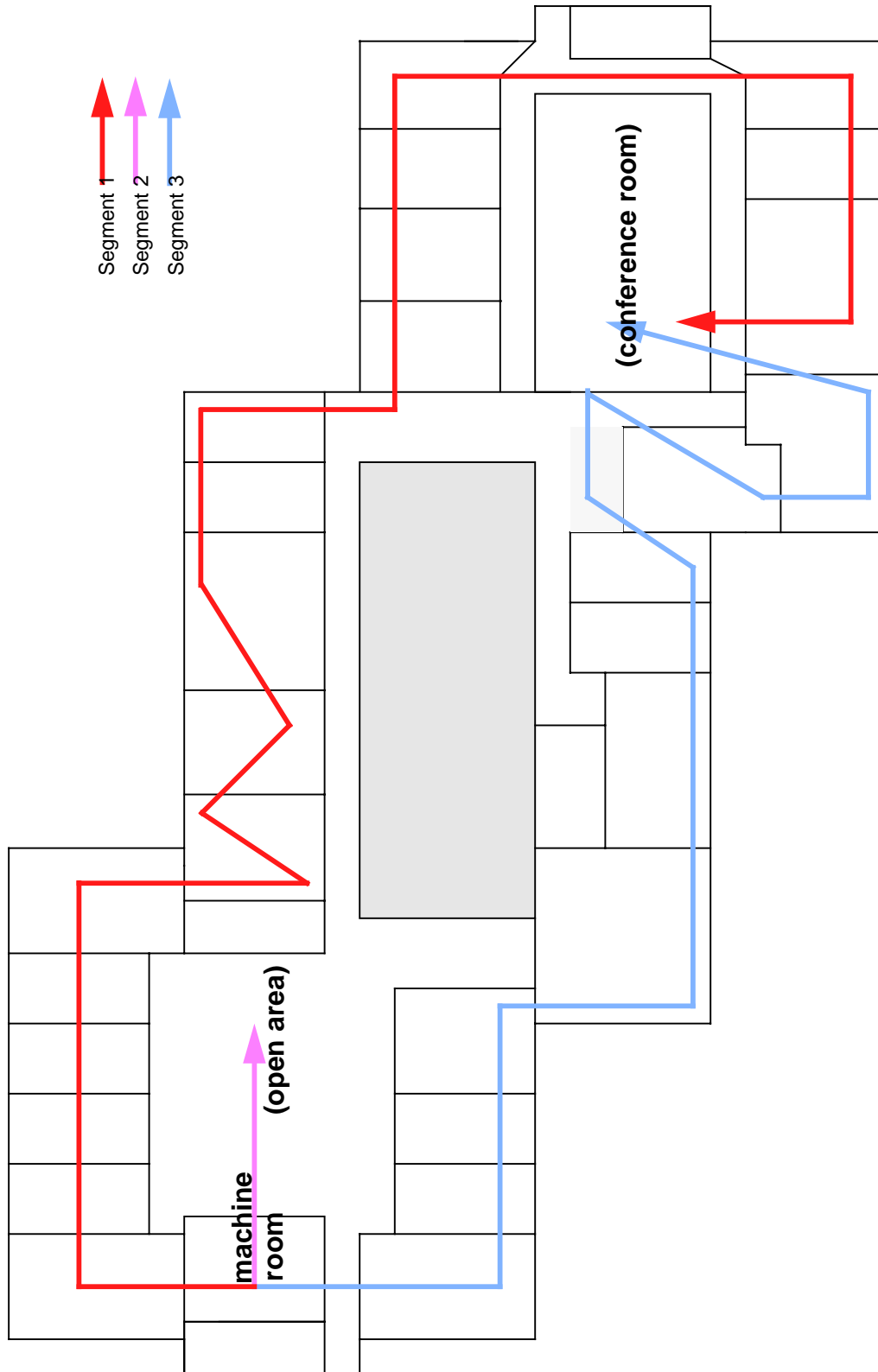


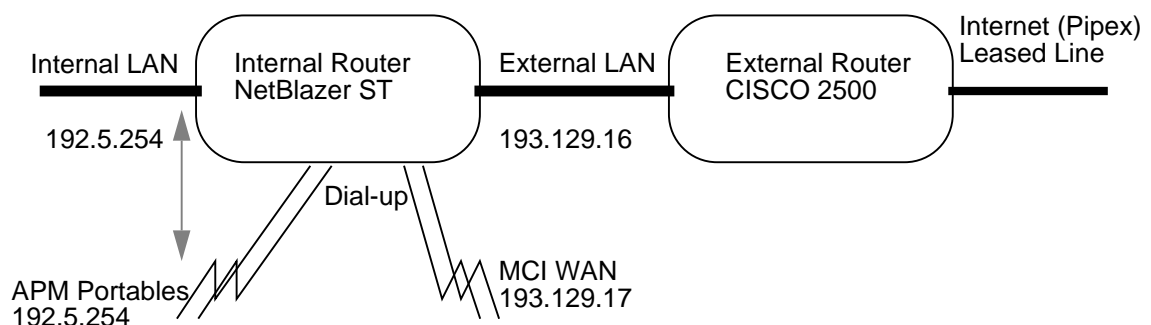
Figure 2.1: APM Internal LAN Map

## 3 APM WAN connections

### 3.1 Overview

The APM network uses two routers to support a permanent leased line and dial-up/dial-back connections.

**Figure 3.1: APM WAN routing**



Note: Ought to use standard network symbols here

The internal router is the firewall between APM and the outside world.

### 3.2 Permanent connections

Note: Need contact information here

APM have a leased line, which connects APM to the (global) Internet.

The service is provided by Pipex. They subcontract the provision of the leased line. We pay a flat rate for the service per year, irrespective of usage.

The service operates at 64 Kbaud, using a leased line, provided by Cambridge Cable. At our end, Cambridge Cable provide a leased line 64 Kbaud modem, and Pipex providing a router. These remain the property of Cambridge Cable and Pipex respectively.

(Originally, a different leased line was supplied by BT, and ran at 14,400 baud. The wall-box is still connected, but the line is not.)

### 3.3 Dial-up connections

#### 3.3.1 Usage

APM provide dial-up connections to support PC and Macintosh users outside the building. As well as APM/ANSA members, the dial-up connections support other members of the MCI project. Members of the MCI project are provided with e-mail facilities only, and should not have access to the internal LAN. (Currently this restriction is not enforced by the routing tables; it could be done, but would require a separate routing rule for each machine.)

#### 3.3.2 Phone lines

All the dial-in connections are protected by dial-back security. One dedicated phone line is used for dial in. Three lines are used for dialling the caller back, thus supporting three concurrent dial-in users. This appears to be adequate.

All the dial-up phone lines are provided by BT. There would be no functional advantage is switching these lines to the (voice) Cambridge Cable Centrex service, since these lines do not require Centrex services. (It is possible that there might be a cost saving.) They are all direct lines.

**Table 3.1: Dial-up**

Direction	Number	Router Line number	Comments
Dial-in	464660	TBD	
Dial-out	303074	11?	
Dial-out	301597	13	Not normally connected. Used for tests, and special dial-back
Dial-out	302791	12?	

Note that dial-back requires that the router know the phone number to dial a user back. If a user is travelling, this can be inconvenient; it needs advance planning - see §3.4.2.5 *Adding new dial-back locations*.

#### 3.3.3 Modems

##### 3.3.3.1 Dial-in line

This uses a US Robotics Sportster V.32bis modem, configured to work at 2400 baud.

##### 3.3.3.2 Dial-out lines

We currently use Courier V.32bis modems for the dial-back lines, thus supporting 14,400 baud. Performance is adequate, and we have no plans to upgrade to V.34 (28,800 baud).

Note: Also have one Telebit Trailblazer 32

##### 3.3.3.3 Remote modems

Users dialling in are supplied with US Robotics Sportster V.32bis modems. Again, performance is adequate.

Note: SLIP and PPP connections?

Note: Describe script configuration at the user end?

PC users should not be supplied with Courier V.32bis modems for dialling in. This is because:

- many PCs (particularly portables) are equipped with serial ports that use the 8250 or 14550 UART. These serial ports cannot run reliably at faster than 9600 baud
- the Courier V.32bis modems have an unusual way of setting its serial port speed. When receiving a dial-back, if the serial port speed is lower than the line speed (14,400 for V.32bis) it will set the serial port speed to the line speed. This usually will be faster than the UART can handle

Macintosh users can use the Courier V.32bis modems, because the Macintosh serial port can run at 38400 baud, and the Courier will not then adjust the serial port speed.

---

## 3.4 Routers

### 3.4.1 Routing protocol

The APM network uses the RIP protocol for routing. This is the earliest and simplest of the TCP/IP routing protocols. If the APM network grows much larger, it may be appropriate to use a more modern routing protocol

To allow workstations to route using RIP, a routing daemon must be loaded:

- for HP workstations, `gated`
- for Sun workstations, `routed`

(In fact `gated` handles a wide range of routing protocols; `routed` only handles RIP.)

For PCs no special software need be loaded; RIP is handled by the PC/TCP TCP/IP kernel.

Note: What about Macintoshes; is this handled by the Gator box?

No RIP administration should be necessary for any of these machines; these machines simply listen for RIP information. The administration is carried out on the two APM routers (internal and external).

RIP changes take place automatically every 30 seconds. In most cases this causes no problems, but see §3.4.2.2 *Routing for dial-back locations*.

### 3.4.2 Internal router

The internal router is a [NetBlazer ST]. It is basically a PC chassis, running a specialized program.

The internal router currently routes between:

- the 'internal' Ethernet
- the 'external' Ethernet
- dial-up connections

The NetBlazer ST has no spare ports; some of the dial-up connections are not used, but there is no room to add another Ethernet port, for instance.

The NetBlazer ST is responsible for broadcasting RIP information.

### 3.4.2.1 *Configuring the NetBlazer ST*

The router's tables can be reconfigured remotely, using the `telnet` program. Refer to [NetBlazer ST] for instructions. Refer to the APM Network Administrator for the NetBlazer ST password.

**Note:** Because of the security policy, need to say more about password change and so on.

The router configuration is held in memory in the router. There is a router command to save the configuration to the router's 3.5 inch diskette drive. A diskette is kept in the drive. Because correct routing is vital to the running of the APM network, after every configuration change, the configuration must be saved to the diskette. A copy of the diskette should also be made, and placed in the fire safe.

**Note:** Is the diskette also used to boot the router? Is the diskette in DOS format? (yes, yes)

For bulk configuration changes, it may be easiest to ftp the files to a Unix machine and edit them there:

```
ftp gatekeeper
root
<password>
binary
mget *
```

The file `STARTUP.CNF` contains the router commands for the saved configuration. This is a ASCII text file and needs `unix2dos` conversion for editing under Unix.

### 3.4.2.2 *Routing for dial-back locations*

There are several ways that routes can be set up for dial-back locations:

- **statically:** in this case, routing is permanently enabled to the dial-back location. If an attempt is made to transmit to that location when it is not currently dialled-up, the NetBlazer ST will simply discard packets.

Static routing cannot be used for portables which may be connected to the APM internal LAN, because the static route would conflict with the Ethernet broadcast routing using ARP.

- **dynamically, using RIP:** in this case, the routing is disabled until a connection is dialled-up; then it is enabled. Once enabled, the NetBlazer will broadcast RIP information for the route.

We have chosen not to employ dynamic routes using RIP. This is because the RIP information takes 30 seconds to propagate, and we anticipate that this might cause problems immediately after a connection is made

- **dynamically, using proxy ARP:** in this case, the routing is disabled until a connection is dialled-up; then it is enabled. Once enabled, the NetBlazer will respond to ARP requests (proxy ARP) on behalf of the dialled-up machine.

We have chosen to employ routing using proxy ARP.

### 3.4.2.3 *Default routing and dial-back locations*

Unfortunately, using dynamic routing for dial-back locations causes a routing loop if the location is not dialled up. This happens as follows:



- some machine attempts to transmit to a dial-back location that is not dialled-up
- the NetBlazer ST determines that the dial-back location is not dialled-up; the route is disabled, and the default route applies
- the NetBlazer ST default route is to the Cisco 2500 external router
- the Cisco 2500 default route is back to the NetBlazer ST

There is no reasonable way to fix this problem, because the NetBlazer ST has no way of setting a default route per interface; the default route applies to all interfaces on the router.

However, there is no real reason a machine should attempt to contact a dial-back location whilst it is not dialled up, and it is bound to fail. Furthermore, the routing loop is localized, and does not take to resolve. We therefore do not plan to fix this problem.

#### 3.4.2.4 *Dial-back for APM portable Macintoshes*

Because of the operation of the Appletalk router (§2.5 *Appletalk to Ethernet gateway*), it is not possible to use the same Internet address for dial-back as is used when the machine is connected to the APM internal LAN.

Two addresses are allocated to each of these machines, and users must reconfigure the Macintosh when changing between dial-up and APM internal LAN.

#### 3.4.2.5 *Adding new dial-back locations*

Adding a new user to the WAN normally requires these steps:

- adding the machine to the MCI domain: this is described in [System Administration]
- adding an account for the user to the external e-mail machine: this is described in TBD
- adding a new dial-back location.

This step is the same for APM portables and MCI users, and is carried out as follows

- TBD
- Allow dial-out from this interface: N

Note: N is correct

- Chat Script: default

The phone number for the dial-back location should be entered as follows:

- if a Cambridge local number, just the number. These dial-back calls will be handled by BT
- if outside the Cambridge area, enter the Mercury access code (131), the PIN, and then the cost centre code (used for billing APM):

**Table 3.2: Mercury cost centre codes**

Cost centre code	Use for
00	Do not use
01-03	Obsolete; do not use
04	APM out-of-area portables (dme, jab, iam)

**Table 3.2: Mercury cost centre codes**

Cost centre code	Use for
05	MCI
06-255	Spare

Strictly speaking a Mercury PIN should only be used on a single line; in practice this does not seem to be enforced. It is possible that in future Mercury will encourage customers to move to 132, which does have caller ID, but does not support cost centres. There is no reason why we should wish to do so

#### 3.4.2.6 *Removing dial-back locations*

Unused dial-back locations pose a security risk, and should be removed. This is straightforward; refer to [NetBlazer ST].

#### 3.4.2.7 *Special dial-up*

Line 13 is sometimes used for dial-up when travelling. This does not use dial-back, so is less secure. This line is normally disconnected.

This interface uses a restricted login shell which only allows telnet to the external mail hub. This telnet mode can be used by Eudora for the Macintosh; see TBD.

**Note:** This is not a satisfactory long-term solution. It might be preferable to use a .forward file and a foreign Internet service provider while travelling abroad for extended periods.

#### 3.4.2.8 *Protocol filtering*

Note that if the protocol filters are set to prevent telnet access to the NetBlazer ST itself, it will no longer be possible to configure the NetBlazer ST remotely; it will be necessary to connect a VT100-compatible terminal to the console port. Take care when reconfiguring the protocol filters!

**Note:** Need more detail here

#### 3.4.2.9 *Monitoring the NetBlazer ST*

The system log is currently held on crippen.

**Note:** Need instructions here for examining the syslog for security issues

#### 3.4.2.10 *Known problems with the NetBlazer ST*

The NetBlazer ST has had recurrent problems with its internal power supply; the fan bearings tend to seize once every 9 months, causing the power supply to fail. For this reason, we have jury-rigged the power supply outside the case, with some ducting and tape to ensure air flow. This is unsatisfactory, but adequate. We also have a spare power supply, if this fails again.

The NetBlazer ST is suspected to have a software memory leak, causing it to crash regularly about once every 2 months. The solution is as follows: once every 6 weeks, after checking that the router configuration has been saved to diskette, reboot it at a convenient moment

Initially there were also problems with the NetBlazer ST software. We are not running the latest version of the software, but have no need to upgrade, and no plans to do so.

**Note:** Which version are we running, and how do you find out? I understand that Version 3 is

### 3.4.2.11 *NetBlazer ST repair and maintenance contracts*

The NetBlazer ST is not covered by a maintenance contract. We investigated this with Chernikeef, but the cost was unacceptable.

Note: Contact information? Also try Telebit for a maintenance contract?

Unfortunately the NetBlazer ST is also a single point of failure with unpleasant consequences. Apart from the §3.4.2.10 *Known problems with the NetBlazer ST*, other permanent failures would be difficult to circumvent. The consequences of permanent failure would be:

- loss of dial-up connectivity for APM Portables and the MCI WAN
- loss of Internet connectivity, including external e-mail
- loss of some services on the internal LAN. (We have noted that when the NetBlazer ST fails, the APM DNS server stops working; it is not clear why.)

We have tolerated such failures for a period of a few hours, or over a weekend; longer periods would have more serious consequences. Loss of Internet connectivity for 3 days or more will cause e-mail to be undelivered.

One temporary means to circumvent the problem would be to:

- disconnect the external LAN
- reconfigure the external router to include the internal router filtering

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**Figure 3.2: APM WAN routing - temporary emergency configuration**

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This temporary circumvention would be tricky in practice, particularly under pressure. It would also have these limitations while in action:

- loss of dial-up connectivity for APM Portables and the MCI WAN
- loss of external LAN for customers (ftp and WWW services)

Even purchasing a new router might be difficult:

- the NetBlazer ST is an old model
- we would need to convert the routing information to the format needed by any new router

Note: Recommendation for further study. It might be worth upgrading the NetBlazer ST software just to make emergency reconfiguration easier.

### 3.4.2.12 *Other sources of information for the NetBlazer ST*

Note: Add mailing lists, etc. here

### 3.4.3 External router

The external router routes between:

- the 'external' Ethernet
- leased line connection (Internet)

The Cisco 2500 does not broadcast RIP information.

#### 3.4.3.1 *Configuring the Cisco 2500*

Unfortunately the Cisco 2500 is supplied without manuals. All the documentation is on CD-ROM, as is the software to browse the documentation.

The configuration of the Cisco router is held in non-volatile RAM within the router. Creating a backup copy is not straightforward.

Since the router is owned by Pipex, the simplest approach is to request that Pipex make all changes to its configuration. They have the means (and responsibility) for backup and restore of its configuration.

Refer to the APM Network Administrator for the Cisco 2500 password. If for any reason you wish to change the configuration yourself, inform Pipex both before and after you make the changes, so they can take a new backup.

The Cisco 2500 has an RJ-45 port via which it can be configured. This requires an RJ-45 to RS-232 converter lead which is in the box in the machine room. There is no reason why we should wish to configure it in this way, though.

Note: `wr mem` to copy to NVRAM, `wr term` to display on terminal for telnet

#### 3.4.3.2 *Protocol filtering*

To be supplied.

#### 3.4.3.3 *Monitoring the Cisco 2500*

Note: What about monitoring any log?

#### 3.4.3.4 *Recovery from power failure*

The Cisco 2500 has no lights at all, not even a power light!

After a power failure, the Cisco 2500 and its modem should recover automatically, after about a minute; during this time a ping will give "host unreachable". The sequence should be as follows:

- the modem goes through its self-test and displays TBD
- the TXD light starts flashing
- the RXD light starts flashing

The connection should then be operating normally.

#### 3.4.3.5 *Cisco 2500 repair and maintenance contracts*

The Cisco 2500 is owned and maintained by Pipex (their serial number 700).

Note: I have the number 01223 502823 as an out-of-hours contact. This may be a personal number, though.

### 3.4.4 **Diagnosing routing problems**

The following commands may be useful. Refer to the Unix manual pages for details:

- `ping`
- `netstat -r`

- etherfind

### **3.5 ISDN**

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Note: Need reference and phone number here

The ISDN connection is provided by BT. It is still connected, but we are not currently making use of it, therefore it is not shown in figure §3.1 *APM WAN routing*.

The ISDN connection was previously used for an HP secondee to log in to HP Bristol. It was connected to the external Ethernet via a dedicated PC server (bouncer) running SCO Unix. This server used proprietary protocols to bridge TCP/IP over ISDN. This server is the property of HP, and is being returned to them.

We have no future plans for this link, except that it may be used for video-conferencing equipment (possibly hired for short periods).

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## 4 Domain Name Service (DNS) Administration

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### 4.1 Domain registrations

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APM are responsible for administering the following domains:

- ansa.co.uk
- mci.org (on behalf of the MCI project)
- innova.co.uk (on behalf of Innovation Accounting)

APM are also applying for registration for:

- ansa.org
- objectlab.org
- apm.co.uk

The domain ansa.com is already registered by another unrelated organization.

### 4.2 Network registrations

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APM are responsible for the following networks:

- 192.5.254.xxx (Class C)
- 193.129.16.xxx (Class C)
- 193.129.17.xxx (Class C)

### 4.3 DNS administration

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For background information, see [DNS].

To be supplied.

Note: Much of this is to do with adding and removing machines, so machine administration might be worth adding here.

Note: Multiple DNS servers?

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## References

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[NetBlazer ST]

NetBlazer ST Installation Guide  
90226-01

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TCP/IP Network Administration - Craig Hunt, O'Reilly & Associates  
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[Backup/Restore]

APM Backup and Restore Procedures  
APM.1099

[System Administration]

APM System Administration Procedures  
APM.1569

