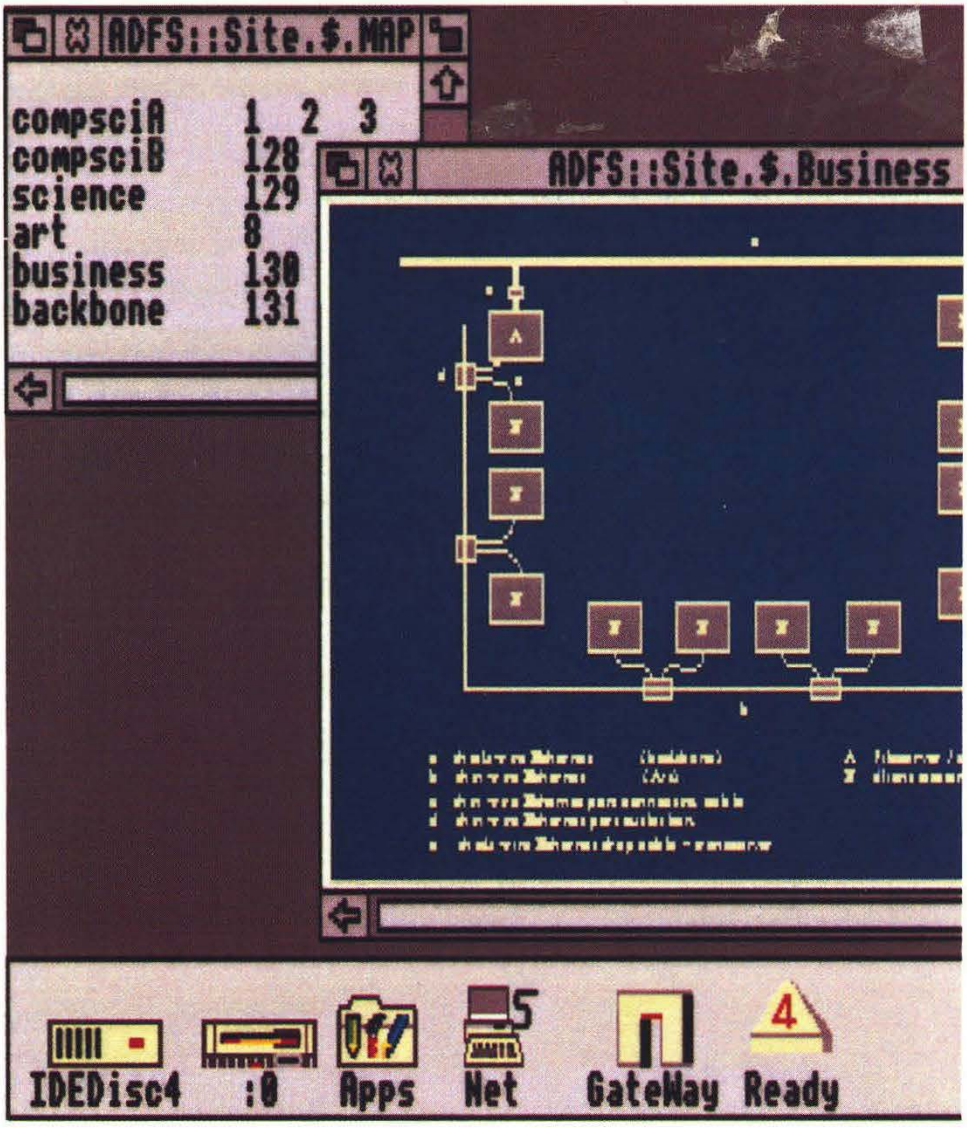
# AUN Manager's Guide

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# Contents

# About this guide

This guide is written for a network manager running or establishing a network to which RISC OS computers are connected. It tells you how to install and maintain the accompanying AUN software.

It doesn't tell you how to use the software. This is because the user interface is identical to that used by existing Econet software, which is fully described in the guides supplied with your computer. If you're not already familiar with this software you – and your users – should refer to the RISC OS 3 *User Guide*.

It likewise doesn't provide detailed information about installing and maintaining Econet or Ethernet, or any other specific network type. This information is available from other sources via your Acorn Network Dealer. Finally, it gives little specific guidance about the physical design of a site-wide network, since this will vary widely depending on the layout and requirements of the site. Again, this is a matter for consultation between you and your Acorn Network Dealer.

## Conventions used

Certain conventions are used in this guide:

### Typefaces

`Courier` type is used for the text of example files and commands. Since all characters are the same width in Courier, this makes it easier for you to tell where there should be spaces.

**`Bold Courier`** type is used in some examples to show input from the user. We only use it where we need to distinguish between user input and computer output.

### Command syntax

Special symbols are used when defining the syntax for commands:

- Italics indicate that you must substitute an actual value. For example, *`filename`* means that you must supply an actual filename.
- Braces indicates that the item enclosed is optional. For example, `[K]` shows that you may omit the letter 'K'.
- A bar indicates an option. For example, `0|1` means that you must supply the value 0 or 1.

## Finding out more

For details of how to set up and maintain your computer, refer to the *Welcome Guide* supplied with your computer. The *Welcome Guide* also contains an introduction to the desktop which new users will find particularly helpful.

For details on the use of your computer and of its application suite, refer to the guides supplied with it – such as the RISC OS 3 *User Guide*.

## Reader comments

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# 1 Introduction to AUN

The AUN software that this guide describes forms the core component of Acorn's new networking strategy, called *Acorn Universal Networking* (AUN). AUN uses an industry standard method of passing data over a network: a protocol called TCP/IP.

AUN uses the TCP/IP standard in such a way as to retain Econet's existing interfaces – both to users and to programs – so your users won't need to learn new skills, and your existing network programs should continue to work. AUN will work over your existing Econet network. However, it also gives you access to the wide range of networking technologies that support TCP/IP, and consequently a choice of prices and performance. For example, it gives you access to Ethernet, which offers a far higher performance than Econet, and which also – like TCP/IP – offers the benefits of being an industry standard.

Consequently, any migration from Econet to a faster technology such as Ethernet can be done on a step-by step basis, as required and as budgets allow, with minimum disruption. You can replace parts of your Econet with Ethernet, or add new segments of Ethernet; the only apparent change will be in the network's speed. Your investment in existing equipment and training will be maintained.

AUN enables you to transparently link together different networks – such as Econet, Ethernet, and third party networks – to build up a truly site-wide network system. However, AUN can also meet more modest requirements; a network may consist of as little as a single segment of Ethernet cable joining two or three machines on a benchtop, with a single machine doubling as a file and print server.

Furthermore, AUN's use of the TCP/IP standard supports the concept of Open Systems. Your Acorn machines – such as Level 4 FileServers – can now co-exist on the same network as other machines that use TCP/IP – such as UNIX workstations and NFS file servers. You can follow this path by using AUN in conjunction with its sister product, the TCP/IP Protocol Suite; this is described in an Appendix to this Guide.

Finally, AUN has been designed with an eye to the future, to preserve your investment as long as possible. In particular, it has been designed so that as new and faster networking technologies become available, support for them can easily be added, either by Acorn or by a third party.

## Using an AUN network

As stated above, a key feature of the AUN software is that **its user interface is the same as that used by existing Econet software**. The only change to software that you'll notice is that the network is now referred to as a 'Net' rather than as an 'Econet'. Your users can continue to refer to file servers and to print servers by the same names that they've always used.

Your investment in your users' skills and training is not lost. As you adopt improved networking technology that offers higher speeds and capacity, your users can immediately benefit from and use it. All they'll notice is that things have got faster!

The only restriction is that – for certain types of file and print servers – your users may have problems if they refer to them by their two byte *net.station* numbers rather than by their names. **You should ensure your users refer to servers by name**.

For details on using existing Econet networks and AUN networks, refer to the guides supplied with your computer, such as the RISC OS 3 *User Guide*.

## AUN concepts

The basic structure of an AUN site network is one of physically distinct networks, typically associated by location and function with a particular room, department or curriculum area. Adjacent networks are interlinked via gateway stations (described below), which pass messages between the two networks.

### Networks

A *network* is a physical network of a single type (e.g. Ethernet, Econet). A network is delimited by any *gateway stations* used to connect it to other networks. For more information on gateway stations, see the section below entitled *Stations*.

#### Network names

Each network must have a unique name. Network names are not seen or handled by users; they are only used to configure the software for your site.

You'll find it easiest if each network's name identifies its location within your site. For example, you may choose to use the name of the department that each network services:

```
compsciA
compsciB
science
art
business
```

## Nets

A *net* is a part of a network that appears to the user as a single entity.

In both Econet and Ethernet, individual segments of a physical network can be linked together by a *bridge*. However, there is a difference between the two:

- Two bridged Econets remain distinct from each other, and so constitute two distinct nets. Hence in an Econet based network there may be several nets: the initial net, and an extra net for every bridge added.

  For an example see the diagram on page 18. The compsciA network is made up from nets 1, 2 and 3, which are three Econet segments connected by a bridge.

- Two bridged Ethernets appears to users to be a single Ethernet, and so constitute a single net. Hence in an Ethernet based network there will always be one net; in other words, the net and the network are one and the same thing.

  For an example see the same diagram on page 18. The science network and net 129 are identical, and consist of the same two bridged Ethernet segments.

It is important that you grasp the distinction between a net and a network; this guide will rigorously distinguish between the two.

### Net numbers

Each net must have a unique number.

For an Econet the net number must be between 1 and 127.

- If the net is a part of a larger Econet network linked together by bridges, its net number will already be set in the bridge, and you should use the same net number for AUN.
- If the net is not connected to any other Econets (i.e. there aren't any bridges on the net) it will not have a net number assigned to it; under native Econet it will just use the default net number of 0. However, for AUN you must assign it an otherwise unused AUN net number in the permitted range 1 - 127.

For types of net other than Econet (e.g. Ethernet) the net number must be in the range 128 - 252. If such a net is the **only** net on the site (i.e. the whole AUN network consists of a single non-Econet net, such as Ethernet), you need not set up a net number. It will use net number 128 by default, but – since it is the local net for all stations – you can also refer to it as net 0, in line with Econet convention.

Net numbers 0, 253, 254 and 255 are reserved.

## Stations

A station is a computer connected to a net. There are two types of AUN stations.

### Client stations

A *client station* has a **single** AUN-configured network interface with which it is connected to a net.

Client stations will form the vast majority of stations in each net, and are typically used as personal workstations.

### Gateway stations

A *gateway station* has **two** AUN-configured network interfaces with which it is connected to a net in each adjacent AUN network. It relays messages between these two networks via the interfaces. The networks may be of different physical types (e.g. Ethernet and Econet). There may only be a single gateway between any two networks.

A gateway station, like a file server or a print server, is an important part of your site's network infrastructure. All have important configuration files that must be kept secure from users; they should not normally be used as personal workstations. You can combine some or all of these functions in a single station; see the section entitled *Using a station both as a gateway and as a server* on page 14.

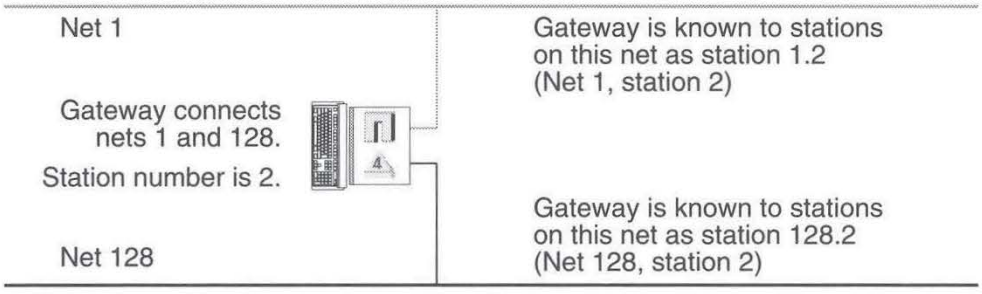
### Station number

Each station must have a number, which must be between 2 and 254. Station numbers 0, 1 and 255 are reserved.

A station number must be unique on the net(s) to which the station is connected. However, for convenience we recommend that you give each station a number that is unique within your site. You will then be able to move stations from one net to another without station numbers ever clashing. For example, if you have fewer than ten nets on your site you might organise your numbering scheme so that client station numbers on each net increment in units of ten, each net starting from a different base number:

| Net number | Station numbers |
|---|---|
| 1 | 10, 20, 30, 40, 50, 60, 70, 80 etc. |
| 2 | 11, 21, 31, 41, 51, 61, 71, 81 etc. |
| 3 | 12, 22, 32, 42, 52, 62, 72, 82 etc. |
| 128 | 13, 23, 33, 43, 53, 63, 73, 83 etc. |

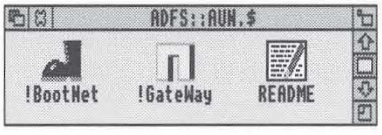
A gateway will have the same station number on both connected nets:




A gateway station's number must therefore be unused by any other station on either net. One way to ensure this is to reserve a range of otherwise unused numbers for use by gateway stations. For example, in the above scheme numbers 2 - 9 are free and so could be used for gateways.

## Software

The software is supplied on a single disc:




The BootNet application is used by client stations, and the Gateway application by gateway stations. Each application contains RISC OS modules, and boot files to load them when a computer is first switched on.

The README file gives extra information; you should read it.

## Machine requirements

AUN software runs on any Acorn computer with 1 Mbyte RAM or more, under RISC OS 3 (version 3.10) or later.

Client stations fitted with a network interface that has an AUN client ROM load all the software from ROM. Other client stations must load the software either from an Econet file server on the same network, or from a local disc; a standard 800K floppy disc drive is sufficient.

A gateway station will always need to load software from a local disc; again, a single floppy drive is quite adequate for this purpose.

### Memory usage

The basic AUN software takes up just under 200 Kbytes of memory, including its workspace. If your network stations are only fitted with 1 Mbyte of memory, you may find that too little memory remains available for your purposes once the AUN software has been loaded. In such cases, you will need to add memory upgrades.

#### Gateway stations

A gateway station uses a different, extended version of the AUN software. This requires some 500 Kbytes of memory as a minimum, but can be configured to use more memory if required.

## Coexistence with existing machines

### Econet

A station connected to Econet can communicate with other stations connected to the **same** network whether or not they are configured for AUN. Thus:

- Stations not configured with AUN software – such as BBC and Master 128 computers – can continue to communicate with stations and file servers that are AUN-configured – such as Level 4 FileServers.
- Stations configured with AUN software can continue to communicate with stations and file servers that are not AUN-configured – such as Level 3 FileServers and FileStores.

However, a station connected to Econet can communicate with a station on a **different** network (i.e. one on the other side of a gateway) only if **both** stations are configured with AUN software.

#### Using redundant Econet interfaces

Stations that do not have their Econet interface configured for AUN may still use it as a native Econet interface. However, there is a restriction: you can do this either for client stations, or for file servers, but not for both at the same time.

For example, a client station with an AUN-configured Ethernet interface may also have a non-AUN-configured Econet interface, so that it can continue to access existing FileStores on an adjacent Econet. Alternatively a file server may have both types of interface: you could then access it from BBC machines over an existing Econet, while RISC OS computers access it via AUN over Ethernet.

This facility may help you to smooth any transition from Econet to Ethernet.

### Ethernet

Client stations connected to Ethernet must be configured with AUN software, and can only interact with other AUN-configured stations.

## Coexistence with TCP/IP

### Adding AUN-configured stations to an existing TCP/IP network

Because both TCP/IP protocols and AUN protocols are founded upon the same Internet family of protocols, you can use both over the same physical network. This means that you can connect AUN-configured stations to the same cabling as is used for an existing TCP/IP network, such as a campus-wide Ethernet to which UNIX workstations are connected.

The AUN-configured stations will be able to communicate with each other. If you install Acorn's TCP/IP Protocol Suite on these stations they will also be able to communicate with the TCP/IP stations. (The TCP/IP Protocol Suite is available from your Acorn Network Dealer.)

For full details of the above, see the chapter entitled *Appendix*: AUN *and* TCP/IP on page 65

### Adding NFS file servers to an existing AUN network

Just as you can add AUN-configured stations to a network set up for TCP/IP, so you can do the reverse. For example you might wish to add a UNIX workstation such as an NFS file server to an existing AUN network. You can then use the TCP/IP Protocol Suite to access the file server.

Again you'll find full details in the chapter entitled *Appendix*: AUN *and* TCP/IP on page 65

## The Broadcast Loader

In a school environment, the worst network overloading typically occurs at the start of a lesson, when a large number of clients might simultaneously attempt to load the same application from a server. The Broadcast Loader module alleviates this situation (and similar ones) by recognising that multiple stations have requested the same data, allowing the simultaneous transfer of identical data to a large number of clients from a single station. It functions with all types of AUN network.

The Broadcast Loader works over an AUN-configured Econet just as it does over native Econet. If you're not already using it, you might like to consider doing so. The software is supplied as a standard part of versions of RISC OS required to run AUN – i.e. RISC OS 3 (version 3.10) or later.

The Broadcast Loader will also work over Ethernet networks within an AUN site. You may find however that it confers little real advantage, both because its mechanism is specifically designed for Econet, and because the higher speed of Ethernet means that you are therefore less likely to get network overloading. We recommend that you don't use the Broadcast Loader over Ethernet, as it slows 'normal' data transfers; but you might like to experiment and decide for yourself.

## Enabling or disabling the Broadcast Loader

In RISC OS 3 the Broadcast Loader is enabled by default. To disable it (or to re-enable it) use the Configure application; see the RISC OS 3 *User Guide* for further details.

# 2 Design and installation of your network

Designing and installing a network requires considerable expertise and knowledge, both technical and practical. We strongly recommend that you get an Acorn Network Dealer to do this work for you. They have the necessary skills to ensure that your network delivers the best possible response across the site, avoiding any bad bottlenecks in the system.

The rest of this chapter will help you to understand the choices available, to provide the information that your dealer will need, and hence to mutually reach a sensible decision on the layout and future development of your site network. It also tells you what limitations there are should you decide to have stations or cabling added to existing installations. It is not a tutorial in network design, nor does it tell you how to install a network.

## Networking technologies

The AUN software you have just bought initially provides support for two different types of networking: Econet and Ethernet. Econet is Acorn's own low-cost network system, whereas Ethernet is a widely adopted system that has become an industry standard. The section below compares the two technologies, which will help you and your Acorn Network Dealer to make an informed decision as to which is best for you.

### Relative speeds

A pair of stations using the AUN software can transfer data over a network at up to 200 Kbytes/sec. This depends on the speed of the two machines: two stations fitted with an ARM3 can transfer data faster than two that are fitted with an ARM2.

#### Econet

However, an Econet is only able to move data at 20 Kbytes/sec, and this limits the maximum speed of the AUN software. A single data transfer on an unladen network will use all the Econet's available capacity. As more stations simultaneously use the network, they have to share the network's capacity, and so the data transfer rate between machines falls.

### Ethernet

An Ethernet can transfer data at 1.25 Mbytes/sec. Since this is much faster than the AUN software is able to transfer data, a large number of stations can be simultaneously using the network before it slows down.

### Summary

The difference between Econet and Ethernet is a bit like that between a country road and an autobahn. On the former, your speed is limited by the road, and it doesn't take much traffic to cause congestion; on the latter, you can normally drive as fast as you are able, and it takes a lot of traffic before there's congestion.

## Limitations

Both types of network have limitations on them. Some of these are theoretical limits beyond which the network cannot ever work; others are practical limits, beyond which performance degrades to an unacceptable level.

### Econet

The theoretical maximum length of an Econet segment is 1270m, but we recommend that you do not exceed a cable length of 500m. Connection sockets for stations may be as close together as you like; the lead from the socket to the station should be no longer than 2m.

You may in theory connect up to 253 stations to a segment of Econet. However, to get an acceptable performance you should connect no more than 40 8-bit stations (such as BBC Masters), or no more than 10 32-bit stations (i.e. RISC OS stations). The reason you may connect more 8-bit stations is that they typically run much smaller applications, and so transfer less data across the network.

The above recommendations are generalisations; they assume that the stations are in simultaneous use, and always use remote storage (such as a file server). They are exactly the same considerations as apply to an existing native Econet.

You can connect more stations and still get a reasonable response if you make use of local storage, or if the stations' use of remote storage is staggered. Using the Broadcast Loader may also help reduce peak network loading; see the section entitled *The Broadcast Loader* on page 7. Your Acorn Network Dealer will have much more experience of Econet design, and can give you alternative solutions and precise recommendations to match your individual needs.

An important difference between Econet and Ethernet is that Econet needs a clock signal to be provided by a *clock box*. Without this signal the network will not work at all; if the quality of the clock signal degrades, so will the performance of the Econet, which can make fault-finding difficult.

### Ethernet

There are three types of Ethernet: *thick Ethernet* (also known as 10BASE5), *thin Ethernet* (also known as Cheapernet, or as 10BASE2), and *twisted-pair Ethernet* (also known as 10BASET). The main differences are:

- Thick Ethernet cable segments can be up to 500m long, and may have up to 100 connections made to them. Connections must be at least 2.5m apart.

  The cable is thick, and so is relatively inflexible; its minimum radius of curvature is about 25cm. It is very resilient to physical damage and to electrical interference.

- Thin Ethernet cable segments can only be up to 185m long, and may only have up to 30 connections made to them, as close together as 0.5m apart. However, this is a theoretical maximum, and we recommend that to get acceptable performance you connect no more than 20 stations to a single segment.

  The cable is thin, and so is comparatively flexible.

- Twisted-pair Ethernet differs fundamentally from the other two types in that it is a *star network* rather than a *bus network*. This means that instead of there being a single length of cable to which all computers connect, each station must have its own length of cabling which plugs into a central *hub* box.

  Each cable may be up to 100m long; each hub can support up to 12 stations.

  The cable is thin and flexible, and is similar to telephone cables.

All types of Ethernet cable can transfer data at the same rate.

An Ethernet is entirely passive, and unlike Econet does not require a clock signal.

## Cost

As with most things, you get what you pay for!

### Econet

The cabling used by Econet costs a similar amount to that used for thin Ethernet. The cost of Econet interfaces is significantly less than for Ethernet interfaces, but the speed of the network and the number of stations that can reasonably use the network at the same time is also less.

### Ethernet

The cost of Ethernet cabling varies:

- Thick Ethernet cabling is the most expensive of all, but it can support the greatest number of machines over the longest length, and is also the most rugged type.
- The cabling for thin Ethernet (as befits its alternative name of Cheapernet) is less expensive than that for thick Ethernet, but cannot support as many stations over as long a length of cabling as thick Ethernet can.
- Twisted-pair Ethernet cabling is the cheapest of all, but a hub device is required for every 8 - 12 stations, which adds to the cost.

The ruggedness and long maximum length of thick Ethernet makes it the most suitable cabling for outside, should you have to connect together buildings on a campus-style site. In general thin and twisted-pair Ethernet are more suited to indoor use, for which they are now the norm. Various ways of protecting the cable from damage – accidental or otherwise – are available from Ethernet suppliers.

Ethernet interfaces vary in capability, size and cost. Factors to consider are:

- Provision of an AUN client ROM:

  If the interface has an AUN client ROM, a client station does not need to load the AUN software from disc or from a file server.
- Type(s) of cabling supported:

  Obviously your interface must be able to connect to the cabling you install! Some interfaces provide two types of socket, and you can choose which of them you use, giving you flexibility in your choice of cabling. Others may only provide a single socket, to reduce their cost and/or their size.
- Type of expansion slot required:

  Some interfaces are the right size for the expansion sockets on the backplane of larger computers (such as the A400 series or the A5000). Others are suitable for the internal expansion slot in smaller RISC OS computers (such as the A3000)

You should check with your Acorn supplier which types are currently available for RISC OS computers

## Future developments in networking technologies

Only a very small part of the AUN software handles hardware interfaces. The software for each type of interface is held in its own *driver module*, and extra modules can easily be added. Thus as new technology such as fibre optic or cordless networking becomes available, support for it can easily be added to AUN, either by Acorn or by a third party.

## Cabling

You must use the correct standard of cabling for the type of network you choose. Resist the temptation to install a cheaper grade of cable which is superficially similar to the specified grade, as your network will not work properly. For example, you mustn't try to run Ethernet over coaxial cable designed for use with TV aerials, even though it may appear similar to the coaxial cable used for thick Ethernet.

Again, your Acorn Network Dealer can advise you about the correct specification of cable to use.

## Topology

### Backbone networks

A backbone network is used to interlink departmental networks. There are two main reasons why you might need to install one:

- When two networks are not physically close enough to connect them using a gateway station.
- When traffic between non-adjacent networks is starting to overload any intervening networks.

  For example, see the diagram of a four-network site on page 17. If you were to send a message from the *compsci*A network to the *art* network, it would need to traverse the *compsci*B and *business* networks. If such messages were frequently sent, the response of the *compsci*B and *business* networks would suffer.

A backbone network is likely to carry a large amount of network traffic and will therefore typically use Ethernet rather than Econet. (It is also likely to be the most inaccessible of your networks, and hence the hardest to later upgrade; it's best to get it right first time.) Correct design and installation of the backbone network is crucial to the success of a whole site network.

The precise layout of your backbone network will depend upon both the architectural plan of your individual site, and the desired extent of the integrated network. In small sites a segment of thin Ethernet will usually suffice; a larger site may require too long a cable run to use thin Ethernet, and so a long segment of thick Ethernet may be used; the largest sites may require a more complex structure still, that uses risers, multiport repeaters and multiple thin Ethernet segments. Again, your Acorn Network dealer can advise you on this.

There's nothing special about the network name or net number you use for a backbone network; so far as the AUN software's concerned, it's just another network.

### Positioning gateway stations

In designing your network, you must take care to ensure that the gateways you install between networks do not form a loop. If they do, your network will not work correctly.

You must always bear in mind that gateway stations are potential bottlenecks in your site's flow of data. Try to design your network to minimise the flow of data through gateways, keeping major resources on the network where they will be used. In particular, try to keep large applications on local file servers.

## Network stations

The earlier chapter entitled *Introduction to* AUN detailed the machine requirements for AUN, and the way in which AUN-configured stations interact with non AUN-configured stations; see respectively the sections entitled *Machine requirements* on page 5, and *Coexistence with existing machines* on page 6.

An ideal client station would be fitted with a network interface having an AUN client ROM. It can then load all the AUN software from ROM, and so doesn't require a boot disc. You'll find it preferable to have at least 2 Mbytes of memory fitted, so there's still plenty of memory free for applications after the AUN software has been loaded. Finally, you might like to consider buying ARM3 based machines (such as the A5000) for demanding tasks such as DTP or CAD.

### Using a station both as a gateway and as a server

You can use a station both as a gateway and as a file and/or print server. Combining these functions makes a lot of sense:

- It saves you the expense of buying a separate machine for each function.
- It combines all your important network resources in a single machine, which is easier to keep securely out of your users' way.

Obviously to function as a file or print server such a machine must be fitted with a hard disc.

The load placed on one function will inevitably impact upon the performance of the others. You should where possible try to balance the relative importance of these functions throughout your network, so a machine which expects relatively little gateway traffic may be considered to be primarily a server, and vice-versa.

You will get significantly better performance from a machine fitted with an ARM3 processor – such as an A5000 – than you will with one that is only fitted with the slower ARM2 processor. The more heavily used a machine is, the more important this is to the network's overall performance. Thus a machine that is used both as a

file server and as an important gateway would greatly benefit from having an ARM3, whereas a little used gateway that doesn't act as a file server could well make do with an ARM2.

Even with an ARM3, if you're over-ambitious – say trying to combine all three functions on a single machine – you may find that there is too much traffic for the machine to adequately cope.

## Infrastructure

### Installing new networks

If you're installing a completely new site network, you should consider carefully which networking technology to use from those that currently support AUN. Try to balance its cost against its performance (see the section entitled *Networking technologies* on page 9). Remember to consider your future needs, so that you don't end up having to upgrade too soon after you purchase.

The same considerations apply when you are adding a new network to an existing site network. Choose the networking technology to use accordingly. Remember that under AUN you're not limited to the types of network cabling you're already using.

There are fewer constraints on the layout of a completely new site network than there are when you have to incorporate existing networks. Consequently you have a far wider choice of layouts. For example, a single site-wide Ethernet may well prove most appropriate, possibly incorporating specialist Ethernet hardware such as bridges, multiport repeaters, and risers. You should take the advice of your Acorn Network Dealer; there are far more options than we can outline here.

### Upgrading existing Econet networks

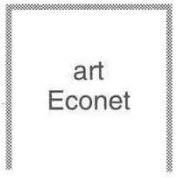
An existing Econet cluster with RISC OS stations already has the necessary infrastructure to use it as an AUN network. All you need do to upgrade it is to install the AUN software. To connect it to other AUN networks, you will need to set up a gateway. If you have an existing Level 4 FileServer or Spooler it's preferable that you use it for this purpose, but you can use any other client station instead.

As funds become available, you can upgrade an existing Econet network to use Ethernet instead. To do this you will need to replace the existing cabling, and to add interfaces to each machine.

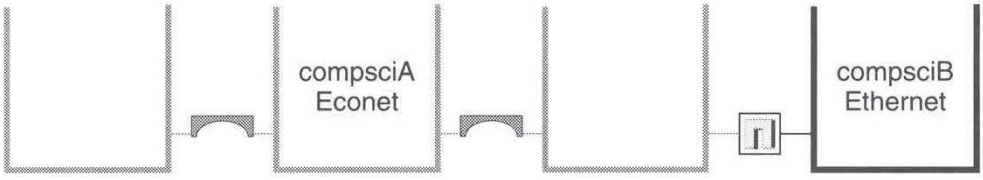
#### An example

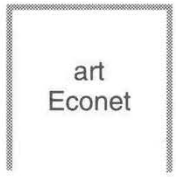
As an example, let's look at how an existing set of Econet networks on a site might be upgraded to form part of a site-wide AUN network.

Initially our example network consists of three Econet nets in the computer science block, connected by bridges. A further separate net exists in the art block:

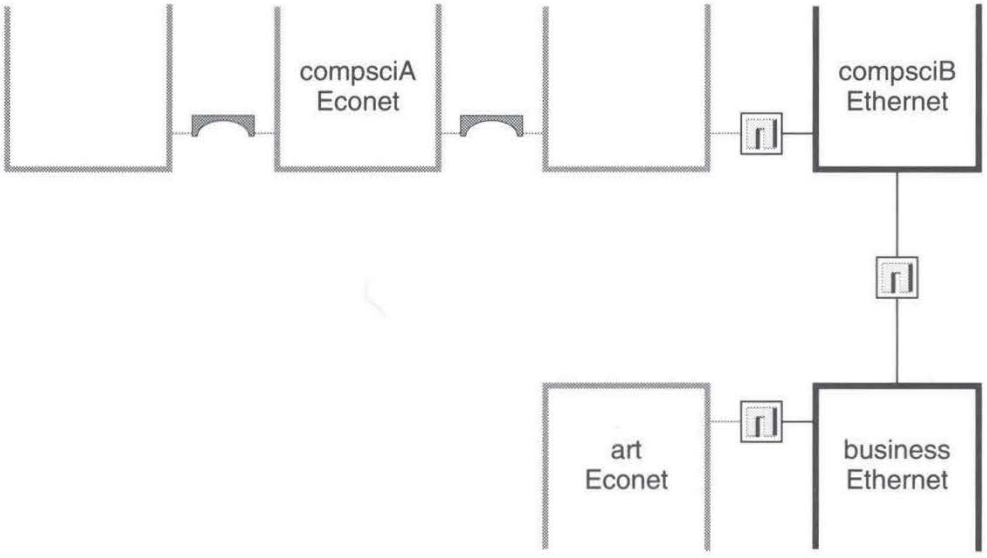




At this stage there's no point in using AUN, because all networks are Econet, and so will always use native Econet even with AUN installed. Let's assume that a new Ethernet network is installed in the computer science block; this, of course, must use AUN. At this point the existing computer science Econets are converted to use AUN, and a gateway is added between the two computer science networks so that they can communicate with each other. The art block's Econet still uses native Econet, and remains isolated:

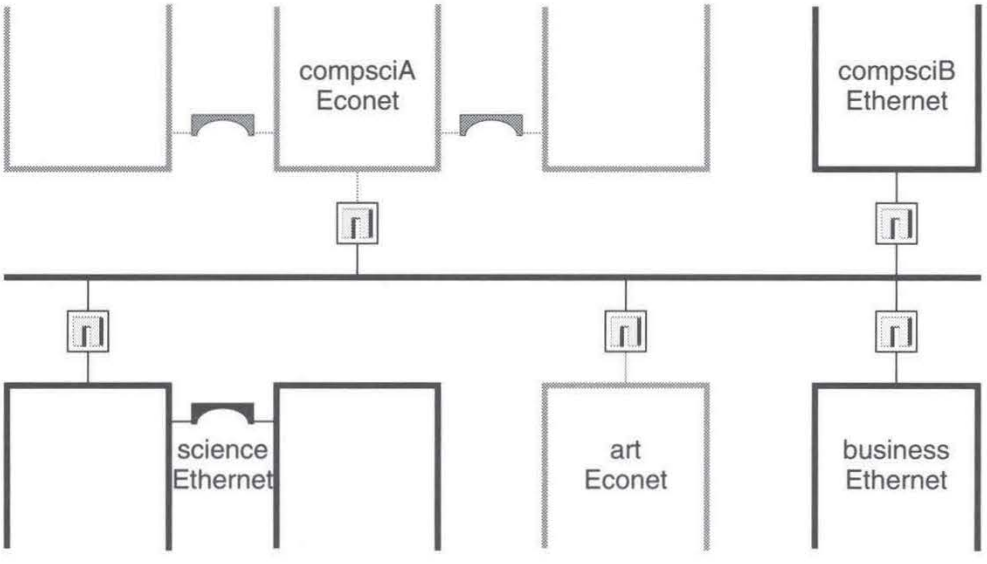


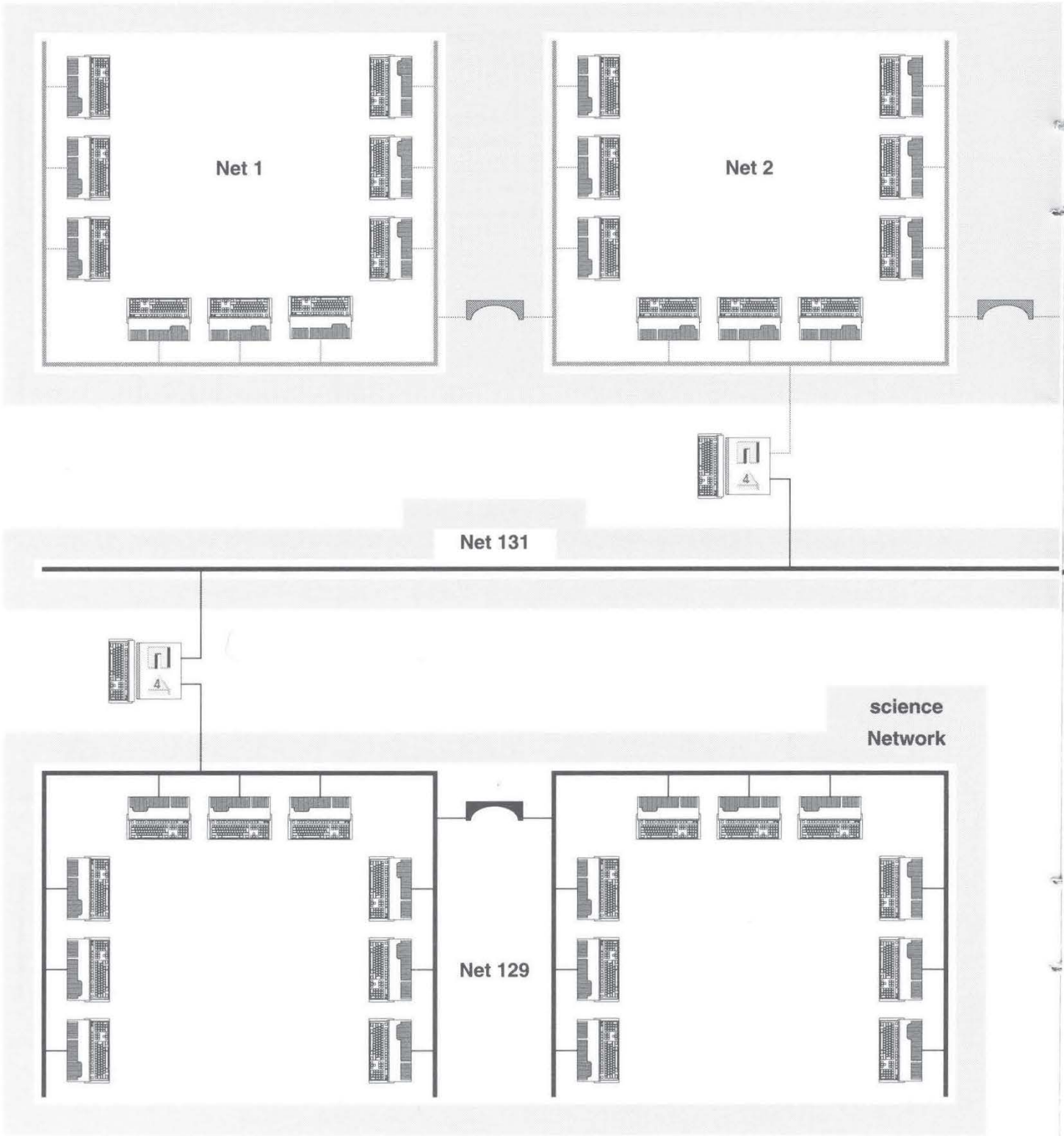
As a next step, the business studies department installs an Ethernet. Because this is near to the art block, the opportunity is taken to convert the art department's Econet to use AUN and to install a gateway from it to the rest of the site network:

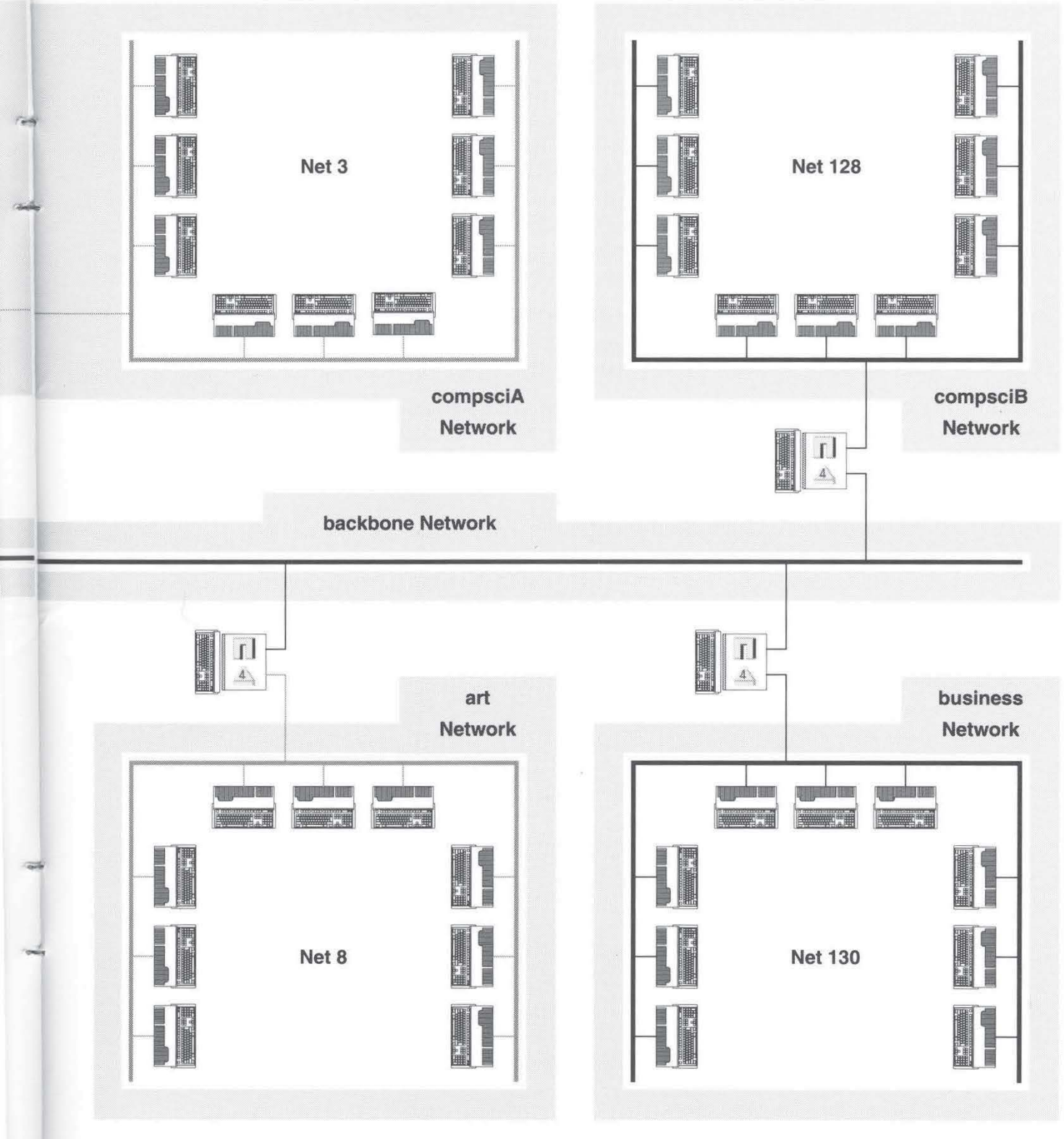



Finally the science department add two bridged Ethernet segments. By this stage a backbone network has also become necessary:




This stage of our example is shown in more detail overleaf; it is used as an example throughout the rest of this guide.


Net 1
Net 2
Net 131
science
Network
Net 129


Net 3
compsciA
Network
Net 128
compsciB
Network
backbone Network
art
Network
Net 8
business
Network
Net 130

# 3 Installing the software

This chapter tells you how to set up a client or gateway station on an AUN-configured network. It also gives you guidelines on how to use the station as a Level 4 FileServer and/or Spooler. If you are using AUN protocols over an existing TCP/IP network, you need to set up the software in a different way; see the *Appendix*: AUN *and* TCP/IP on page 65.

Before you can set up the software, you must first have installed your network cabling. You must also have assigned names to each network, and numbers to each net and station. For guidance on this, see the earlier chapters of this Guide.

This chapter assumes you know how to perform basic operations on the RISC OS desktop; if you don't already know this, you should see the manuals supplied with your computers.

# ROM based client stations

Some client stations are able to load all the necessary software from ROM, and do not need to use a disc. Such stations must be:

- suitable to run AUN (i.e. fitted with 1 Mbyte RAM or more, and RISC OS 3 (version 3.10) or later)
- fitted with a network interface that has an AUN client ROM
- connected to an AUN-configured network.

Setting up a ROM based client station is simple. You merely have to configure the station to boot from ROM, and to set the station's number

### Configure the station to load the software from ROM

You must configure the station to load the AUN software from ROM:

```
*Configure BootNet On
```

For full details of the *Configure BootNet command, see page 44.

### Set the station's number

You also need to set the station's number using the SetStation command. You can run SetStation by double-clicking on its icon; a window appears prompting you for the new station number. If you decide you do not wish to change the station number, press the *Esc* key. For full details of the SetStation command, see page 53.

# Econet based client stations

Econet based client stations that do not have an AUN client ROM can load the software from a local Econet file server (i.e. one that is connected to the same Econet network as the client). This section describes how to set up the client station to boot from the file server, and how to set up the file server itself.

If you prefer, you can set up such stations to load the software from a local disc; see the section entitled *Disc based stations* on page 25.

## Ensure the station's configuration is correct

### Configure the station to boot correctly

You need to ensure that the station's configuration settings are correct, so that the station will auto-boot from the file server. The necessary commands are:

```
*Configure Filesystem Net
*Configure FS file_server
*Configure Language 0
*Configure Boot
```

where *file_server* is the name of the file server from which you are booting.

### Set the station's number

You also need to set the station's number using the SetStation command. You can run SetStation by double-clicking on its icon; a window appears prompting you for the new station number. If you decide you do not wish to change the station number, press the *Esc* key. For full details of the SetStation command, see page 53.

## Set up the file server

To set up the file server you need to do the following:

1. Create a user named Boot, ensuring that you set its boot option to **Run**.
2. Copy the BootNet application to the Boot user's home directory.
   You do not need to alter the application in any way, as the distributed version is pre-configured to set up Econet as the AUN-configured network interface.
3. Copy the ArmBoot application from the Extras directory of the Level 4 FileServer distribution disc to the Boot user's home directory.
4. Open the ArmBoot application directory by holding down the *Shift* key while you double-click on its icon.

5 Edit the PreDesktop file:

- Load it into Edit by dragging its icon to the Edit icon on the icon bar.
- Following the instructions in the file, edit it so that it runs the BootNet application.
- Save the edited PreDesktop file, overwriting the original.

For more complete information on file server configuration and management, see the *Level 4 FileServer Manager's Guide*.

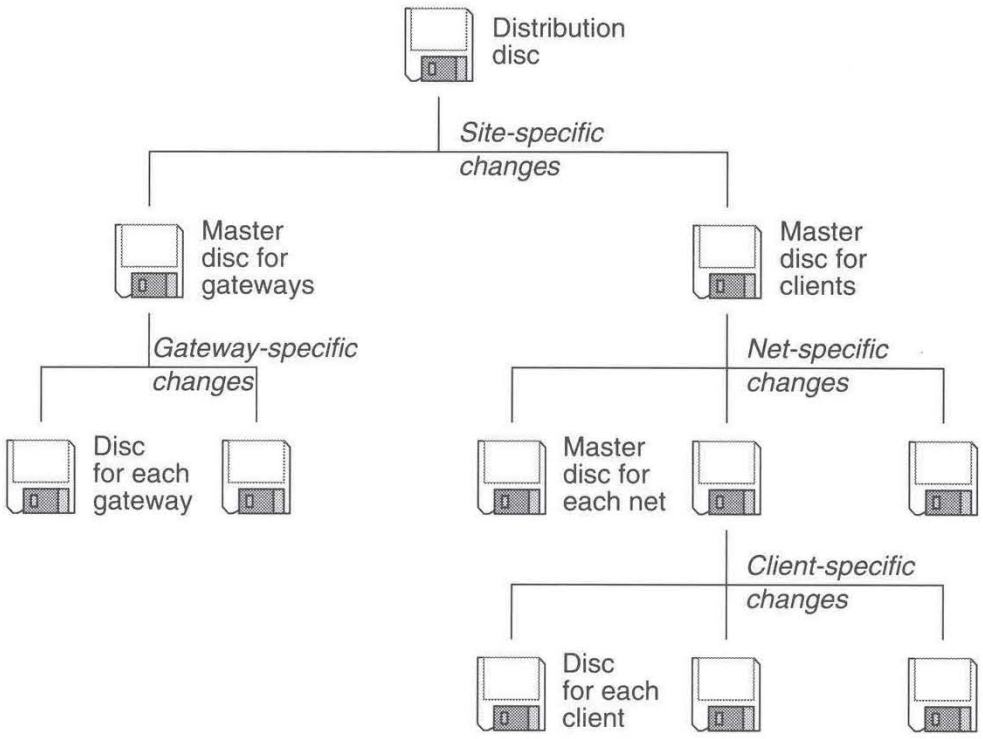
# Disc based stations

This final part of the chapter describes how to set up the AUN software for a station that is loading it from disc, whether it be a client station or a gateway station.

## Using discs

In setting up disc based stations you'll need to alter the software. **You must not alter the distribution disc itself**; always work on a copy of it.

The instructions in this part tell you how to alter the software to set up a single station. In practice, you'll find yourself repeating many of the changes for every station on your site, or on a particular network. We suggest that rather than repeating the same work, you create several 'levels' of 'master' discs.




In the example above:

- You would take two copies of the distribution disc, and make any changes you need to make for all stations on your site. This would give you two master discs: one for clients, and one for gateways.
- You would then take the master disc for gateways, and alter copies of that to give you discs suitable for each individual gateway.

- Likewise, you would take the master disc for clients, and alter copies of that to give you master discs suitable for the clients on each individual net.
- If your client stations will be loading the software from disc rather than from a local Econet file server, you would finally make copies of the master for a particular net to give the disc for each client.

  Typically clients on a given net will have a similar hardware configuration, and load the same software at boot time, so few – if any – changes would be needed at this stage.

We suggest that you use a similar scheme for your site. It's best if you read through this chapter, and then devise a plan suited to your site. In doing so, you should try to make as little work for yourself as possible. If you can see a way of only making a change once, do so.

### Naming and labelling discs

As you can see from the above example, you can easily end up with many subtly different discs, particularly if all your stations install the software from floppy disc. It's important that you can distinguish between these discs. Give each disc an appropriate name by choosing **Name disc** from the floppy disc drive's icon bar menu. You might base these names on the net or station numbers by which the disc is to be used. You should also label each disc.

## Client installation

This section tells you the steps needed to install the AUN software on a client station that needs to load the software from disc.

### Configure the BootNet application

The BootNet application needs to be set up to configure the correct network interface for AUN. The application is supplied already set up to use a machine's Econet interface, so you don't need to alter it unless you'll be using some other interface.

#### Summary

Parts of the application you may need to change are:

- The !Configure file, which sets what type of network interface you wish to configure for AUN, and hence what driver to load.

  You will need to edit this file so that the AUN software loads the driver for your network interface.

- The Drivers subdirectory, which contains driver modules for network interfaces.

  If you use a third party AUN-compatible network interface that provides its driver software on disc, you will need to add that driver to those already in the Drivers directory.

You must not alter **any** other parts of the application.

### Making the changes

1 Load Edit onto the icon bar – if it's not already loaded.

2 Open the BootNet application directory by holding down the *Shift* key while you double-click on its icon.

3 If you have a third-party network interface fitted that has a disc-based driver, add that driver to the Drivers subdirectory:

   - Open the directory display that shows the third-party driver.
   - Open the Drivers subdirectory of the BootNet application by double-clicking on its icon.
   - Drag the third-party driver from its directory display to the !BootNet.Drivers directory.

   Take note of the name of the driver; you'll need to know this for the next step.

4 Edit the !Configure file:

   - Load it into Edit by dragging its icon to the Edit icon on the icon bar.
   - Change the word EconetA in the line:

     `set Net$Device` *`EconetA`*

     to the name of the driver for the station's network interface. The names of current Acorn drivers are:

| Name | Driver for: |
|---|---|
| EconetA | Acorn Econet (the default) |
| Ether1 | Acorn Ethernet I |
| Ether2 | Acorn Ethernet II |

     For third party network interfaces you should refer to the documentation supplied, which should give the correct driver name.

   - Save the edited !Configure file, overwriting the original.

You can ignore the next section, which tells you how to install a gateway station. If you intend using the client station as a Level 4 FileServer and/or Spooler, you should go on to the section entitled *Setting up Level 4 FileServers and Spoolers* on page 35. Otherwise you should turn to the section entitled *Loading the software* on page 36.

## Gateway installation

Gateway stations load the AUN software using the Gateway application, which must be stored on a local disc. This section tells you the steps needed to install the software on a gateway station.

You will not need to install the Gateway application at all if you are setting up a single standalone network, such as a system using only Ethernet. The gateway application is only needed to link together two different networks. For a more detailed explanation, see the section entitled *Gateway stations* on page 4.

### Create the Gateway application's Map file

The file !Gateway.Files.Map contains the 'map' of your entire AUN site network, defining its layout to the AUN software. The gateway station uses information extracted from this file to work out the correct route to use to send data between different parts of the site network.

**The Map file must always be identical on every gateway station in the site network.** If it is not, stations in different parts of your site will have different ideas of its layout, and so will have problems communicating with each other. We strongly recommend that you make a master copy of the Map file for your site, and then copy that to each gateway station.

#### Format of the Map file

The format of the Map file is simple: each line lists the name of one network, and the number(s) of the net(s) that make up that network. You may use the '|' character to introduce a comment. Thus the general format is:

```
| comment
network_name     net_number net_number
                 net_number              | comment
network_name     net_number              | etc
```

The order in which you give the networks doesn't matter – so long, of course, as it's the same across your site. There should be at least two lines, since if your site has only one network you don't need to use gateways.

As an example, here's the file for the site illustrated on page 18:

```
| Example: Large site network containing 5 dept networks linked via backbone

compsciA        1 2 3                   | old compblock econet (2 bridges)
compsciB        128                     | compblock Ethernet
science         129                     | science Ethernet
art             4                       | art room econet
business        130                     | business studies ethernet
backbone        131                     | backbone ethernet
```

### Editing the Map file

You will need to edit the Map file to make a master copy that matches the layout of your site's network. To do so:

1. Load Edit onto the icon bar – if it's not already loaded.
2. Open the Gateway application directory by holding down the *Shift* key while you double-click on its icon.
3. Open the Files subdirectory of the Gateway application by double-clicking on its icon.
4. Edit the Map file:
   - Load it into Edit by dragging its icon to the Edit icon on the icon bar.
   - Edit it so that it specifies the map of your site.
   - Save the edited Map file, overwriting the original.

If you have any other gateway stations, you should take a copy of the master file you've just created, and use that to replace the other gateways' existing Map files:

### Changing existing Map files

If you ever need to change the Map file – for example if you add a new net – you **must** ensure that you do not have gateways using the new Map file connected to your network at the same time as ones still using the old Map file. The best way to ensure this is:

1. For each gateway station:
   - Shut it down by choosing **Shutdown** from the Task Manager's icon bar menu.
   - Restart the station, preventing it from running the Gateway application. (The easiest way to do this is to prevent the station from running its boot file by holding down the *Shift* key.)

   This effectively isolates all the gateway stations from the network whilst you update their Map files.

2 Make a working copy of the old Map file, and update it to make a new master Map that specifies the new layout of your site.

3 Update all the gateway stations' Map files by overwriting the old file with the new master.

4 Restart all the gateway stations as normal, so that the Gateway application runs.

You don't need to power down client stations while you make these changes, but since the client stations won't know of any changes until they're next restarted, you might prefer to do so. If you do get any problems with client stations after you've changed the Map files you should just restart them.

## Create the Gateway application's Configure file

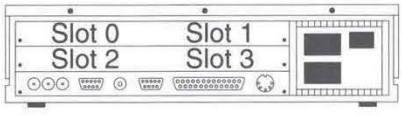
The file !Gateway.Files.Configure contains AUN configuration information for an individual gateway. The gateway uses the information in this file to work out its own relative position within the site network described in the Map file.

Whereas the Map file must be the same throughout the system, the Configure file must be different on each gateway station. If you ever find two identical Configure files on your system, each of which correctly specifies its gateway, then your network will contain a loop and hence its design is flawed.

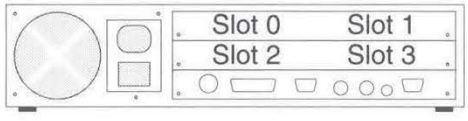
The format of a Configure file is again simple. It consists of two lines, each of which specifies one of the station's two interfaces, and the name of the network to which it is connected. As with Map files, you can use the '|' character to introduce a comment.

Network interfaces other than Ethernet are specified by their slot number in the expansion card backplane.

For larger stations such as the A400 series or the A5000, the top left card (seen from the back of the computer) is slot 0, and the numbers increase from left to right, top to bottom – the same order as you would read a book. For example:

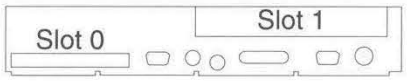



A400 series: rear view




A5000: rear view

For smaller stations such as the A3000, the external expansion card slot is slot 0, and the internal expansion card slot is slot 1:




A3000 series: rear view

The format of a Configure file varies depending on whether or not the gateway uses an Econet interface. For a gateway with an Econet interface the format is:

```
Econet          is network_name
Slot n          is network_name
```

For example:

```
| Example1:
|       network compsciA is Econet;
|       network backbone is Ethernet.

Econet          is compsciA
Slot 0          is backbone
```

For a gateway with no Econet interface the format is:

```
Slot m          is network_name
Slot n          is network_name
```

For example:

```
| Example2:
|       network compsciB is Ethernet;
|       network backbone is Ethernet.

Slot 0          is compsciB
Slot 1          is backbone
```

### Editing the Configure file

You will need to edit the Configure file so it specifies the position within the site network of the one particular gateway you are setting up. To do so:

1. Load Edit onto the icon bar – if it's not already loaded.
2. Open the Gateway application directory by holding down the Shift key while you double-click on its icon.
3. Open the Files subdirectory of the Gateway application by double-clicking on its icon.

4 Edit the Configure file:

- Load it into Edit by dragging its icon to the Edit icon on the icon bar.
- Edit it so it specifies the relative position of the gateway within the site.
- Save the edited Configure file, overwriting the original.

You must take special care to ensure that this file is correct. In particular, if you have a gateway with two identical network interfaces, it's easy to connect them the wrong way round. The cabling for each network **must** be plugged into the correct interface.

## Configure the Gateway application

### Network interfaces

Although gateway stations must load the Gateway application from disc, it can still load the driver for an interface from an AUN client ROM – if the interface has one.

As supplied, the Gateway application is set up to use two interfaces fitted with AUN client ROMs. You will need to alter the application if this is not correct, possibly also adding driver modules for third party network interfaces – just as with the BootNet application.

### Memory usage

You may also wish to alter the amount of memory allocated to the Gateway application, particularly if the gateway is expected to be very busy. For example, this may be necessary if the gateway connects a fast network (such as Ethernet) to a busy slower network (such as Econet). Because data messages will arrive on the faster network much more rapidly than they can be placed on the slower one, the gateway may have to queue (or *buffer*) large numbers of messages in RAM.

As supplied, the Gateway application is configured to allocate 256Kbytes to buffering data. It runs comfortably on a 1 Mbyte machine. If your gateway station has memory over and above this 1 Mbyte, we recommend that you put it to good use:

- If the station is to be used solely as a gateway, you should allocate all this extra memory to the Gateway application.
- If the station is also to function as a Level 4 FileServer, you should allocate half the machine's memory to the Gateway application, and leave half free for the FileServer.
- If the station is also to function as a Spooler, you should allocate 500Kbytes to the Spooler, and allocate the rest of the memory to the gateway application.

- If the station is also to function both as a Level 4 FileServer and as a Spooler, you should allocate 500Kbytes to the Spooler, half the remaining memory to the Gateway application, and the other half to the FileServer.

This leads to these buffer sizes:

| Memory allocated to Gateway app | Unused memory with default buffer | Recommended buffer size |
|---|---|---|
| 1 Mbyte | some | 256K (default) |
| 2 Mbytes | over 1 Mbyte | 1280K (default + 1 Mbyte) |
| 3 Mbytes | over 2 Mbytes | 2304K (default + 2 Mbytes) |
| 4 Mbytes | over 3 Mbytes | 3328K (default + 3 Mbytes) |

As you use the network, you may find that the buffer size requires tuning, depending on the relative levels of use of the different functions provided by the gateway station.

### Summary

Parts of the application you may need to change are:

- The !Configure file, which sets what type(s) of network interface you wish to configure for AUN, and hence what driver(s) to load. It also sets the amount of memory to use for buffering data messages.

  You will need to edit this file if you are using any network interface(s) which do not have an AUN client ROM, or if you wish to allocate extra memory for buffering data.

- The Drivers subdirectory, which contains driver modules for network interfaces.

  If you use a third party AUN-compatible network interface that provides its driver software on disc, you will need to add that driver to those already in the Drivers directory.

### Making the changes

1 Load Edit onto the icon bar – if it's not already loaded.

2 Open the Gateway application directory by holding down the *Shift* key while you double-click on its icon.

3 If you have a third-party network interface fitted that has a disc-based driver, add that driver to the Drivers subdirectory:

- Open the directory display that shows the third-party driver.
- Open the Drivers subdirectory of the Gateway application by double-clicking on its icon.
- Drag the third-party driver from its directory display to the !Gateway.Drivers directory.

Take note of the name of the driver; you'll need to know this for the next step.

4 Edit the !Configure file:

- Load it into Edit by dragging its icon to the Edit icon on the icon bar.
- If one of your gateway station's network interfaces doesn't have an AUN client ROM, change the double quotes in the line:

  ```
  set Net$Device ""
  ```

  to the name of its driver. The names of current Acorn drivers are:

| Name | Driver for: |
|---|---|
| EconetA | Acorn Econet |
| Ether1 | Acorn Ethernet I |
| Ether2 | Acorn Ethernet II |

  For third party network interfaces you should refer to the documentation supplied, which should give the correct driver name.

- If your gateway station's other network interface requires a different driver, and it doesn't have an AUN client ROM, you need to change similarly the line:

  ```
  set Net$DeviceB ""
  ```

- If you wish to change the default amount of memory allocated to buffering data, change the line:

  ```
  set Net$Memory 256K
  ```

  to specify the new amount, which must be given in Kilobytes.

- Save the edited !Configure file, overwriting the original.

Unless you intend using the gateway station as a Level 4 FileServer and/or Spooler, you should go on to the section entitled *Loading the software* on page 36.

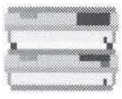
## Setting up Level 4 FileServers and Spoolers

A Level 4 FileServer or Spooler connected to an AUN net must be configured either as a client or as a gateway. For details of how to do this refer to the section entitled *Client installation* on page 26 or the section entitled *Gateway installation* on page 28. By the way, you can find some guidance on using a Level 4 FileServer or Spooler as a gateway in the section entitled *Using a station both as a gateway and as a server* on page 14.

### Upgrading old software

There are two variants of the Level 4 FileServer software: an old non-AUN variant, and the current AUN-supporting variant. You can distinguish the two variants by the icons they use:


Current AUN-supporting variant



Old non-AUN variant

If you have the old non-AUN Level 4 FileServer you should upgrade to the AUN-supporting variant.

Likewise, you should upgrade any old versions of the Spooler application to the AUN-supporting variant. (In this case, there's no difference between the different versions' icons.)

Both these applications will normally be bundled with the AUN software, together with the *Level 4 FileServer Network Manager's Guide* which gives full installation instructions.

## Loading the software

Having installed the AUN software you then need to set up the station to load the software from the disc. This section describes how to set up the station itself.

#### Using other locations for the software

The descriptions below assume you've installed the software in the root directory, as recommended in this chapter. If you've installed any of the software in different locations you should, of course, alter any pathnames below that are incorrect.

### Set up a desktop boot file

We recommend that you load the AUN software from a desktop boot file that is run at power on. You'll need to add the necessary commands to an existing desktop boot file by hand.

If you don't already use a desktop boot file, follow the instructions in the RISC OS 3 *User Guide* to create one, ensuring that you turn on the **Auto boot** option.

#### Add a command to run the AUN application

Add a command in the desktop boot file to run the relevant AUN application – either BootNet for a client station, or Gateway for a gateway station. For example:

```
Run $.!BootNet
```

or:

```
Run $.!Gateway
```

This command **must** be before any other command that accesses the net (such as one to log on to a file server). Adding the command by hand ensures it's in the right order.

Again, you'll find extra help on how to edit a desktop boot file in the RISC OS 3 *User Guide*.

Your users could accidentally overwrite the desktop boot file by saving one themselves. The new file wouldn't load the AUN software; obviously this would be a problem. You can prevent your desktop boot file from being overwritten by changing its access permission so that it is locked and read-only. Select the file, and then use the **Access** dialogue box on the Filer's **File '*bootfile*'** submenu.

### Using a boot file on a file server

Remember that you can also set up each file server to run a boot file whenever users log on. If you wish to set up the same environment for all your users, you'll probably find it best not to do this in each station's desktop boot file. Instead you can use the station's desktop boot file just to load the AUN software and log on to a file server, and then use a boot file on that file server to set up everything else.

The advantage of this method is that the commands that set up the environment – and hence that you're most likely to need to change – are held in a far more convenient location. You'll find it much easier to edit a single boot file on a file server that you can access over the net, than to edit multiple desktop boot files that you can only access *in situ*.

### Starting the Level 4 FileServer and/or Spooler software

If you're using the Level 4 FileServer and/or Spooler software, you must start it **after** the AUN software has been run – just as you must any other networking software. The AUN software should be run at boot time, so this will only be an issue if you also wish to load the server software at boot time.

For details of the commands you need to use to start the server software, see the *Level 4 FileServer Network Manager's Guide*.

## Ensure the station's configuration is correct

### Configure the station not to load the software from ROM

Gateway stations fitted with an AUN client ROM must be configured not to load the software from ROM:

```
*Configure BootNet Off
```

(Client stations fitted with an AUN client ROM should load their software from the ROM. See the earlier – separate – instructions in the section entitled ROM *based client stations* on page 22.)

For full details of the *Configure BootNet command, see page 44.

### Set the station's number

You also need to set the station's number using the SetStation command. You can run SetStation by double-clicking on its icon; a window appears prompting you for the new station number. If you decide you do not wish to change the station number, press the *Esc* key. For full details of the SetStation command, see page 53.

# 4 Troubleshooting

This chapter lists the various error and warning messages that you may get from the AUN software, and gives further information on what may cause each message. This will help you to isolate the cause of any problems.

It also gives you hints on what you can do to establish the cause of any problems you have in communicating between different networks.

Finally it gives a warning for more advanced users who may wish to reinitialise any of the AUN modules.

## Warnings and error messages

This section details the warnings and error messages that you may get at AUN start-up time. These differ for client stations and gateway stations.

### Client stations

Client stations present any problems as warnings, thus:

**Warning: Please set a station number in the range 2 to 254**

The configured station number of the client station is not in the range 2 - 254.

**Warning: Possible net hardware problem; check device support module**

The client station cannot access the network interface specified in Net$Device. (The network interface it specifies is not present, or is faulty; alternatively the driver module for the interface is missing, or has not correctly loaded and initialised.)

**Warning: No AUN MAP data; possible GateWay configuration error**
**Warning: No AUN Routing data; possible GateWay configuration error**

The client station started its initialisation exchange with a gateway station, but did not complete it. The warning tells you which data the client station failed to receive; the usual reason for this is that the information in the Map and/or Configure files is not correctly configured on the gateway station.

**Warning: No access to network; restart computer to clear**

The Internet module (a part of the AUN software) is not responding.

## Gateway stations

Gateway stations present any problems as errors, refusing to start until the problem is solved. Possible errors are:

**Interface card or driver not present**

The gateway station cannot access the network interface specified in Net$Device or Net$DeviceB. (The network interface it specifies is not present, or is faulty; alternatively the driver module for the interface is missing, or has not correctly loaded and initialised.)

**Cannot open MAP**

The gateway station cannot find its MAP file.

**Net number out of range in MAP**

A net number specified in the Map file is not in the valid range 1 - 252.

**Non-Econet net number < 128 in MAP**

A net number assigned in the Map file to a non-Econet network is not in the permitted range 128 - 252.

**Cannot open Configure**

The gateway station cannot find its Configure file.

**Invalid slot number in Configure**

A slot number given in the Configure file is not in the valid range 0 - 3.

**Wrong number of interfaces in Configure**

The Configure file does not describe exactly two network interfaces.

**Unknown network name in Configure**

A network name used in the Configure file does not also appear in the Map file.

**Duplicate Econet in Configure**

The Configure file describes more than one Econet interface.

**Duplicate slot number in Configure**

There is more than one network interface assigned to a given slot number in the Configure file.

## Problems communicating between different networks

If you have problems communicating between different networks, you should first check that all the necessary hardware and software is running. If it is, then the problem may be caused by a mistake in a gateway station's Configure file. In particular, if your network has any gateway stations with two interfaces of the same type (e.g. Ethernet), these may be connected the wrong way round (i.e. the two networks may be physically connected the opposite way to that specified in the Configure file).

If you suspect that this may have happened you should type

```
*NetStat a
```

on a selection of client stations. If a client station has detected that there may be a problem you will see one of the warning messages described earlier:

```
Warning No AUN MAP data; possible GateWay configuration error
Warning No AUN Routing data; possible GateWay configuration error
```

## Reinitialising the AUN modules

The main AUN software is made up from four modules:

- Net
- Internet
- a device driver module (such as EconetA)
- Econet – which is only active if there's an Econet interface fitted.

Should you ever have cause to use the *RMReInit command to reinitialise the Internet, device driver or Econet module, you **must** subsequently reinitialise the Net module if you are to restore the AUN system as a whole.

# 5 Commands

This chapter gives details of the * Commands provided by the AUN software. These commands may help you in managing your network, and seeing how it is operating. To use the more esoteric commands you will need a more technical understanding of AUN than we have so far given you, particularly its use of Internet addressing. You'll find this information in the chapter entitled *Technical information* on page 55.

The list below summarises the commands in this chapter:

| Command | Summary | Page |
|---|---|---|
| *Configure BootNet | Sets the configured state for whether or not the AUN software is loaded from ROM | 44 |
| *EcInfo | Displays Econet driver module internal statistics | 45 |
| *E1Info | Displays Acorn Ethernet II driver module internal statistics | 45 |
| *E2Info | Displays Acorn Ethernet I driver module internal statistics | 45 |
| *InetInfo | Displays Internet module internal statistics | 46 |
| *NetMap | Displays the current AUN map table | 47 |
| *NetProbe | Reports if a remote station is accessible and active | 48 |
| *NetStat | Displays the current status of any network interface(s) configured for AUN | 49 |
| *NetTraceOff | Turns off a gateway's tracing of routing protocol messages | 50 |
| *NetTraceOn | Turns on a gateway's tracing of routing protocol messages | 51 |
| *Networks | Displays the current AUN routing table | 52 |
| *SetStation | Sets a station's number | 53 |

# * Commands

## *Configure BootNet

Sets the configured state for whether or not the AUN software is loaded from ROM

### Syntax

```
*Configure BootNet On|Off
```

### Use

*Configure BootNet sets the configured state for whether or not the AUN software is to be loaded from ROM. Drivers are always loaded from the ROM, irrespective of this configured setting. **This command is only available on stations fitted with an AUN client ROM**.

For such stations, you should configure this value to 'On' if the station is to be a client station using an AUN-configured network, and to 'Off' otherwise (i.e. if the station is to be a gateway station, or to be connected to a TCP/IP-configured network).

The default state at installation of the card is 'Off'.

### Example

```
*Configure BootNet On
```

### Related commands

None

# *DeviceInfo

Displays driver module internal statistics

## Syntax

```
*EcInfo
*E1Info
*E2Info
```

## Use

A *DeviceInfo command displays detailed information about driver module activity. Each of the standard Acorn drivers provides such a command:

| Command | driver for: |
|---|---|
| *EcInfo | Econet |
| *E1Info | Acorn Ethernet I |
| *E2Info | Acorn Ethernet II |

We expect third party drivers to provide a corresponding command; you should see the documentation supplied for the command name.

It is presented mainly as an aid to trouble-shooting, should you require it.

## Example

```
*E2Info
Card Info          Slot=1, Ethernet address=00:00:a4:00:01:00

I/O Stats          Rxframes=113, Rxerrs=0, Txframes=111, Txerrs=0
                   Collisions=0
```

## Related commands

None

# *InetInfo

Displays Internet module internal statistics

## Syntax

```
*InetInfo
```

## Use

*InetInfo displays information and statistics about the current state of the Internet module, which forms a part of the AUN software. Most of the information displayed is runic in nature. It is presented mainly as an aid to trouble-shooting, should you require it.

## Example

```
*InetInfo
```

## Related commands

None

# *NetMap

Displays the current AUN map table

## Syntax

*NetMap [*net_number*]

## Use

*NetMap displays the current AUN map table either for the specified net, or for all nets if no parameter is specified. The map table shows the net number of each net, its name, and its Internet address.

Each station obtains the information held in the map table from a gateway's Map file. Since this file is identical for all gateways on a correctly set up network, the output from this command is the same for all stations, and only varies when the network's layout is altered.

## Examples

```
*NetMap 129
129     science         1.3.129.x

*NetMap
1       compsciA        1.1.1.x
2       compsciA        1.1.2.x
3       compsciA        1.1.3.x
128     compsciB        1.2.128.x
129     science         1.3.129.x
8       art             1.4.8.x
130     business        1.5.130.x
131     backbone        1.6.131.x
```

## Related commands

*Networks

# *NetProbe

Reports if a remote station is accessible and active

## Syntax

*NetProbe *net_number.station_number*

## Parameters

| | |
|---|---|
| *net_number* | remote station's net number |
| *station_number* | remote station's station number |

## Use

*NetProbe reports if a remote station is accessible and active, and hence can be reached from the local station and network. This command does so by sending a control message to the specified station and awaiting a reply.

## Examples

```
*NetProbe 128.135
Station present

*NetProbe 128.201
Station not present
```

## Related commands

None

# *NetStat

Displays the current status of any network interface(s) configured for AUN

## Syntax

```
*NetStat [a]
```

## Parameters

a give all information, rather than simplified version

## Use

*NetStat displays the current status of any network interface(s) configured for AUN. The optional parameter a gives extra information, including traffic counters and full IP addresses. Known network numbers which are marked with an asterisk ('*') represent nets in a directly connected Econet network.

## Example

```
*NetStat a
Native Econet     0.19                    information for native Econet

Interface         EconetA                 information for first AUN interface
AUN Station       8.19
Full address      1.4.8.19

Interface         Ether2                  information for second AUN interface
AUN Station       131.19
Full address      1.6.131.19

Known nets        1     2     3     *8      128   129   130
                  131
                                          information below only given if optional parameter a supplied
TX stats.         Data=0, Immediate=2, Imm_Reply=0, Retry=0
                  Error=20, Data_Ack=5, Data_Rej=0, Broadcast=10
                  (local=0, global=5)

RX stats          Data=5, Immediate=0, Broadcast=0, Discard=0
                  Retry=0, Error=0, Data_Ack=0, Data_Rej=0
                  Imm_Reply=2, Reply_Rej=0

Module status     0140
```

## Related commands

None

# *NetTraceOff

Turns off a gateway's tracing of routing protocol messages

## Syntax

```
*NetTraceOff
```

## Use

*NetTraceOff turns off a gateway's generation of trace information about its transmission and reception of routing protocol messages. For more details, see the description of the *NetTraceOn command.

This command is provided by the gateway variant of the AUN module, and is hence only available on gateway stations. It is anyway irrelevant to client stations.

## Example

```
*NetTraceOff
```

## Related commands

*NetTraceOn

# *NetTraceOn

Turns on a gateway's tracing of routing protocol messages

## Syntax

```
*NetTraceOn [filename]
```

## Parameters

| | |
|---|---|
| *filename* | name of file to which to direct output |

## Use

*NetTraceOn turns on a gateway's generation of trace information about its transmission and reception of routing protocol messages. This information is stored in the given file, or – if none is specified – in the file !Gateway.Trace. You can load the trace file into a text editor such as Edit in the usual way.

To view the default file you will need to open the Gateway application directory; hold down the *Shift* key while you double-click on its icon.

This command is provided by the gateway variant of the AUN module, and is hence only available on gateway stations. It is anyway irrelevant to client stations.

## Example

```
*NetTraceOn
```

## Example output

```
Fri Mar 27 16:26:06:  ==> 131.123
    compsciB          local
    backbone          local
Fri Mar 27 16:26:17:  ==> 131.19
    compsciB          local
    backbone          local
Fri Mar 27 16:27:31:  ==> 131.150
    compsciB          local
    art               gateway=1
    backbone          local
```

## Related commands

*NetTraceOff

# *Networks

Displays the current AUN routing table

## Syntax

```
*Networks
```

## Use

*Networks displays the current AUN routing table. This shows the names of any local networks (i.e. those to which the station is directly connected). It also shows the names of those remote networks that the station knows how to reach, and the gateway that it will use to do so

The AUN routing table alters as gateways start up and shut down, and so the information returned by this command varies as the state of the network alters.

## Examples

```
*Networks
art             gateway=131.19
backbone        local
```

*a client on the 'backbone' net connected to the 'art' net by gateway 131.19*

```
*Networks
art             local
backbone        local
```

*a gateway between the 'art' net and the 'backbone' net (i.e. station 131.19 above)*

## Related commands

*NetMap

# *SetStation

Sets a station's number

## Syntax

```
*SetStation [station_number]
```

## Parameters

| | |
|---|---|
| *station_number* | a station number in the range 2 - 254 |

## Use

*SetStation sets a station's number, storing it in CMOS RAM so it is not lost when the computer is switched off. If no number is specified then one is prompted for. If the new station number given is invalid, then the current station number is preserved.

This command is not a part of the standard AUN software, to prevent users from altering station numbers. It is instead supplied as a separate program on the Support disc of the Level 4 FileServer distribution, in the ArthurLib directory. You can run this program from the desktop by double-clicking on its icon; a window shows the prompt for the station number.

The number is stored in the same location as is used by Econet to store station numbers. If the station is connected to both an AUN network and a native Econet, it will accordingly use the same station number for both types of network. Altering the station number for one network will alter it for the other.

You can find out a station's current station number by typing at a command line:

```
*Help Station
```
*if Econet is fitted*

or:

```
*NetStat
```
*if* AUN *is installed*

## Examples

```
*SetStation 20
```

```
*SetStation
New station number: 20
```

## Related commands

*Help Station

# 6 Technical information

This chapter gives some more technical information on how the AUN software works. You don't need to read this chapter, since you can install, use and manage the network without knowing any of the information it contains. However, the more technically minded amongst you may be interested in what follows.

## Protocols

AUN uses the UDP, IP, ARP, RevARP and RIP protocols from the TCP/IP family:

- The transport protocol is User Datagram Protocol (UDP), enhanced by a proprietary handshake mechanism designed to support the semantics of Econet SWI calls. This is not a straightforward port of the four-way handshake mechanism used by native Econet, but is rather a two-way handshake protocol overlaid with a timeout and retransmission mechanism better suited to the characteristics of IP traffic.

  TCP itself is not used, as it is a stream oriented protocol unsuited to supporting an Econet-like data delivery service.
- The network protocol is Internet Protocol (IP).
- Address Resolution Protocol (ARP) is used to map IP addresses into physical network addresses.
- Reverse Address Resolution Protocol (RevARP) is used by client stations to request their own IP addresses from gateway stations.
- Routing Information Protocol (RIP) is used to pass routing table information between stations.

## Software

The AUN software consists of three closely related modules:

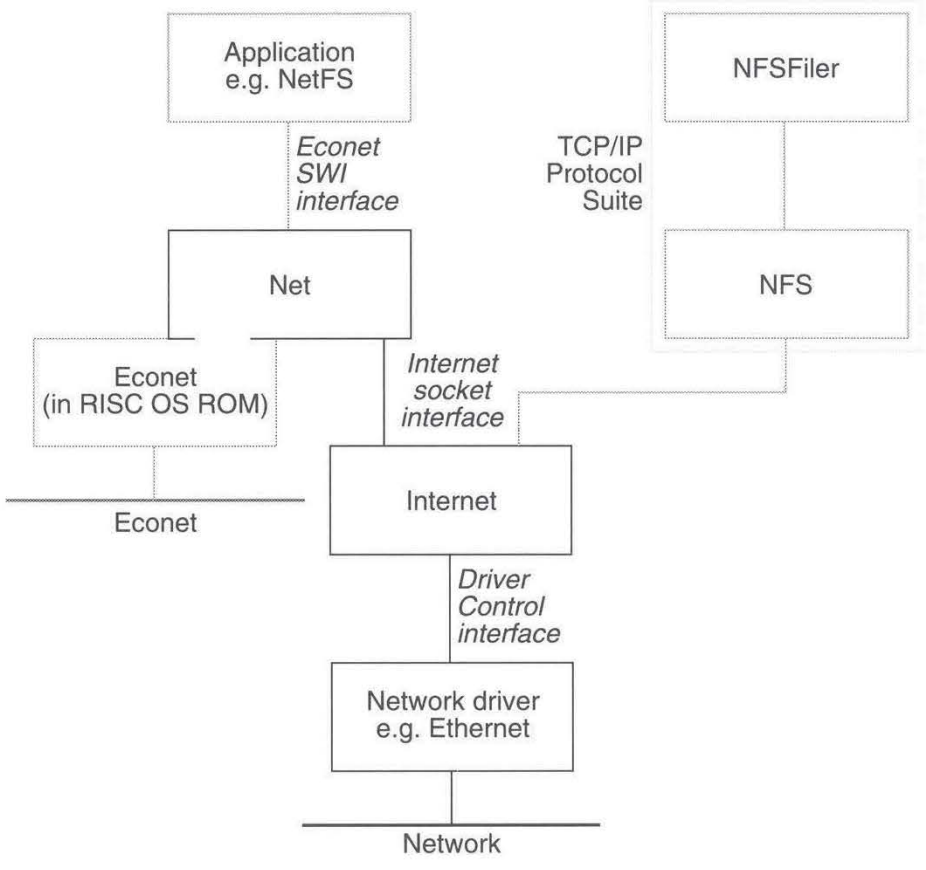
- The **Net** module implements the two-way acknowledgement handshake, and presents an Econet-like service to applications via Econet SWI calls. It also implements the RIP function.
- The **Internet** module implements UDP, IP, ARP and RevARP protocols, and exports an industry standard (Berkeley socket) interface to other RISC OS software such as the TCP/IP Protocol Suite.

- The **device driver** module enables the AUN software to communicate with a particular network interface. Each type of network interface needs its own device driver.

  The AUN software comes with three different driver modules: **EconetA** (for Econet interfaces), **Ether1** (for an Acorn Ethernet I card), and **Ether2** (for an Acorn Ethernet II card). The Econet driver accesses the network interface via the Econet handler resident in the RISC OS ROM, whereas the Ethernet drivers directly access the Ethernet hardware.

## The software in detail

The following diagram illustrates the relationship between the modules in AUN:




There is a particularly close connection between the Net module and the Econet module. The Net module learns which nets may be accessed via a directly connected Econet, and which nets need to be accessed via IP (ie nets that do not use Econet, or nets using Econet that can only be reached via a gateway). The Net module intercepts SWI calls to Econet from higher-level applications such as

NetFS, NetPrint and Broadcast Loader, and – by examining the destination net number – determines whether to route the calls to the Econet module for traffic over native Econet, or to the Internet module for traffic over IP.

If the AUN station does not have an Econet interface fitted then the Econet software module will not be present, and so all traffic will be via the Internet module and IP protocol.

The Internet socket interface – used by the Net module in AUN – remains exposed for parallel use by other applications. Hence other protocols running over IP, such as NFS, can run at the same time as AUN.

## Addresses in Econet and AUN

Under native Econet, users and programs uniquely identify each station with two one-byte numbers, thus:

*net.station*

Under AUN, users and programs use exactly the same scheme, to preserve compatibility with native Econet. However, the underlying Internet protocols used by AUN use four-byte numbers to identify stations. The AUN software therefore needs to translate each two-byte address passed by a user or program into a four-byte IP address. The AUN interpretation of each of the four bytes is:

*site.network.net.station*

The bottom two bytes (*net.station*) are the same two bytes as are seen by users and programs. The *network* byte is used to provide additional routing information to the underlying IP software only, so that it can route data to the correct destination network. The *site* byte is currently unused and always has a value of one.

Technically speaking, an AUN IP address is a Class A IP address, with a netmask of &FFFF0000.

For example, the AUN interpretation of a command – in the normal IP emphasis – to:

'send data to host 1.3.129.16'

is actually:

'send data to station 129.16... (which is located in network number 3)'

or, more meaningfully:

'send data to station 129.16... (which is located in the science network)'.

The difference between the addressing used by native Econet and the IP address used by AUN is summarised by the table below:

| Network | Bytes | Form | Examples |
|---|---|---|---|
| Native Econet address | 2 | *net.station* | 3.2<br>8.103<br>129.12 |
| AUN IP address | 4 | 1.*network.net.station* | 1.1.3.2<br>1.4.8.103<br>1.3.129.12 |

## AUN IP address configuration

### How a gateway station finds its full IP address

When a gateway station starts up, it reads its station number from CMOS RAM. (This number is set by the SetStation command; see page 53.)

To find the site, network and net numbers of both its interfaces, the gateway station looks at its Map file and its Configure file.

#### The Map file

The Map file tells the gateway station the IP address of each net on the site. As an example, let's look at the Map file for the site illustrated on page 18:

```
| Example: Large site network containing 5 dept networks linked via backbone

compsciA        1 2 3                   | old compblock econet
compsciB        128                     | compblock Ethernet
science         129                     | science Ethernet
art             4                       | art room econet
business        130                     | business studies ethernet
backbone        131                     | backbone ethernet
```

The gateway station converts each network name to a network number in the order they're read; the first network has the number 1, the second is number 2, and so on. Adding in the net numbers to the example above, the following full IP

addresses apply to the example network. (The site number defaults to 1, and the *station* field is read by each individual station from its configured value in CMOS RAM):

| Network name | Network number | Net number | Returned IP address |
|---|---|---|---|
| compsciA | 1 | 1<br>2<br>3 | 1.1.1.*station*<br>1.1.2.*station*<br>1.1.3.*station* |
| compsciB | 2 | 128 | 1.2.128.*station* |
| science | 3 | 129 | 1.3.129.*station* |
| art | 4 | 4 | 1.4.4.*station* |
| business | 5 | 130 | 1.5.130.*station* |
| backbone | 6 | 131 | 1.6.131.*station* |

### The Configure file

The Configure file tells the gateway station its own position in the site: specifically, which network is connected to which interface. For example:

```
| Example1:
|       network compsciA is Econet;
|       network backbone is Ethernet.

Econet          is compsciA
Slot 0          is backbone
```

This tells the gateway that its Econet interface is connected to the compsciA network, and its Ethernet interface (in slot 0) is connected to the backbone network. What it does not tell the gateway is whether the Econet interface is connected to net 1, 2 or 3. The gateway station resolves this by reading the correct net number (in this case 2) from an Econet bridge on its own net. Thus, if the station number were 7, the two interfaces' IP addresses would be:

1.1.2.7 for the Econet interface
1.6.131.7 for the Ethernet interface

Note that an Ethernet network must always consist of a single net, and so the gateway does not have to resolve the same ambiguities as for Econet.

## How a client station finds its full IP address

Like a gateway station, an AUN client station reads its station number from CMOS RAM at start-up time.

However, at this stage it does not know its site, network and net numbers; instead, it finds these out from a gateway station connected to its local network.

To do so the client station broadcasts a RevARP message requesting its IP address. The gateway receives this broadcast on the interface that is connected to the client's network, and returns that interface's IP address, first setting the station number to zero:

*site.network.net*.0

Because the gateway station's interface and the client station are on the same network, the returned site and network numbers are therefore the same as those of the client station. The net numbers will also be the same, unless the client station and the gateway station are on different nets within the same network (which can only be the case if they are separated by Econet bridges).

The client station takes the returned address and substitutes its own station number. It also determines if it is connected to a bridged Econet; if so, it replaces the returned net number – which may be incorrect – with the correct net number, read from an Econet bridge on its own net.

## Default addresses

If a client station does not get a response to its request for its full IP address, this means that no gateway computer is present and so the local network is isolated. This being the case, then:

- If the station is connected to an Econet it will use native Econet rather than the Internet protocols used by AUN.
- If the station is connected to any other network it adopts a default IP address of 1.0.128.*station*, giving a user address of 128.*station*.

When/if a gateway computer subsequently comes 'on-line' it will immediately send a message to the other stations on the previously isolated network, so they may then complete their address and routing configuration, and get access to all other networks in the AUN system.

Consequently while a network is isolated all its stations may communicate between themselves; stations don't 'hang' awaiting a response from a gateway. You may later start up a gateway station to bring the isolated network into your site's AUN network. However, since this is likely to change 'on the fly' all the addresses of that network's stations, you must take care only to do this when there are no users active on the network.

## Application program interface

The application program interface, or API, is the same as the RISC OS 3 (version 3.10) Econet SWI interface, with certain usage qualifications described below. For full details, refer to the RISC OS 3 *Programmer's Reference Manual*.

Existing user applications which access Econet do not require functional modification at the network interface in order to run over an AUN network.

The AUN module intercepts SWI calls to Econet from user software. It treats the calls differently according to how it can access the destination station:

- If the destination station can be accessed directly via Econet, AUN passes the SWI calls to the resident Econet handler. This avoids unnecessary IP protocol overheads for a localised Econet-only transaction.
- Otherwise the destination station must be accessed via IP. AUN maps the SWI calls into calls to the Internet module, having first expanded the two-byte *net.station* destination address into a four-byte *site.network.net.station* IP address.

The maximum amount of data which can be passed in a single transmission SWI via IP is 8192 bytes.

When transmitting to a station via IP, transmission SWI calls will return only the error values Status_NetError and Status_NotListening in the event of failure. Over raw Econet other Econet-specific error values may be returned.

### Constraints on the use of Econet SWI calls over AUN

#### Immediate operations

In general the Immediate mechanism is considered to be Econet specific. The only Immediate operation supported by AUN over IP is Econet_MachinePeek. All other Immediate SWI calls return Status_NotListening, unless the destination station is accessible via a directly connected Econet.

#### Transmission strategy

An application's choice of values for the Count and Delay parameters it passes to transmission SWIs may make assumptions about the actual physical characteristics of Econet. For example some Econet utility programs set the Count to 0 in Immediate operations, relying on the fact that the return of a scout acknowledge frame in response to a valid scout frame will always be effectively instantaneous. However, over an AUN IP network this assumption is invalid; the functional equivalent of the scout acknowledge may arrive 'sometime', or even 'never'.

Consequently AUN uses a retransmission strategy more suitable to the nature of IP traffic, whilst retaining the existing retransmission strategy for transmissions to a directly connected Econet. The retransmission strategy for AUN over IP is as follows:

**For ordinary data**, AUN employs a two-way handshake. A receiving station will return a positive acknowledgement if it has successfully received a data frame into an open receive block, or else a reject message if there is currently no open receive block, or some other detectable reception error has occurred.

**If** Count > 1

The maximum elapsed timeout period in seconds (T) requested by the application is computed as:

T = (Count × Delay) / 100.

On receipt of reject messages, the sender will retransmit the data frame 10 times after 1 centisecond timeouts, then:

**If** T < 5

T × 10 retransmissions will occur, each after 10 centisecond timeouts;

**Else**

**If** the destination station is not on the same network as the sender

exactly 50 retransmissions will occur, each after (T × 100) / 50 centisecond timeouts;

**Else**

**If** the retry delay < 25 centiseconds

exactly 50 retransmissions will occur;

**Else**

(T × 4) retransmissions will occur, each after a 25 centisecond timeout.

(This provides some optimisation for simultaneous loading of software from a local file server, whilst protecting against excessive overload at gateway stations caused by rapid retransmission.)

**If** no response is received at all then:

**If** T < 5

1 retransmission will occur, after a 5 second timeout;

**Else**

T / 5 retransmissions will occur, each after 5 second timeouts.

**Else**

The sender will transmit exactly once. The transmission status will not change until a positive acknowledgement or a reject message has been received, or a 5 second timeout has elapsed.

**For an Immediate operation** (i.e. Econet_MachinePeek), a SWI call with Count = 0 or Count = 1 always results in a Status_NotListening return; no actual network transmission is made. In other cases the sender transmits an Immediate message exactly once, changing transmission status only when a response has been received or a 5 second timeout has elapsed.

### Bridge protocol

Use of the Econet Bridge protocol by a RISC OS net utility program to identify valid net numbers does not work over non-Econet networks within an AUN system, as no actual Econet bridges are present to respond. However, cycling through the range of net numbers in a sequence of calls to Econet_ReadTransportType can provide this information without involving any network transactions; the call returns R2 = 0 if the given net number is not currently accessible from the local station.

Note that this constraint does not affect use of the Bridge protocol onto a directly connected Econet system.

### Meaning of net 0

In AUN, a station may be connected to both an Econet and an Ethernet at the same time. This means that the assumption that Net 0 means the local network is no longer safe, as the AUN software could not, in this case, distinguish the two connected networks with certainty. Hence applications running over AUN should strive to supply an actual net number with every transmission SWI call.

You should note that the actual net number of a connected Econet may in fact be 0, if there are no bridges present; however the net number of an Ethernet in a correctly configured AUN network can never be 0, so no clash will occur. If a net number of 0 is supplied to a transmission SWI, AUN maps it to the net number of a directly connected net, with Econet taking priority over Ethernet if both are connected.

### Local broadcasts

If a station is connected to both Econet and Ethernet, transmit SWI requests for a local broadcast – as issued by Broadcast Loader– are directed to the Econet only.

### Data delivery

As with Econet, AUN over IP cannot guarantee that a message apparently correctly received and acknowledged by a receiving station will not be retransmitted if the acknowledgement is lost in transit. Applications using AUN should therefore ensure that they can detect whether a transmission has been repeated. This is usually done by adding a sequence number or bit to transmissions.

# Appendix: AUN and TCP/IP

This appendix describes two ways of using together the software in this product and the software in Acorn's full standard TCP/IP product, the TCP/IP *Protocol Suite*. This is only likely to be relevant to you if you wish to mix together on the same network both RISC OS stations (including Level 4 FileServers) and UNIX (or RISC iX) computers.

The first description tells you how to connect AUN-configured stations to an existing TCP/IP network, such as a University's campus-wide Ethernet to which UNIX workstations are connected. Using this method you could, for instance, connect Level 4 FileServers or Spoolers to standard TCP/IP networks.

The second description tells you how to run the industry standard NFS protocol over an AUN-configured network, such as might be found in a school. Using this method you could, for instance, connect NFS file servers (such as RISC iX computers) to AUN networks.

In both the above cases you would then be able to access both Level 4 FileServers and NFS file servers from the same RISC OS station. You can view the files on the Level 4 FileServer in a directory display using the Net icon, just as usual; likewise you can view the files on the NFS file server using the NFS Filer. You can treat the files in the same way as those on any RISC OS filing system: for instance, you can transfer files between the different servers just by dragging them from one directory display to the other.

The TCP/IP Protocol Suite is available from your Acorn Network Dealer.

## The Broadcast Loader

The Broadcast Loader and the TCP/IP Protocol Suite are incompatible, and you must not use them together. In RISC OS 3 the Broadcast Loader is enabled by default. To disable it use the Configure application; see the RISC OS 3 *User Guide* for further details.

## Adding AUN-configured stations to an existing TCP/IP network

Because both TCP/IP protocols and AUN protocols are founded upon the same Internet family of protocols, you can use both over the same physical network. The software components you'll need are:

- !Internet from the TCP/IP Protocol Suite
- !BootNet from AUN.

If you're setting the machine up as a Level 4 FileServer you'll also need:

- !Server etc. from the Level 4 FileServer.

Similarly, to set the machine up as a Spooler you'll also need:

- !Spooler etc. from the Level 4 FileServer.

The addressing scheme used must be consistent; both TCP/IP and AUN must number networks and stations in the same way.

The normal scheme used by AUN to map two-byte Econet addresses to four-byte IP addresses only uses a very small subset of all possible IP addresses. (For full details of this default mapping, see the chapter entitled *Technical information* on page 55.) It's extremely unlikely that this will match the addressing scheme already used by your existing TCP/IP network. Consequently you'll need to install the AUN software in a different manner to that you'd use on an AUN-configured network, so that it uses the TCP/IP network's addressing scheme rather than its default one.

### Don't use AUN client ROMs

You cannot use an AUN client ROM with a TCP/IP network, because the software it contains assumes that the AUN addressing scheme is used, and so is only suitable for an AUN-configured network. You must always load the software from disc.

### Don't use AUN gateways

Likewise, AUN gateways assume that the underlying network uses the standard AUN addressing scheme, which differs from the scheme used by a TCP/IP network. Consequently gateways on a TCP/IP network **must** be conventional TCP/IP gateways, **not** AUN gateway stations (i.e. not stations running the AUN Gateway application).

You can set up a TCP/IP gateway between Econet and Ethernet using the TCP/IP Protocol Suite, and hence connect AUN-configured Econet stations to an existing TCP/IP Ethernet.

## Client installation

### Set up the Internet application

Install the Internet application from the TCP/IP Protocol Suite, configuring it to set up addresses that follow the scheme used by your existing TCP/IP network. You'll find full instructions for doing this in the TCP/IP *Protocol Suite Installation Guide*.

### Set up the BootNet application

The BootNet application needs to set up explicit mappings between the two-byte net.station addresses used by Econet software, and four-byte addresses that are correct for your existing TCP/IPnetwork. This is done using the AddMaps file, held in the Files subdirectory. The format of the file is simple. It consists of a series of lines having the syntax:

```
addmap byte1.byte2.byte3.0 net
```

where `net` is a net number used by RISC OS, and `byte1`, `byte2` and `byte3` are respectively the first, second and third bytes of the corresponding TCP/IP address.

For example, the line:

```
addmap 89.0.2.0 130
```

would cause a RISC OS address of 130.*station* to be translated to a TCP/IP address of 89.0.2.*low_byte*, and vice versa; so the RISC OS address 130.57 would correspond to the TCP/IP address 89.0.2.57.

To set up these mappings:

1. Load Edit onto the icon bar – if it's not already loaded.
2. Open the BootNet application directory by holding down the *Shift* key while you double-click on its icon.
3. Open the Files subdirectory of the BootNet application by double-clicking on its icon.
4. Edit the AddMaps file:
   - Load it into Edit by dragging its icon to the Edit icon on the icon bar.
   - Edit it so that it specifies the mappings for your site.
   - Save the edited AddMaps file, overwriting the original.

No further configuration is necessary, as the Internet application specifies the network interface to use, and the address of the station.

### Loading the software

The procedure to load the software is almost identical to that for a dedicated AUN-configured network – as described in the section entitled *Loading the software* on page 36. Follow those instructions, with these two important changes:

#### Run the Internet application from the desktop boot file

Your desktop boot file must run the Internet application **before** it runs the BootNet application. For example:

```
Run $.TCP_IP.!Internet
Run $.!BootNet
```

#### Do not set the station's number

You should not use the SetStation program to set the station number, because that is set in the Internet application's !Configure file. Ignore the instructions in the section entitled *Set the station's number* on page 23.

## Adding NFS file servers to an existing AUN network

Just as you can add AUN-configured stations to a network set up for TCP/IP, so you can do the reverse. For example you might wish to add an NFS file server to an existing AUN network. The software components you'll need to run on a client station to access an NFS file server on an AUN network are:

- !BootNet from AUN
- !NFSFiler from the TCP/IP Protocol Suite.

Again the addressing must be consistent; in this case the NFS file server's IP address must use the same site and network numbers as the AUN client stations connected to the same network. (The addressing scheme used by AUN stations is described in detail in the chapter entitled *Technical information* on page 55.) For example, the compsciB network of our example AUN site (illustrated on page 18) has a site number of 1, a network number of 2, and a net number of 128. The configured IP address of an NFS file server connected to this network must therefore be 1.2.128.*byte*. (For example, you could use 1.2.128.4.)

You should not start the NFSFiler application until **after** you have loaded the AUN software at boot time. Full information about using the NFSFiler to access files on remote file servers is given in the TCP/IP *Protocol Suite User Guide*.

# Glossary

*This glossary defines any new terms that you may have come across in this Guide – mostly those that are that are specific to networking and to* AUN. *Terms in italics have their own definition in this glossary.*

**AUN** — Acorn Universal Networking, Acorn's new networking strategy, of which this product is the core.

**backbone network** — a *network* the purpose of which is to carry traffic directly from one *network* on a *site* to another.

**boot file** — a file used to load other software when a particular event occurs, such as switching on a computer or logging on to a *file server*.

**BootNet application** — one of the two applications in the software, which loads the various modules required for a *client station* to use AUN.

**bridge** — a hardware device used to link together two parts of a physical network of the same type (e.g. *Econet*) and to filter out data not destined for either part.

**Broadcast Loader** — an Acorn product that enables the simultaneous transfer of identical data to a large number of *clients* from a single *station*.

**Cheapernet** — an alternative name for *thin Ethernet*.

**client station** — a *station* connected to a single AUN-configured *net*.

**clock box** — a piece of hardware used to supply a clock signal to an *Econet*.

**desktop boot file** — a *boot file* used when entering the RISC OS desktop.

**driver** — a module that connects the rest of the AUN software to a particular type of *network interface*.

**Econet** — Acorn's own low cost networking system.

**Ethernet** — an industry standard networking system offering a greater bandwidth than *Econet*, but at a higher cost.

**file server** — a *station* on which other *stations* can store and retrieve files.

**Gateway application** — one of the two applications in the software, which loads the various modules required for a *gateway station* to use AUN.

**gateway station** — a *station* connected to two AUN-configured *networks*, and used to pass data between them.

**hub box** — a piece of *Ethernet* hardware used to connect together *twisted-pair Ethernet* cabling from a number of *stations*.

**Internet** — a family of *protocols* that have become an industry standard.

**Internet application** — an application used only with TCP/IP configured networks, containing the necessary configuration files for AUN to work over such a network.

**IP** — an abbreviation for the industry standard *Internet* protocol.

**Level 4 FileServer** — Acorn software that turns an ordinary *station* into a *file server* without the need for specialised hardware.

**multiport repeater** — a *repeater* that provides a number of identical outputs.

**native Econet** — an *Econet* that uses ordinary Econet protocols rather than AUN.

**net** — a part of a *network* that appears to the user as a single entity.

**network** — a physical network of a single type, delimited by any *gateway stations* used to connect it to other networks.

**network interface** — a hardware device used to connect a computer to a network, typically produced as a plug in circuit board or as an expansion card.

**NFS** — the Network File System, provided as a part of the TCP/IP *Protocol Suite*, used to access files on other machines running NFS (such as UNIX workstations).

**print server** — a *station* to which other *stations* can send output for printing.

**protocol** — the way in which data is sent over a network.

**repeater** — a hardware device used to extend the distance a network can cover by restoring the strength and quality of signals.

**riser** — a vertical section of cabling used to connect networks on separate floors, and typically connected to them by *bridges* or *repeaters*.

**site** — a term for all the physical networks on a single AUN site.

**Spooler** — Acorn software that turns an ordinary *station* into a *print server* without the need for specialised hardware.

**station** — a computer connected to a *net*.

**TCP/IP** — an abbreviation for Transmission Control Protocol / Internet Protocol, an industry standard used in particular by UNIX computers.

**TCP/IP Protocol Suite** — an Acorn product providing a wide range of facilities to RISC OS stations connected to a TCP/IP configured network.

**thick Ethernet** — a variety of *Ethernet* cabling able to support more stations over a longer cable run than *thin Ethernet*, but in a less convenient and more expensive form.

**thin Ethernet** — a variety of *Ethernet* cabling able to support fewer stations over a shorter cable run than *thick Ethernet*, but in a more convenient and less expensive form.

**twisted-pair Ethernet** — a variety of *Ethernet* cabling that is inexpensive, and used to connect a single station to a *hub box*.

**UNIX** — a widely used operating system.

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# Reader's Comment Form

AUN *Manager's Guide*

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