About this Software Reference

Introduction

This Software Reference is the complete reference to the configuration, management and operation of all AR400 Series routers, and includes detailed descriptions of all management commands.

AR400 Series routers provide efficient and cost-effective multiprotocol routing, terminal serving and integrated network management over wide area networks and LANs.

The router provides wide area networking via

- Point-to-Point Protocol
- Frame Relay, and X.25, operating over synchronous links up to 2Mb/s (routers with PIC bay only).

Structure of this Software Reference

Part 1: Introduction and Setup

See this chapter...	For information about...
Chapter 1, Getting Started	how to start operating the router.
Chapter 2, Using the Command Line Interface (CLI)	the structure of commands, command line editing, and aliases.
Chapter 3, Using the Graphical User Interface (GUI)	how to access the router via the GUI, and an overview of the GUI's features and navigation.
Chapter 4, Configuring and Monitoring the System	the router's system identification parameters and how to monitor system functionality and the router's environment.
Chapter 5, Managing Configuration Files and Software Versions	how to save and edit the router configuration, how to load files to and from the router, and how to upgrade the router software.
Chapter 6, Managing the File System	router memory and how to create, edit, and delete files.

Part 2: LAN Switching and WAN Connections

See this chapter...	For information about...
Chapter 7, Overview of Physical and Layer 2 Interfaces	the physical and logical interfaces available on the base unit router and the optional interfaces available as expansion options on models that have a PIC bay.
Chapter 8, Switching	how to configure the Layer 2 switch ports on the router, their VLAN membership, and their Quality of Service mapping.
Chapter 9, Interfaces	the Ethernet, synchronous (router with PIC bay only) and asynchronous network interfaces on the router.
Chapter 10, ATM over xDSL	Asymmetric Digital Subscriber Line (ADSL) and Symmetrical High-speed Digital Subscriber Line (SHDSL) over Asymmetric Transfer Mode (ATM) on the router.
Chapter 11, Integrated Services Digital Network (ISDN)	the ISDN service provided by the router, and how to configure ISDN interfaces (router with PIC bay only). The router offers Basic Rate and Primary Rate access to ISDN services, with dial-on-demand and channel aggregation.
Chapter 12, Time Division Multiplexing (TDM)	the router's implementation of time division multiplexing over G.703 links (router with PIC bay only).
Chapter 13, X.25	how to configure the router's implementation of the ITU-T Recommendation X.25 protocol, and how to build an X.25 Packet Switched Network (routers with PIC bay only).
Chapter 14, Frame Relay	the router's implementation of Frame Relay, and how to configure the router's Frame Relay interfaces (routers with PIC bay only).
Chapter 15, Point-to-Point Protocol (PPP)	the router's implementation of the Point-to-Point Protocol (PPP).
Chapter 16, Bridging	the router's implementation of the IEEE 802.1D–1990 standard for MAC bridges and remote bridging.
Chapter 17, Synchronous Tunnelling	the router's mechanism for tunnelling synchronous (HDLC) data through a TCP/IP network (routers with PIC bay only).
Chapter 18, Transaction Packet Assembler Disassembler (TPAD)	the router's method of exchanging credit card transaction information between a transaction terminal or back office server and a credit card authorisation service (routers with PIC bay only).
Chapter 19, Asynchronous Call Control	the router's facilities for managing dial-in connections or interconnecting routers using the asynchronous ports.
Chapter 20, Layer Two Tunnelling Protocol (L2TP)	the router's implementation of the Layer Two Tunnelling Protocol.

Part 3: Routing—IP and Other Protocols

See this chapter...	For information about...
Chapter 21, Overview of Routing	some of the routing protocols supported by the router.
Chapter 22, Internet Protocol (IP)	implementation of the Internet Protocol (IP), which provides TCP/IP routing in hardware. This chapter also describes IP filters, RIP, and the address resolution protocols ARP, Proxy ARP, and Inverse ARP.
Chapter 23, Dynamic Host Configuration Protocol (DHCP)	implementation of the Dynamic Host Configuration Protocol. The router can act as a DHCP server and automatically assign IP addresses and other configuration information to PCs and other hosts on TCP/IP networks.
Chapter 24, IP Multicasting	IP multicasting, including IGMP for group management, IGMP snooping, and DVMRP and PIM Sparse and Dense Mode for multicast routing.
Chapter 25, Routing Information Protocol (RIP)	implementation of the Routing Information Protocol (RIP), a simple routing protocol.
Chapter 26, Open Shortest Path First (OSPF)	implementation of the Open Shortest Path First (OSPF) routing protocol.
Chapter 27, Border Gateway Protocol version 4 (BGP-4)	implementation of BGP-4 and how to configure it on the router.
Chapter 28, Filtering IP Routes	how to select which routes the router imports, uses, and advertises.
Chapter 29, Voice over IP (VoIP)	how to configure Voice over IP on the router.
Chapter 30, Generic Routing Encapsulation (GRE)	the router implementation of the Generic Routing Encapsulation (GRE) protocol to connect private IP networks via public internets.
Chapter 31, Internet Protocol version 6 (IPv6)	implementation of IPv6, the next generation of the Internet Protocol, including stateless address autoconfiguration, RIPv6 and ICMPv6.
Chapter 32, Dynamic Host Configuration Protocol for IPv6 (DHCP6)	implementation of Dynamic Host Configuration Protocol for IPv6 and the support provided by the router.
Chapter 33, IPv6 Multicasting	IPv6 multicasting, including MLDv2 for group management, and PIM Sparse and Dense Mode for multicast routing.
Chapter 34, Open Systems Interconnection (OSI)	he router's implementation of the Connectionless Network Service (CLNS), End System to Intermediate System routing exchange protocol (ESIS), and Intermediate System to Intermediate System routing exchange protocol (ISIS), from the Open Systems Interconnection (OSI) protocol suite.
Chapter 35, AppleTalk	the router's implementation of Apple Computer Inc.'s AppleTalk protocol.
Chapter 36, Novell IPX	the router's implementation of Novell®'s IPX protocol, including RIP and SAP.
Chapter 37, DECnet	the router's implementation of Digital Equipment Corporation's DECnet Phase IV+ protocol. The router offers DECnet™ routing (Phase IV+ and area) (router with PIC bay only).

Part 4: Traffic Engineering

See this chapter...	For information about...
Chapter 38, Generic Packet Classifier	how the router performs packet classification.
Chapter 39, Software Quality of Service (QoS)	how the router performs policy-based priority, queuing and bandwidth management operations on packets egressing and ingressing WAN links, and over tunnels.
Chapter 40, Resource Reservation Protocol (RSVP)	implementation of the Resource Reservation Protocol, which allows receivers of traffic flow to reserve resources for the flow. RSVP delivers quality of service to application data streams.

Part 5: Security

See this chapter...	For information about...
Chapter 41, User Authentication	how to put the router into secure mode, and how to authenticate users who access the router. Authentication options include a built-in user database, and interaction with external servers such as RADIUS, TACACS and TACACS+.
Chapter 42, Compression and Encryption Services	the data compression and encryption services provided by the router. This includes Van Jacobson's header compression, STAC LZS and Predictor compression, and hardware-based AES and DES encryption.
Chapter 43, Port Authentication	how to configure 802.1x port authentication on the router.
Chapter 44, Secure Shell	the router's implementation of the Secure Shell protocol for secure remote management.
Chapter 45, Secure Sockets Layer (SSL)	the router's implementation of SSL and how to configure it on the router.
Chapter 46, Firewall	the router's firewall, which is a fully featured, stateful inspection firewall, including proxies and URL filtering.
Chapter 47, UPnP	the router's implementation of UPnP that supports the Internet Gateway Device (IGD) Standard. UPnP works in conjunction with the firewall.
Chapter 48, IP Security (IPsec)	the router's implementation of the *Internet Protocol Security Facility* (IPsec), the *Internet Security Association Key Management Protocol* (ISAKMP) and the *Internet Key Exchange* (IKE) protocol.
Chapter 49, Public Key Infrastructure (PKI)	the configuration of the router for interaction with a Public Key Infrastructure (PKI).
Chapter 50, Link Compression and Encryption	the link compression and encryption facilities provided by the router for Point-to-Point Protocol (PPP), Frame Relay and X.25 links.

Part 6: High Availability

See this chapter...	For information about...
Chapter 51, Server Load Balancing	how to configure server load balancing on the router, for distributing traffic among multiple resources.
Chapter 52, WAN Load Balancing	how to configure WAN load balancing on the router, for distributing traffic among multiple resources.
Chapter 53, Virtual Router Redundancy Protocol (VRRP)	implementation of the Virtual Router Redundancy Protocol (VRRP), a mechanism for combining backup routers into a single logical gateway.
Chapter 54, Ping Polling of Device Reachability	how to configure the router to regularly check whether it can reach a device. The router can also respond when a device or link goes up or down.

Part 7: Network Management and Utilities

See this chapter...	For information about...
Chapter 55, Simple Network Management Protocol (SNMP)	the router's implementation of the Simple Network Management Protocol. Support for SNMP, combined with standard MIBs and the Allied Telesis Enterprise MIB, enables the router to be managed by a separate SNMP management station.
Chapter 56, Link Layer Discovery Protocol (LLDP)	the router's implementation of the Link Layer Discovery Protocol (LLDP) for receiving and processing Cisco® Discovery Protocol messages.
Chapter 57, Network Time Protocol (NTP)	the router's implementation of the Network Time Protocol (NTP).
Chapter 58, Scripting	the router's scripting facility for creating, storing and executing sequences of commands. Scripting enables automated configuration of routers and centralised management of configurations.
Chapter 59, Trigger Facility	the router's automated trigger facility for timed execution of management commands in response to specific events.
Chapter 60, Logging Facility	the router's flexible event logging capability and how to configure it to monitor router activities. The advanced logging facility allows alarm notification to single or multiple management centres.
Chapter 61, Terminal Server	terminal services the router provides and the router's implementation of the Internet Telnet protocol. This includes using Telnet with local host nicknames.
Chapter 62, Permanent Assignments	the permanent assignment services provided by the router. Permanent assignments create permanent data pipes between asynchronous ports on the same, or different, routers.
Chapter 63, Test Facility	describes the facilities built into the router for testing the router's interfaces, and how to execute and interpret the tests.

Support Information

See this section...	For...
Command Summary	an alphabetical list of all router commands and their syntax.
Appendix A, Messages	informational, warning, and error messages generated by the router.
Appendix B, Reference Tables	identifiers and return codes for a range of router functions and network services.
Appendix C, SNMP MIBs	a description of the *Management Information Bases (MIBs)* and managed objects supported by the router's SNMP agent, including the Allied Telesis Enterprise MIB.
Glossary	definitions of terms and concepts used in this Software Reference.
Index	a master index to topics and commands covered in this Software Reference.

Intended Audience

This Software Reference is intended for the system administrator, network manager, or communications technician who configure and maintain the AR400 router, or who manages a network of routers.

It is assumed that the reader is familiar with:

- The topology of the network in which the AR400 router is to be used.
- Basic principles of computer networking, protocols and routing, and interfaces.
- Administration and operation of a computer network.

This Software Reference is not intended for users who use the computer network to access network services from their terminal, personal computer, or workstation. Most of the commands require Manager privilege and can be entered only from a terminal or port that has been assigned Manager privilege.

Conventions

A number of symbols, typographic, and stylistic conventions are used throughout this Software Reference to aid learning and make information easier to find. The following table explains them.

This typeface...	Is used for...
Italic	Introducing and emphasising new terms. Referring to other documents by their title (for example, "RFC 2236, *Internet Group Management Protocol, version 2*").
`Monospace`	Text as it appears on-screen, or something you must type.
bold	Names of commands, parameters and options, when they are written within a paragraph of text. Also sometimes used for emphasis.
0xFF	Numbers starting with the 0x prefix are hexadecimal values.
[Key]	A key on your keyboard. For example, "at the prompt, type a command and press [Enter]. Examples of keys include [Shift], [Alt], [Ctrl] and [Backspace]. Keys may also be referred to using the word "key" (for example, "Press the Ctrl key").
[Key+Key]	A pair of keys on your keyboard that should be pressed together. For example, [Ctrl+P] means to press and hold down the [Ctrl] key, and then press and release the [P] key. Then release the [Ctrl] key.
[Key,Key]	A sequence of keys that should be pressed in sequence. For example, [Break,T] means to press and release the [Break] key; and then press and release the [T] key. The [Key+Key] and [Key,Key] symbols can be combined. For example, [Ctrl+P,T] means to press and hold down the [Ctrl] key, press and release the [P] key, and release the [Ctrl] key; and then press and release the [T] key".
Attention	A special keystroke known as the attention character, which is either [Break] or [Ctrl/P].

Note. A note like this presents additional information, tips, or interesting sidelights.

Warning or Caution. A warning alerts you to situations in which you could hurt yourself. A caution alerts you to situations in which you could lose data or cause damage to the equipment.

Screen views show examples of the output resulting from particular commands or what the screen should look like at a particular time, for instance:

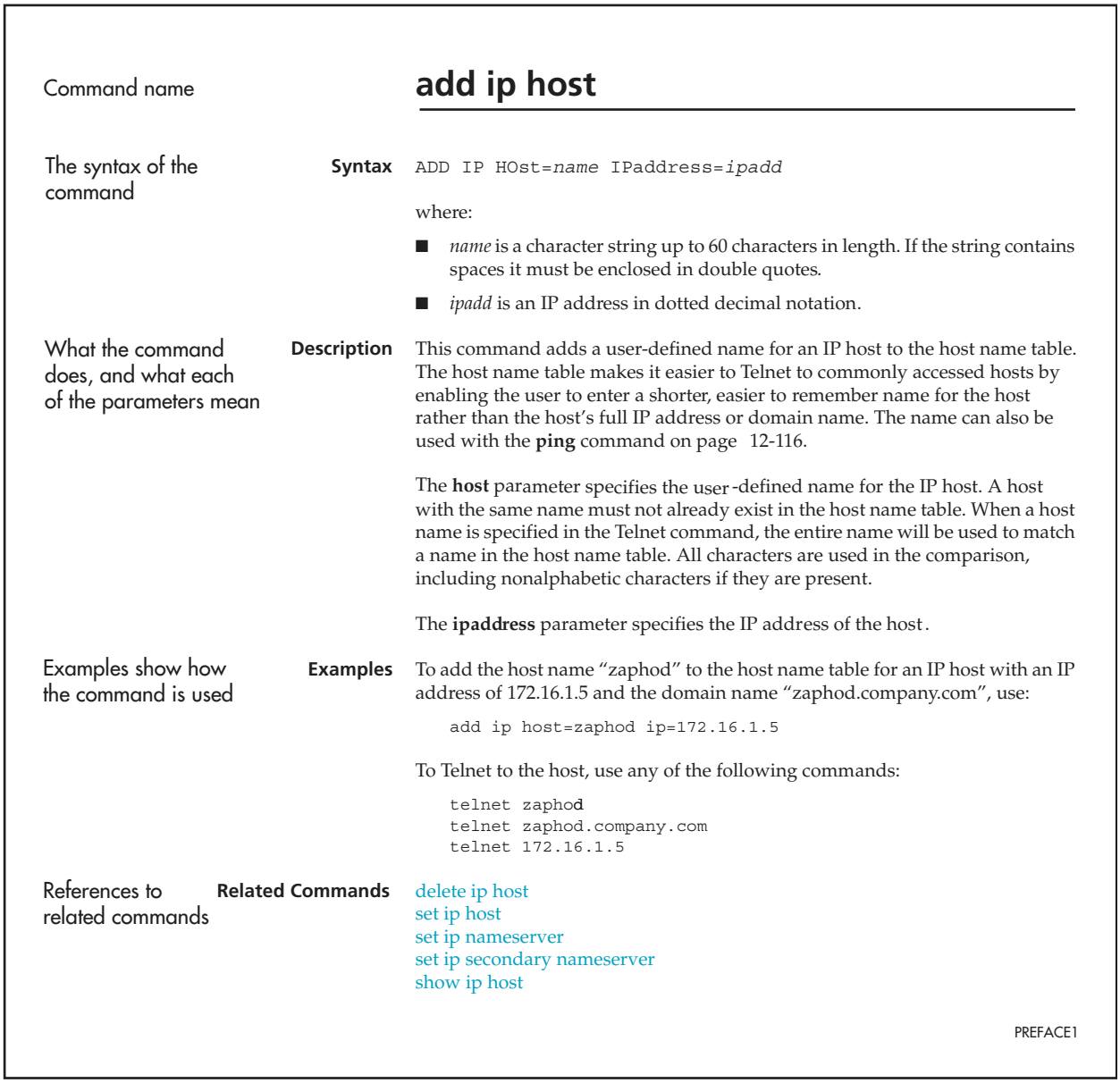
```
Configuration for ETH instance 0:

  Module            Protocol         Format    Discrim     MAC address
  ------------------------------------------------------------------------
  IPG               IP               Ethernet  0800        0000cd000027
  IPG               ARP              Ethernet  0806        0000cd000027
  IPX               Novell           Novell    -           0000cd000027
  DNT               DECnet           Ethernet  6003        aa0004003908
  Bridging          LAT              Ethernet  6004        -
  Bridging          EtherTalk        SNAP      00000080f3  -
  ------------------------------------------------------------------------
```

Command Descriptions

Commands are described in the Command Reference section of the individual chapter for the protocol or feature. Each command is described in the format shown in Figure 1.

Figure 1: Command format



Command syntax are explained with conventions in the following table.

Element	Description
`Keywords in CAPS and lower case (mixed case)`	The shortest valid command is denoted by capital letters. Exceptions are commands with profound effects such as *restart immediately*, which must be typed in full.
`italic`	A variable placeholder to be replaced by an actual value in a command.
`[]`	Square brackets enclose optional items. Enter the item or items but do **not** type the brackets.
|	Vertical bars separate choices in a list—choose **one** of the items.

Element	Description
`...`	Ellipses indicate that the preceding element may be repeated any number of times.
`{}`	Braces surround a choice of options that is required; you must choose one of the options listed.
`n..m`	Defines a range of values—most often positive integers—from n to m inclusive.
`interface`	An interface type and one of the following: `ETHn` for Ethernet interfaces `SYNn` for Synchronous interfaces (PIC bay only) `ASYNn` for Asynchronous interfaces (also PORTn) `BRIn` for Basic Rate ISDN interfaces (PIC bay only) `PRIn` for Primary Rate ISDN interfaces (PIC bay only) `PPPn` for Point-to-Point interfaces `FRn` for Frame Relay interfaces (PIC bay only) `LAPBn` for LAPB interfaces (PIC bay only) `LAPDn` for LAPD interfaces (PIC bay only) `X25Tn` for X.25 DTE interfaces (PIC bay only) `SLIPn` for SLIP interfaces `VLANn` for Virtual LAN interfaces `n` when defining one of the above interface types. `n` is a non-negative, zero-based decimal number.
`ipadd`	IP address in dotted decimal form, such as 131.203.9.197. In some situations, an address in domain name format.
`macadd`	Hardware address, such as an Ethernet address, in the format XXXXXXXXXXXX, where XX is a two-digit hexadecimal number with leading zeros if necessary.
`dntadd`	A DECnet address in the format area.node, where *area* is a decimal number from 1 to 63 and *node* is a decimal number from 1 to 1023.

Where To Find More Information

The Documentation and Tools CD-ROM bundled with each router contains the complete Document Set for your router and, where applicable, its expansion options. The CD-ROM also includes tools for managing your router.

The Document Set includes:

- The Installation and Safety Guide for your router, which outlines the procedure for installing the router, and provides safety and statutory information.
- The Hardware Reference for your router, which provides detailed information on the hardware features of AR400 Series routers.
- The *Port Interface Card Quick Install Guide*, which outlines the procedure for installing PICs; and the *Port Interface Card Hardware Reference*, which provides detailed information on PICs (routers with PIC bay only).
- This Software Reference, which provides detailed information on configuring the router and its software.

These documents can also be downloaded from *http://www.alliedtelesis.com*.

Obtaining Copies of Internet Protocols and Standards

The Internet Protocols are defined in *Requests For Comments* (RFCs). RFCs are developed and published under the auspices of the *Internet Engineering Steering Group* (IESG) of the *Internet Engineering Task Force* (IETF). For more information about the IESG and IETF, visit the IETF web site at http://www.ietf.org/. For more information about RFCs and Internet-Drafts (the starting point for RFCs), visit the RFC Editor web site at http://www.rfc-editor.org/. This site has information about the RFC standards process, archives of RFCs and current Internet Drafts, links to RFC indexes and search engines, and a list of other RFC repositories.

RFCs can be obtained electronically from many RFC repositories, mail servers, World Wide Web (WWW), Gopher or WAIS sites. A good starting point for finding the nearest RFC repository is to point your Web browser at http://www.isi.edu/in-notes/rfc-retrieval.txt.

To obtain a copy of an RFC using FTP, FTP to the host and login as user `anonymous`, and a password of either `guest` or your email address. The FTP server usually prompts you for one or the other. Use the `get` command to retrieve the desired RFC. Most sites have a file, usually `rfc-index.txt`, which lists the titles and file names of all available RFCs. Most sites have a file, usually `rfc-retrieval.txt`, which gives detailed information about RFC repositories and how to retrieve RFCs via FTP, mail servers, WWW, Gopher, and WAIS.

To learn how to obtain a copy of an RFC via email from a mail server, point your browser at http://www.isi.edu/in-notes/rfc-editor/rfc-info.help.

To obtain a copy of an RFC from a Web site, or to search RFC repositories for a specific RFC or all RFCs relating to a topic, point your Web browser at http://www.rfc-editor.org/rfc.html.

Publicly Accessible Documents

Allied Telesis maintains an online archive of documents and files that you can access in the following ways:

- WWW: http://www.alliedtelesis.com
- Anonymous FTP: ftp.alliedtelesis.com
  Login as user “anonymous” and enter your email address as the password.

Allied Telesis Offices and Locations

With locations covering all of the established markets in North America, Latin America, Europe, Asia and the Pacific, Allied Telesis provides localized sales and technical support worldwide. To find our representative nearest you, visit Allied Telesis on the web at: http://www.alliedtelesis.com.