Chapter 52

WAN Load Balancing

Introduction

This chapter describes the WAN load balancing feature, how it is supported on the router, and how you can configure its operation.

With the increasing use of the Internet to service core business functions comes the need for reliable WAN connectivity. A specific aspect of this requirement is the need for reliable connectivity to specific destinations. This requirement can be simply and effectively met by providing alternative network connections via different Internet service providers (ISPs). In this way an outage limited to one ISP will not result in a loss of connectivity to remote destinations, providing these are still accessible via the other ISP.

Readers interested in other methods of load balancing are directed to *Chapter 51, Server Load Balancing*.

WAN Load Balancer Operating Principles

When a WAN load balancing router simultaneously connects to multiple WAN networks, it will try to distribute its traffic equally across each network interface. A typical example is a router that has two Internet connections, each exchanging data to remote sites via different Internet providers (ISPs). In this case you can configure the load balancer to balance its traffic based either on the traffic profile to each port's ISP, or to specific remote destinations.

Although connectivity via multiple WAN interfaces can be achieved using routing protocols such as RIP and OSPF; these protocols usually choose their routing paths based on routing metrics rather than on dynamic load conditions. For example, if a router has two WAN ports and each port connects to a different ISP, the router will send most of its traffic via the port offering the best metric. Although this method provides alternative connectivity in the event of an ISP network failure, under normal operating conditions it wastes the bandwidth available via the alternative port.

When a router receives a packet from one of its interfaces, it creates an IP session (termed an *IP flow*) based on the following fields:

- source and destination IP addresses
- upper layer protocol used.

When WAN load balancing is enabled, the router creates each load balancer session based the particular combination of values contained within these fields. Each field combination is represented by a particular *IP flow*. The router then creates a mapping between the particular IP flow and its load balancer session. The IP flows and the load balancer sessions have a many-to-one relationship. This means many IP flows can be mapped onto a single load balancer session. Once the load balancer has applied its algorithm to determine the best balanced route to use, it remembers this route for future traffic. Therefore IP flows that share the same LB session will use the same route for forwarding.

When WAN load balancing is disabled, the router uses its existing routing protocols and tables to determine the path for a particular IP flow and will also remember this route for future packets that belong to the same flow.

In order to efficiently operate with applications that can simultaneously run multiple applications, the WAN load balancer is able to create sessions without the need to specify port information.

The load balancer manages its sessions (creating, deleting, etc.) by starting a timer for each new session created. Each timer is refreshed when a packet for its particular session passes through the load balancer. When a particular timer reaches its **orphantimeout** value, its associated session is deemed to be orphan and is deleted.

If the load balancer is unable to find a particular resource in its tables and alternative non-load-balanced routes exist, the router will use the best alternative route available. Note that it is not mandatory for a router's WAN links to operate via the load balancer.

Load Distribution Methods

The following load distribution methods can be configured:

- **Round Robin Distribution**
- **Weighted Lottery Distribution**
- **Weighted Least Connect Distribution**
- **Weighted Fast Response Distribution**

Round Robin Distribution

This distribution method assigns new load balancer sessions alternately to each of the WAN ports available. This distribution method is simple to implement and is light on processing resources. However, round robin takes no account of factors such as the bandwidth of each WAN connection, as does the weighted lottery distribution method, which is described next.

Weighted Lottery Distribution

This distribution method assigns load balancer sessions to WAN ports by using a pseudo-random selection process. Each WAN port is assigned a weighting factor that increases or decreases the chances of the pseudo-random selection process selecting a particular port. Weighting factors can be set either manually or automatically.

When configuring the WAN load balancer manually, we recommend setting the weighting factor equal to the bandwidth of the link divided by a factor such as 1000. Therefore, a 10 Mbps link would be assigned a weighting factor of 10000000 ÷ 1000 = 10000.

The higher the weighting factor that is applied to a port, the greater will be its chances of being selected.

For example, if a router has two ports A and B, and:

- port A is configured with a weighting factor of 1000
- port B is configured with a weighting factor of 2000

then the load balancer is twice as likely to select port B than port A. However, if both ports are assigned the same weighting factor then the selection process resorts to the round robin selection method.

Weighted Least Connect Distribution

This distribution method assigns new load balancer sessions to WAN ports based on the current load (in sessions) on each WAN port. The load on a port is determined by dividing the number of its current sessions, by its weighted value. The WAN load balancer selects the WAN port with the smallest load, or more precisely, the port with the least connections relative to its weighting. To simplify configuration, *weighted least connect* uses the inverse of these values then selects the port with the *highest* numeric value. This is explained in the following example.

If a router has two ports A and B, and:

- port A is configured with a weighting factor of 4000 and has 10 current WAN load balancer sessions
- port B is configured with a weighting factor of 2000 and has 4 current WAN load balancer sessions

then the weighted least connect for port A will be, 4000 ÷ 10 = 400, and the weighted least connect for port B will be 2000 ÷ 4 = 500.

In this case, the load balancer will select port B next because it has the higher weighted least connect value.

Because the weighted least connect method is based on dynamic information, it offers a slight advantage over the static ratio assignment method used by the weighted lottery selection. In the weighted lottery configuration, distribution of WAN load balancer sessions could become slightly unbalanced if some of the WAN ports are unavailable for selection, or if some WAN load balancer sessions persist for longer than others. By contrast, the weighted least connect configuration would maintain an even session distribution.

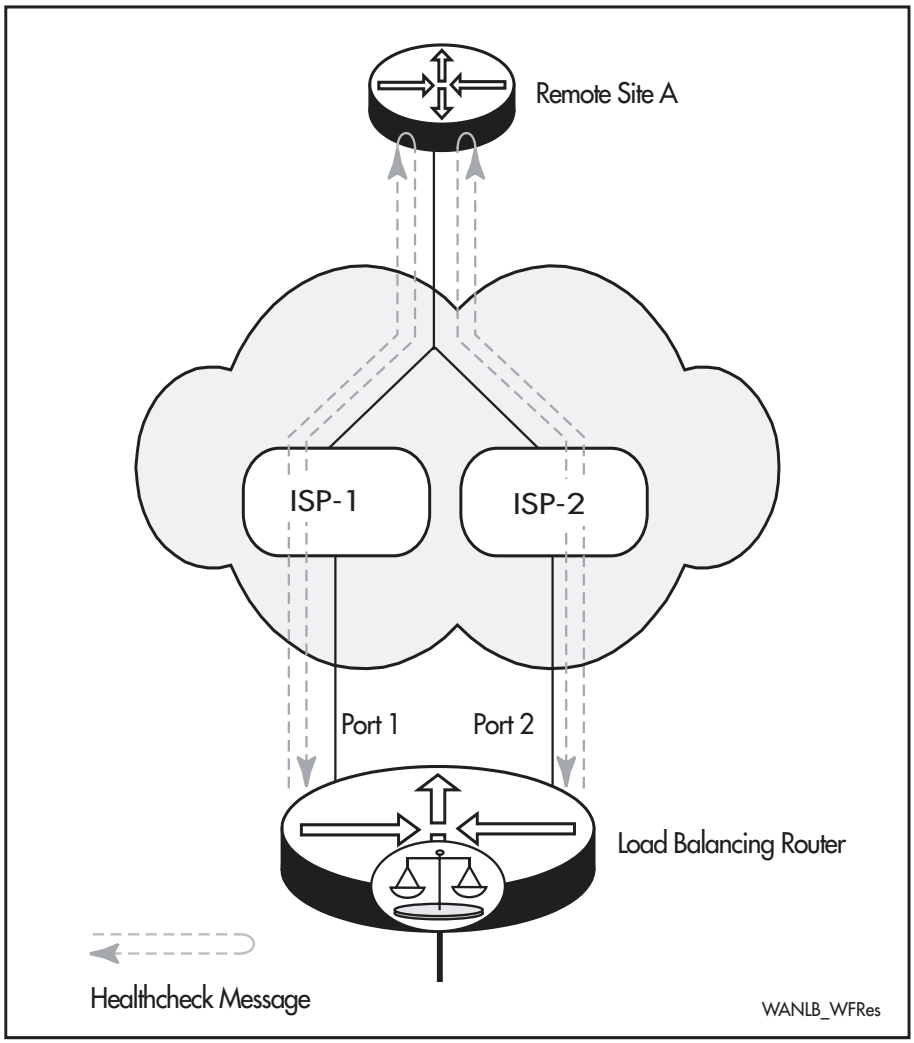
Weighted Fast Response Distribution

This distribution method assigns new load balancer sessions to WAN ports based on the response times recorded for the transmission of WAN load balancer healthcheck messages. These messages are transmitted from each of the WAN load balancer's ports, and record response times between these ports and selected distant hosts. WAN ports that have faster healthcheck response times will be selected more frequently than those with slower response times. This distribution method is useful when network latency is an important factor.

Note that you must configure WAN load balancer healthchecks in order to operate the weighted fast response distribution. Without healthchecks configured, the selection process will apply the equivalent of the round robin selection method.

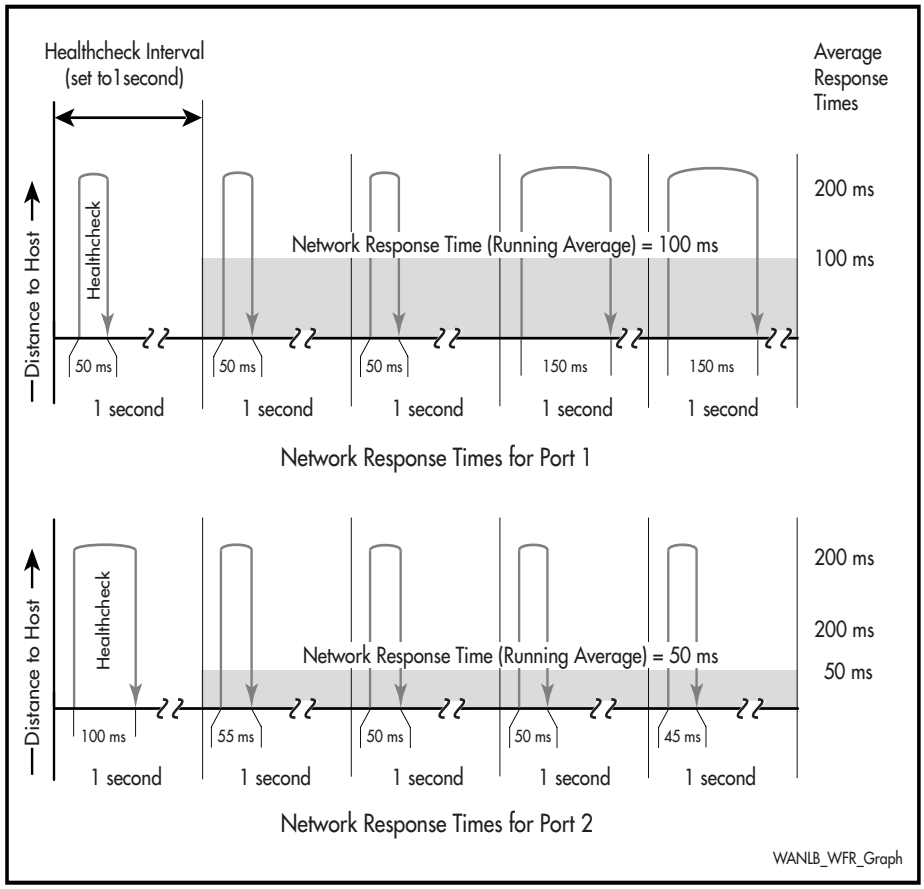
Each WAN load balancer resource maintains a moving average that covers the last four response times recorded for each healthcheck host. From the averages received for each healthcheck host, the WAN load balancer calculates an overall average for each port.

The following figure shows a simple single host network configured for weighted fast response distribution.



The load balancer sends healthcheck messages from its ports 1 and 2, to remote site A. Although the messages from each port have a common destination, their network path and conditions are different.

The following figure shows how the round trip response times are used to determine which port the load balancer will use for its data traffic.



This figure illustrates the timing delays for a series of healthcheck messages transmitted from 2 ports on a router, where each port is sending healthchecks to a common host via its own respective network. The distance travelled by the healthchecks is indicated by the vertical arrow shown on the left-hand side of the chart, whilst their delay is measured on the horizontal time scale. An average response time, based on the last 4 healthchecks, is shown by the grey bars, which are measured by the time scale shown on the right-hand side of the chart.

The following table shows the last 4 response times recorded for each port together with their average values.

Port	Last 4 response times	Average
1	50,50,150,150	100
2	55,50,50,45	50

Because messages transmitted from port 2 have an average response that is twice as fast as those from port 1, the load balancer will select port 2 twice as often as port 1 for the data it transmits during the next healthcheck interval.

Note that because the WAN load balancer healthcheck's messages are based on ICMP packets, the response times recorded may not reflect the latency for other traffic types. Also, it is important that the sites chosen as healthcheck hosts are appropriate. For example, public servers can get overloaded with requests. Selecting these servers as healthcheck hosts could produce unrealistic results.

Assigning Weights

For weighted least connect and weighted lottery, the WAN port's assigned weight influences how often the WAN port will be selected. A good rule of thumb is to base this weight on the link's bandwidth. For situations where the underlying bandwidth of a WAN port is not known, or the bandwidth does not reflect the actual achievable throughput, WAN load balancer provides two alternatives; *Automatic*, and *Perfect Automatic*, weightings.

Automatic Weight

This method assigns a weight based on the port speed of your WAN interface. The WAN port's weight is automatically set to the speed of the link (in bits per second) divided by 1000. Therefore, a 10Mbps link, has a weight of:

$$\frac{\text{Port Speed (bps)}}{1000} = \frac{10000000}{1000} = 10000$$

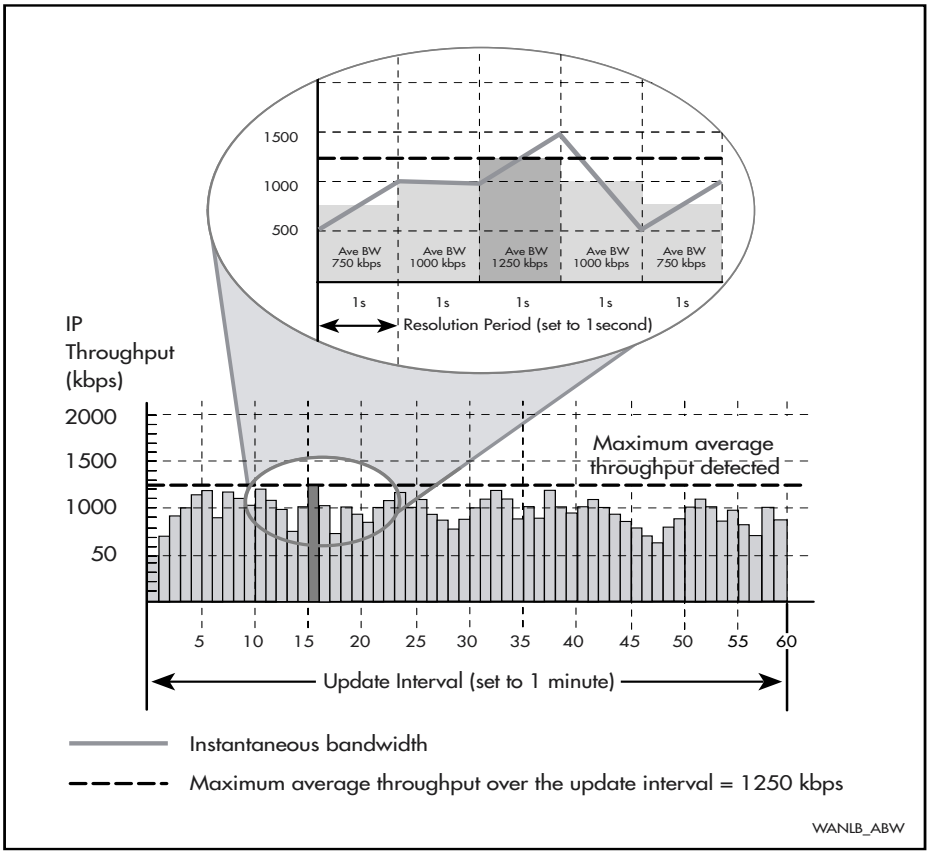
Where a port has autonegotiated its speed, the load balancer uses the negotiated speed for its weight calculation.

Where several IP interfaces use the same physical interface, the automatic weighting does not reflect the actual IP throughput that the interface is capable of. For this reason, you should not use automatic weighting with PPP links over Eth, VLAN, or L2TP interfaces.

Perfect Automatic Weight

This method assigns a weight based on throughput measurements taken by an adaptive bandwidth detection (ABD) process. ABD calculates a WAN port's available bandwidth based on the average throughput of its IP interface measured over small preset *resolution periods*. After a predefined *update interval* has expired, the ABD process records the maximum value from the individual averages observed during this interval, and uses this as the WAN port's weight for the next update interval.

The following figure illustrates the adaptive bandwidth Detection - Weight Calculation process



Healthchecks

By default, the WAN load balancer is only able to detect network malfunctions as far as the first remote connection from its wide area ports. To detect malfunctions within the wider Internet you will need to configure the WAN load balancer's healthchecks facility. By periodically sending healthcheck packets to remote hosts and monitoring their responses, the router can determine the health of selected WAN links. The WAN load balancer healthchecks can be sent from every WAN load balancer resource, to every configured host.

It is important that you give some thought to your choice of a healthcheck host and select a site that is highly reliable. The healthcheck host could be a website critical to your organisation, however, public servers can get overloaded with requests and may drop healthcheck packets. Servers within a VPN network, or an intermediate node within your ISP, are recommended for use as hosts.

When healthchecks are configured, the operational state of a WAN load balancer resource is determined by the reachability of its healthcheck hosts. A WAN load balancer resource needs at least one reachable host before it can start balancing traffic. If the WAN load balancer has no reachable healthcheck hosts then the resource will no longer balance its traffic. Although you can configure healthchecks to operate with any distribution method, only the weighted fast response method applies load balancing based on network response.

To determine a host's reachability, the router sends it a series of healthcheck packets. After it receives a set number of successful responses called *successchecks*, it considers the host to be *reachable*. If the router has received no replies to a defined number of healthcheck requests called *failchecks*, it considers the host to be *unreachable*.

You can configure the various healthcheck parameters by using the **set wanlb healthcheck** command on page 52-30.

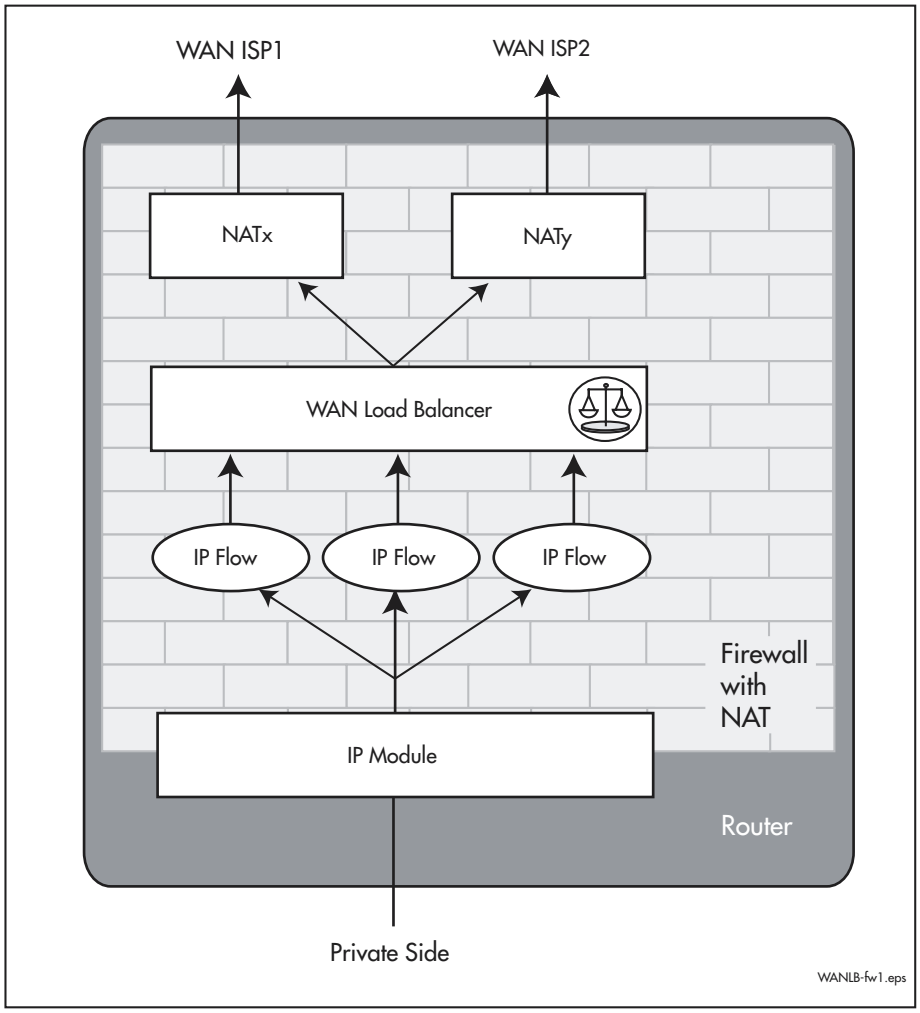
Operation with Other Software Features

This section describes how the load balancer can be used with other software features within the router.

Operation with Firewall

It is not necessary to configure the router as a firewall in order to apply WAN load balancing, although the two features have been designed to operate together and the load balancing operation will operate more effectively when used with a firewall running network address translation (NAT). The diagram shown in Figure 52-1 shows the relationship between the load balancer and the firewall functions within the router.

Figure 52-1: Example load balancer operation with firewall



The firewall shown has two public interfaces, WAN ISP1 and WAN ISP2, that are configured for both network address translation (NAT) and for WAN load balancing. Two translated IP addresses (i.e. NATx and NATy) are configured for the two WAN connections ISP1 and ISP2. When the firewall receives a packet from its private interface, it finds a route in its routing table based on the WAN load-balancing algorithm. This route determines the public interface from which it transmits the packet and which of the two addresses (NATx or NATy) it attaches as the IP source address. An important aspect is that with NAT applied, the returning packets are more likely to take the same path (via the same ISP) as the data sent and therefore offer a degree of load balancing for the return path. For more information on NAT, see "Network Address Translation (NAT)" on page 46-20 of Chapter 46, Firewall.

Operation with IP NAT

The WAN load balancer is not designed for use with IP NAT, because IP NATs are not associated with interfaces. Configurations that use an IP NAT cannot vary the global IP address (the **gblip** parameter) based on the outgoing interface, so the WAN load balancer sends all traffic out with the same source address. Therefore, the return traffic probably comes back via the WAN load balancer resource that is associated with the global IP. The impact is that the WAN load balancer balances the outgoing traffic but not the return traffic.

We recommend using firewall NAT instead of IP NAT with the WAN load balancer.

Operation with Policy Based Routing

Policy routing is an alternative mechanism for routing packets and is based on policies or rules that you or your network manager have set. Because policy routing provides *dedicated* routing, it does not participate in WAN load balancing. When a packet is received via an interface with an assigned policy filter, and the packet matches an entry in the policy filter, the routing process will bypass the WAN load balancer and forward the packet using a route with the same policy number specified in the matching policy filter entry. For more information see, "Policy-Based Routing" on page 22-26 of Chapter 22, Internet Protocol (IP)

Operation with Priority Based Routing

Priority based routing is used in situations where you want to route a particular traffic type over paths other than those offering the best route. For example, you might want to route high priority interactive traffic over the path offering the best route, and low priority batch traffic over a path having a less efficient route.

Before the router transmits a packet via one of its interfaces, it first checks the packet for a match against the priority filter that is assigned to that particular interface. If a match is found the router assigns the packet a new priority.

The IP module places packets for forwarding in a priority queue determined by the packet's assigned priority. Packets in higher priority queues are forwarded ahead of those in lower priority queues. Since WAN load balancing is performed before packet priority assignment, both features can work together simultaneously.

Operation with UPnP NAT Traversal

Since all UPnP related data is transmitted over a single interface, this data does not take part in load balancing. However, the UPnP feature can operate simultaneously with the WAN load balancer, although this data will add a degree of imbalance to the data distribution across the WAN load balancer interfaces.

Configuring WAN Load Balancing

This section gives a step by step procedures and simple configuration examples for configuring WAN load balancing on the router.

Before you configure

Before you configure, you need the following:

- the IP addresses of the healthcheck destination sites
- the IP addresses of the ISPs that your data will be sent to
- the network masks that you will apply for these addresses
- PPP configured, if required

How to configure the WAN Load Balancer

Table 52-1: WAN load balancing configuration procedure

Step	Commands	Description
1	**enable ip**	Enable the IP routing module (if it has been disabled).
2	**disable ip route** disable ip route multipath	Because multipath IP routing and WAN load balancing have overlapping functionality, you must disable multipath routing before running the WAN load balancer.
3	**add ip interface**=*interface* ipaddress={*ipadd*|dhcp} [*other-options*...]	Add the interfaces to the IP module.
4	**add ip route**=*ipadd* interface=*interface* nexthop=*ipadd*[mask=*ipadd*] [*other-options*...]	Add your static routes to the IP route table. Static routes can be used to define default routes to external routers or networks.
5	**add ip route**=0.0.0.0 interface=*interface* nexthop=*ipadd* [*other-options*...]	Add the default routes for each interface. Default routes always have the network address 0.0.0.0. When the router receives data for which it has no route, it sends this data to the default route. To define a default route, set the IP address to 0.0.0.0 and set the nexthop address to be the network (router) that is to receive the default packets.

Table 52-1: WAN load balancing configuration procedure (Continued)

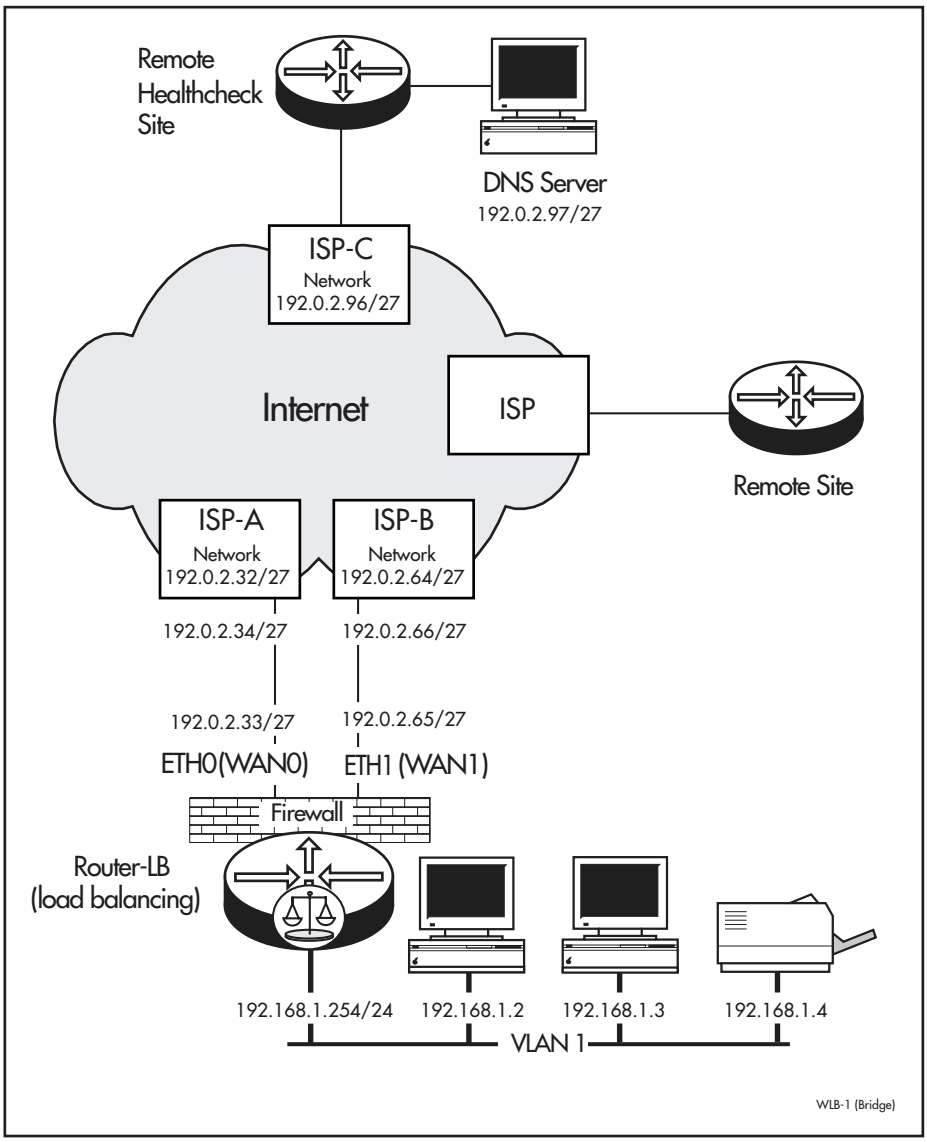
Step	Commands	Description
6	**enable firewall**	If firewall operation is required, enable the firewall function on the router. A log message is generated when this command is issued. Note that although the WAN load balancer will run without the firewall, we recommend that firewall NAT be used. If you are not using a firewall go to step 12 and set wanlb.
7	**create firewall policy**=*policy-name*	Create (and name) a firewall policy for the WAN load balancer.
8	**add firewall policy interface** add firewall policy=*policy-name* interface=*interface* type={public|private}	Add the firewall policy to the interfaces that the load balancer will use.
9	**add firewall policy nat** add firewall policy=*policy-name* nat={enhanced|standard} interface=*interface* [ip=*ipadd*] gblinterface=*interface* [gblip=*ipadd*[-*ipadd*]]	Add the firewall policy for NAT and define the global IP addresses. We recommend using enhanced NAT when configuring the WAN load balancer.
10	**enable wanlb**	Enable the WAN load balancer.
11	**add wanlb resource**	Add a WAN load balancer resource to each port.
12	**set wanlb** [orphantimeout={off|1..65535}] [select={roundrobin|wleastconnect|wlottery|wfastresponse}]	Select the load balancing method you require, or keep the default settings.
13	**add wanlb resource**=eth0 [weight={0..10000000|automatic|perfectautomatic}]	If you have selected either wleastconnect or wlottery, you can select the weight options for each of the wan load balancer interfaces. Default weight: **10000**
14	**add wanlb healthcheck** host=*hostipadd* (or host=*domain name*)	If you are using healthchecks, add your remote healthcheck site(s).
15	**enable wanlb healthcheck**	If you are using healthchecks, enable healthchecking.

Configuration Example

The following examples illustrate the steps required to configure WAN load balancing on the router.

This example shows a load balancer where data travels to remote destinations via two Internet connections, each routed via a separate ISPs. A simple firewall configuration is also included that provides for basic network address translation (NAT). This configuration will load balance data from different devices regardless of the session types that they are running, and data from the same device on a session type basis. So a data packet for an HTTP session followed by a data packet for a TFTP session transmitted from the same device would be routed via alternate ports.

Figure 52-2: Example network configuration for WAN load balancer with a single destination



To configure the WAN Load Balancer.

1. **Enable IP.**

   To enable the IP routing module, if it has been disabled, use the command:

   ```
   enable ip
   ```

2. **Disable multipath IP route.**

   To disable multipath IP routing use the command:

   ```
   disable ip route multipath
   ```

3. **Add the IP interfaces.**

   To add the interfaces to the IP module, use the command:

   ```
   add ip interface=eth0 ip=192.0.2.32 mask=255.255.255.224
   add ip interface=eth1 ip=192.0.2.65 mask=255.255.255.224
   add ip interface=vlan1 ip=192.168.1.254 mask=255.255.255.0
   ```

4. **Add the static IP routes.**

   ```
   None for this configuration
   ```

5. **Add the default IP routes.**

   To add the IP routes and the next hop addresses use the command:

   ```
   add ip route=0.0.0.0 int=eth0 next=192.0.2.33
   add ip route=0.0.0.0 int=eth1 next=192.0.2.66
   ```

6. **Enable the firewall (where firewall operation is to be used).**

   ```
   enable firewall
   ```

7. **Create firewall policy.**

   ```
   create firewall policy=wlb
   ```

8. **Add interfaces to the firewall policy.**

   ```
   add firewall policy=wlb int=eth0 type=public
   add firewall policy=wlb int=eth1 type=public
   add firewall policy=wlb int=vlan1 type=private
   ```

9. **Configure nat.**

   ```
   add firewall policy=wlb nat=enhanced interface=vlan1
      gblint=eth0
   add firewall policy=wlb nat=enhanced interface=vlan1
      gblint=eth1
   ```

10. **Enable the WAN load balancer.**

    ```
    enable wanlb
    ```

11. **Add the WAN load balancer resource to each global interface.**

    ```
    add wanlb resource=eth0
    add wanlb resource=eth1
    ```

12. Set the WAN load balancer selection method.

For round robin selection

```
set wanlb select=roundrobin
```

For weighted least connect selection

```
set wanlb select=wleastconnect
```

For weighted lottery selection

```
set wanlb select=wlottery
```

For weighted fast response selection

```
set wanlb select=wfastresponse
```

13. Set the WAN load balancer resource weight.

This step is only required if you are using weighted lottery or weighted least connect selection methods.

Using a weight value of 5000

```
set wanlb resource=eth0 weight=5000
```

For automatic weighting

```
set wanlb resoueve=eth0 weight=automatic
```

For perfect automatic weighting

```
set wanlb resource=eth0 weight=perfectautomatic
```

14. Add WAN load balancer healthchecks.

Ignore this step if you are not using healthchecks. Healthchecks are required in order to use the weighted fast response distribution. You can also use healthchecks to check the connectivity between sites, and this will operate with any distribution method.

In this configuration healthchecks are used to monitor the response times to a remote DNS server. These response times are used to indicate the delay through each of the ISP networks. A DNS server was chosen in this example, because DNS servers offer an *always available* service.

```
add wanlb healthcheck host=192.0.2.97
```

Note that the IP address used in this example is shown for document purposes only and should not be used in a practical network.

15. Enable WAN load balancer healthchecks.

```
enable wanlb healthcheck
```

Command Reference

This section describes the commands available on the router to enable, configure, control and monitor the WAN load balancing module.

The shortest valid command is denoted by capital letters in the Syntax section. See "Conventions" on page lxv of About this Software Reference in the front of this manual for details of the conventions used to describe command syntax. See Appendix A, Messages for a complete list of messages and their meanings.

add wanlb healthcheck

Syntax `ADD WANLB HEALthcheck[=1..3] HOst=`*`hostaddress`*

Description This command adds a healthcheck host to the WAN load balancer. Up to three hosts can be added. The WAN load balancer will use these hosts for checking the status of its resources.

You can display details of the healthcheck hosts by using the **show wanlb healthcheck** command on page 52-34. To display the status of the healthcheck hosts for each resource, use the **show wanlb resource** command on page 52-35 command. To delete a host, use the **delete wanlb healthcheck** command.

Parameter	Description
1..3	Specifies the index number assigned to a host.
HOst	The address of the site that will receive the WAN load balancer healthchecks. This can be either an IP address or domain name. The healthcheck responses for a host can change the operational state of the WAN load balancer resources. Also, in the weighted fast response mode, the host is used for resource selection. For this reason you should choose your host sites with care. For your healthcheck host, you could select a website critical to your organisation. However, public servers can get overloaded with requests and the response time may be less representative of the WAN link. Servers in a remote private network, or an intermediate node within your ISP, are recommended for use as healthcheck hosts. You can enter the IP address or the domain name (e.g. www.critical-site.com) of your selected host.

Examples To add two healthcheck hosts that have the IP address 202.36.8.8 and www.vpn-site.com respectively, use the commands:

```
add wanlb heal ho=202.36.8.8
add wanlb heal ho=www.vpn-site.com
```

Related Commands
delete wanlb healthcheck
show wanlb healthcheck
show wanlb resource

add wanlb resource

Syntax

```
ADD WANLB RESource=interface [HEALthchecksipaddress=ipadd]
    [WEIght={0..10000000|AUTOmatic|PERFectautomatic}]
```

Description

This command adds a new resource to the WAN load balancer interface. By default, a newly added resource is *enabled*. The state of a new resource is the same as that of its associated IP interface. This means that the WAN load balancer interface will be available whenever the interface is available. A resource in the *up* state can participate in load balancing immediately.

Parameter	Description	
RESource	An existing IP interface for the resource. Valid interfaces are: ● eth (such as eth0, eth1) ● PPP (such as ppp0, ppp1) To see a list of current valid interfaces, use the **show interface** command on page 9-72 of Chapter 9, Interfaces. This parameter must be specified before a new resource can be created.	
HEALthchecksipaddress	The source IP address that the WAN load balancer resource uses when transmitting healthchecks to a configured host(s). If this parameter is not specified, the WAN load balancer will use the IP interface address that it has associated with the resource. This parameter is useful in VPN environments, where the healthcheck host is located in the remote private network.	
WEIght	The preference factor that the WAN load balancer will apply to a resource when creating a new WAN load balancer session. The weight of a resource is only used when the configured WAN load balancer select method is weighted lottery) or weighted least connect). The higher the weight of a resource compared to the other resources, the more likely are its chances of selection for the session. Default: **10000**	
	0..10000000	The specified weight is used.
	AUTOmatic	The weight is the specified (or auto-negotiated) bandwidth of the WAN link.
	PERFectautomatic	The weight is the estimated bandwidth of the WAN link, as detected automatically through the adaptive bandwidth detection (ABD) mechanism. See the **set wanlb abd** command on page 52-28.

Examples

To add a new resource using the IP interface of PPP0 (which is configured for PPP over a 64 kbps ISDN channel) use the command:

```
add wanlb res=ppp0 wei=64
```

Related Commands

delete wanlb resource
set wanlb abd
set wanlb resource
show wanlb resource

delete wanlb healthcheck

Syntax `DELete WANLB HEALthcheck={1..3|ALL}`

Description This command removes one or more healthcheck hosts from the WAN load balancer. If all hosts are deleted, the WAN load balancer cannot use its healthchecks to determine the status of its resources. In this situation, the router will change the state of its WAN load balancer resources to be the same as their associated IP interfaces.

Parameter	Description
`1..3`	Selects a specific healthcheck host to delete.
ALL	All the healthcheck hosts will be deleted.

Examples To delete the number 2 host use the command:

```
del wanlb heal=2
```

Related Commands **add wanlb healthcheck**
show wanlb healthcheck

delete wanlb resource

Syntax `DELete WANLB RESource={ALL|`*`interface`*`}`

Description This command deletes a WAN load balancer resource. You can only delete the resource when it is in the *down* state and there are no WAN load balancer sessions assigned to it. To place the resource in the *down* state, use the **disable wanlb resource** command.

Parameter	Description
RESource	An existing IP interface for the resource. Valid interfaces are: ● eth (such as eth0, eth1) ● PPP (such as ppp0, ppp1) To see a list of current valid interfaces, use the **show interface** command on page 9-72 of Chapter 9, Interfaces. The **resource** parameter specifies the resource that is to be deleted. This resource must match an existing IP interface. If **all** is specified then all resources will be deleted.

Examples To delete the resource PPP0 use the command:

```
del wanlb res=ppp0
```

Related Commands
add wanlb resource
disable wanlb resource
enable wanlb resource
set wanlb resource
show wanlb resource

disable wanlb

Syntax `DISable WANLB`

Description This command disables WAN load balancing.

Examples To disable WAN load balancing, use the command:

```
dis wanlb
```

Related Commands
disable wanlb resource
enable wanlb
show wanlb

disable wanlb debug

Syntax

```
DISable WANLB
   DEBug[={ABD|HEALthcheck|IP|RESource|SELect|ALL}]
```

Description This command disables debugging on the WAN load balancer.

Parameter		Description
DEBug	The type of debugging to disable. Default: **all**	
	ABD	Disables adaptive bandwidth detection debugging.
	HEALthcheck	Disables healthcheck debugging.
	IP	Disables debugging for the creation of WAN load balancer sessions for new IP flows.
	RESource	Disables debugging for WAN load balancer resource state changes.
	SELect	Disables debugging for resource selection of new WAN load balancer sessions.
	ALL	Disables all WAN load balancer debugging information.

Examples To disable debugging on the WAN load balancer, use the command:

```
dis wanlb deb
```

Related Commands

disable wanlb debug
enable wanlb debug
show wanlb debug

disable wanlb healthcheck

Syntax `DISable WANLB HEALthcheck`

Description This command disables background healthchecking for resources. Under high load, these resources may sometimes ignore ICMP healthchecks and be marked as *closing or down* even though the resource is still operational and can take connections. After executing this command, response times for resources are set to zero. healthchecks are disabled by default.

Note that when healthchecks are disabled, the weighted-fast-response algorithm used for selecting resources operates as the round-robin algorithm. This is because all resources effectively have the same response time. Also, the states of all resources will change to the states of their associated IP interface. This is because WAN load balancer can no longer use the healthchecks to determine the states of its resources.

Examples To disable the healthchecking, use the command:

```
ena wanlb heal
```

Related Commands
enable wanlb healthcheck
show wanlb
show wanlb healthcheck

disable wanlb resource

Syntax `DISable WANLB RESource={ALL|`*`interface`*`} [IMMEDiately]`

Description This command disables a resource by moving it from the *up* state to the *down* state, or by moving it from the *up* state to the *closing* state and then to the *down* state. When a resource moves to the *closing* state it allows all existing sessions associated with it to complete, but the resource cannot participate in load balancing for any new sessions. Once all the sessions associated with the resource have completed, the resource is automatically moved to the *down* state.

Parameter	Description
ALL	Disables all WAN load balancer resources.
interface	The resource to be disabled. Valid interfaces are: ● eth (such as eth0, eth1) ● PPP (such as ppp0, ppp1) To see a list of current valid interfaces use the **show interface** command on page 9-72 of Chapter 9, Interfaces. The resource name must match an enabled resource or the command will fail. If all is specified, all resources configured on the WAN load balancer will be disabled.
IMMEDiately	Moves the resource directly from the *up* state to the *down* state. If this parameter is not specified, the resource will move from the *up* to the *closing* state. A resource with no more sessions associated with it then moves to the *down* state. If this parameter is specified, all the sessions associated with the resource are deleted and the resource moves straight from the *up* state to the *down* state. Default: no default.

Examples To disable the resource interface eth0, use the command:

```
dis wanlb res=eth0
```

Related Commands
add wanlb resource
delete wanlb resource
enable wanlb resource
set wanlb resource
show wanlb resource

enable wanlb

Syntax `ENAble WANLB`

Description This command enables the WAN load balancer. Although you do not need to enable the WAN load balancer to configure its settings, you do need to enable it to run the WAN load balancing operation.

You cannot enable the WAN load balancer when equal cost multipath routing is also enabled. To disable equal cost multipath routing, use the **disable ip route** command on page 22-118 of Chapter 22, Internet Protocol (IP).

Examples To enable WAN load balancer, use the command:

```
ena wanlb
```

Related Commands
disable wanlb
set wanlb
show wanlb

enable wanlb debug

Syntax

```
ENAble WANLB
   DEBug[={ABD|HEALthcheck|IP|RESource|SELect|ALL}]
```

Description

This command enables debugging on the WAN load balancer.

Parameter		Description
DEBug	Enables WAN load balancer debugging	
	ABD	Displays information about Adaptive Bandwidth Detection calculations, such as the observed resource throughput and updates to the resource weight.
	HEALthcheck	Displays information about the reception and transmission of healthcheck packets, the average response time, and any changes in whether healthcheck hosts are reachable.
	IP	Displays information about the creation of new WAN load balancer sessions for new IP flows.
	RESource	Displays any state changes that occur for WAN load balancer resources.
	SELect	Displays how resource selection for new WAN load balancer sessions is determined
	ALL	Enables all types of debugging

Caution: Enabling WAN load balancer debugging may affect packet forwarding performance.

Examples

To enable WAN load balancer debug, use the command:

```
ena wanlb deb
```

Related Commands

disable wanlb debug
show wanlb debug

enable wanlb healthcheck

Syntax `ENAble WANLB HEALthcheck`

Description This command enables background healthchecking for WAN load balancer resources. Background healthchecking periodically monitors the health of connections between each WAN load balancer resource and its configured healthcheck hosts. The WAN load balancer healthchecks consist of sending ICMP echo requests to the healthcheck hosts. The response time for healthchecks form the basis of the weighted fast response resource selection method.

Healthchecks are disabled by default.

Examples To enable healthchecking, use the command:

```
ena wanlb heal
```

Related Commands
add wanlb healthcheck
disable wanlb healthcheck
show wanlb

enable wanlb resource

Syntax `ENAble WANLB RESource={ALL|`*`interface`*`}`

Description This command enables a configured resource by moving it from the *down* state to the *up* state. A device must be in the *up* state to participate in WAN load balancing.

Parameter	Description
RESource	Enables the specified interfaces
interface	Specifies an existing IP interface for the resource. The resource must currently be in the *down* state before it can be enabled. *interface* is a valid interface name formed by concatenating an interface type and an interface instance. Valid interfaces are: ● eth (such as eth0, eth1) ● PPP (such as ppp0, ppp1) To see a list of current valid interfaces, use the **show interface** command on page 9-72 of Chapter 9, Interfaces.This parameter must be specified before a new resource can be created.

Examples To enable the resource PPP0 use the command:

```
ena wanlb res=ppp0
```

Related Commands
add wanlb resource
delete wanlb resource
disable wanlb resource
set wanlb resource
show wanlb resource

reset wanlb resource

Syntax `RESET WANLB RESource={ALL|`*`interface`*`}`

Description This command resets states of the specified wan load balancer resource. A reset is equivalent to the **disable wanlb resource** command on page 52-22, immediately followed by the **enable wanlb resource** command on page 52-25.

Parameter	Description
Resource	The resource whose states are to be reset. *Interface* is a valid interface name formed by concatenating an interface type and an interface instance. Valid interfaces are: ● eth (such as eth0, eth1) ● PPP (such as ppp0, ppp1) To see a list of current valid interfaces, use the **show interface** command on page 9-72 of Chapter 9, Interfaces.
ALL	Resets the state of all wan load balancer interfaces and counters.

Examples To reset the states of all of the resources currently configured on a router, use the command:

```
reset wanlb res=all
```

Related Commands **reset wanlb resource counter**
show wanlb resource

reset wanlb resource counter

Syntax `RESET WANLB RESource={`*`interface`*`|ALL} COUnter`

Description This command resets the specified wan load balancer resource counters.

Parameter	Description
interface	The resource whose counters are to be reset. *Interface* is a valid interface name formed by concatenating an interface type and an interface instance. Valid interfaces are: ● eth (such as eth0, eth1) ● PPP (such as ppp0, ppp1) To see a list of current valid interfaces, use the **show interface** command on page 9-72 of Chapter 9, Interfaces.
ALL	Resets the counters on all interfaces

Examples To reset the counters of all of the resources currently configured on a router, use the command:

```
reset wanlb res=all cou
```

Related Commands **reset wanlb resource**
show wanlb resource

set wanlb

Syntax

```
SET WANLB [ORPhantimeout={OFF|1..65535}]
   [SELect={ROundrobin|WLEastconnect|WLOttery|
   WFAStresponse}]
```

Description This command sets the global parameters of WAN load balancer.

Parameter		Description
Orphantimeout	Specifies the number of seconds in which a WAN load balancer session can remain in an *orphan state* before timing out. An orphan state exists when the load balancer session is open, but neither sending nor receiving traffic. If you are using the WAN load balancer with the firewall enabled, you should either set this parameter to **off**, or set it to a value that is equal to, or greater than, the maximum timeout period of the firewall session. This is to maintain synchronisation between the WAN load balancer and firewall modules. Default: **3600**	
	OFF	Sets the *orphantimeout* parameter to never timeout.
	1..65635	Sets the *orphantimeout* period, in seconds
Select	Determines the algorithm that the WAN load balancer uses when selecting its resources (interfaces). Default: **roundrobin**	
	ROundrobin	The WAN load balancer selects each resource alternately.
	WLEastconnect	The WAN load balancer selects the resource with the highest result achieved after dividing its assigned weight by the number of its current sessions. To specify a resource's weight, use the **add wanlb resource** command on page 52-17.
	WLOttery	The WAN load balancer randomly selects a resource among its available resources. A resource with a higher weight is more likely to be selected, but if all resources have the same weight *wlottery* provides a similar result to the round *roundrobin* algorithm. To specify a resource's weight, use the **add wanlb resource** command on page 52-17 command.
	WFAStresponse	The WAN load balancer selects the resource based on the fastest response time received for resource healthchecks. For example, a resource with a response time that is twice as fast as another, will be selected twice as often.

Examples To turn off the **orphantimeout** use the command:

```
set wanlb orp=off
```

Related Commands

enable wanlb
show wanlb

set wanlb abd

Syntax

```
SET WANLB ABD [RESOLution=200..5000]
   [UPDAteinterval=1..1440] [DECReasethreshold=0..75]
   [TRAFfic={TOTal|INBound|OUTBound}]
```

Description

This command sets the parameters for adaptive bandwidth detection (ABD) that are used to update the weight of resources. To apply this command you must first set the **weight** parameter of the **add wanlb resource** command on page 52-17, to **perfectautomatic**.

ABD estimates the available bandwidth for a WAN load balancer resource by observing the resource's peak throughput. The maximum detected throughput is then used as the resource's weight for the next update interval. The resource's weight for the first update interval will be set to 10,000 (the default resource weight). "Perfect Automatic Weight" on page 52-7.

Note that the detected bandwidth will not restrict the amount of traffic the resource is actually capable of transmitting. However, it will influence how often the resource is selected.

Parameter	Description
RESOLution	The *resolution period*, in milliseconds, over which a resource's throughput is observed. At the end of each *resolution period* the average throughput (in kbps) is calculated for the resource based on the results obtained. The maximum value of the averages detected during an *update interval* is then used to estimate the weighting to apply for the next *update interva*l. ABD is more likely to detect a higher peak throughput for smaller *resolution periods*. However, smaller *resolution periods* may incur more CPU overhead. Default: **1000**
UPDAteinterval	The interval in minutes for updating the weight of a resource. The maximum throughput detected over the last update interval is used as the resource's weight for the next update interval. A lower update interval will mean the resource's weight will change more adaptively as the detected throughput changes. Default: **60**
DECReasethreshold	The threshold that determines whether a resource's weight should be updated if a decrease in throughput is detected. The threshold relates to the percentage decrease between the current maximum throughput detected for a resource, and its current weight (which is the maximum throughput detected for the previous update interval). If the percentage decrease is greater than the threshold, the resource's weight is not updated. If zero is specified, then the weights for resources will never decrease. Note that in addition to throughput decreasing due to problems or congestion, it can also decrease due to lack of traffic. Default: **50**

Parameter	Description	
TRAFfic	The type of traffic that will be measured in the throughput calculations. This parameter may be useful for disparities in price or speed between the upstream and downstream ISP connections. Default: **total**	
	INBound	The throughput is calculated based on inbound traffic only.
	OUTBound	The throughput is calculated based on outbound traffic only.
	TOTal	The throughput is calculated based on both inbound and outbound traffic.

Examples To change the resolution interval to 500 milliseconds use the command:

```
set wanlb abd res=500
```

Related Commands

enable wanlb
show wanlb

set wanlb healthcheck

Syntax

```
SET WANLB HEALthcheck [INTerval=1..300] [FAILchecks=1..6]
   [SUCCesschecks=1..5]
```

Description

This command sets parameters used by the healthchecking mechanism.

Parameter	Description
INTerval	The period of time, in seconds, with which WAN load balancer regularly commences healthchecking of each resource to each healthcheck host. For example, with the default setting and two hosts, each port will check each host once every 60 seconds. Default: **60**
SUCCesschecks	The number of the consecutive successful healthchecks to a host to determine the host is reachable. Default: **2**
FAILchecks	The number of the consecutive failed healthchecks to a host to determine the host is unreachable. Default: **3**

Examples

To set the healthcheck interval to 30 seconds use the command:

```
set wanlb heal int=30
```

Related Commands

enable wanlb healthcheck
show wanlb healthcheck

set wanlb resource

Syntax

```
SET WANLB RESource=interface [HEALthchecksipaddress=ipadd]
   [WEIght={0..10000000|AUTOmatic|PERFfectautomatic}]
```

Description

This command sets the configuration of a resource. The **weight** parameter can be changed when the resource is in either the up or down state. Changes to a resource will take effect the next time the resource is used for a WAN load balancer session. Attempting to change parameters when the WAN load balancer resource is in the closing state will result in an error message. You can check the WAN load balancer state by using the **set wanlb resource** command on page 52-31.

Parameter	Description
RESource	An existing IP interface for the resource. Valid interfaces are: ● eth (such as eth0, eth1) ● PPP (such as ppp0, ppp1) To see a list of current valid interfaces, use the **show interface** command on page 9-72 of Chapter 9, Interfaces. This parameter must be specified before a new resource can be created.
HEALthchecksipaddress	The source IP address that the WAN load balancer resource uses when transmitting healthchecks to a configured host(s). If this parameter is not specified, the WAN load balancer will use the IP interface address that it has associated with the resource. This parameter is useful in VPN environments, where the healthcheck host is located in the remote private network.
WEIght	The preference factor that the WAN load balancer will apply to a resource when creating a new WAN load balancer session. The weight of a resource is only used when the configured WAN load balancer select method is weighted lottery) or weighted least connect. The higher the weight of a resource compared to the other resources, the more likely are its chances of selection for the session. Default: **10000**
0..10000000	The specified weight is used.
AUTOmatic	The weight is the specified (or auto-negotiated) bandwidth of the WAN link.
PERFectautomatic	The weight is the estimated bandwidth of the WAN link, as detected automatically through the adaptive bandwidth detection (ABD) mechanism. See the **set wanlb abd** command on page 52-28.

Examples

To set the weight of resource PPP0 when the selection method is weighted lottery, use the command:

```
set wanlb res=ppp0 weight=640
```

Related Commands

add wanlb resource
delete wanlb resource
set wanlb
set wanlb abd

show wanlb

Syntax `SHow WANLB`

Description This command displays information about the general configuration and status of the WAN load balancer (Figure 52-3, Table 52-2).

Figure 52-3: Example output from the **show wanlb** command

```
Global WAN Load Balancer Configuration
------------------------------------------------------------
Status ..................... ENABLED
Select Method ............... ROUNDROBIN
Orphan Timeout .............. 3600s
Current Sessions ............ 1
Total Resources ............. 2
Debug ....................... ENABLED
Max WANLB Sessions .......... 34952
Healthchecks ................ ENABLED
Adaptive Bandwidth Detection (ABD)
   Resolution ............... 1000 ms
   Update Interval .......... 2 minutes
   Decrease Threshold ....... 0 %
   Traffic .................. TOTAL
------------------------------------------------------------
```

Table 52-2: Parameters in the output of the **show wanlb** command

Parameter	Description
Status	Whether the WAN load balancer is enabled or disabled.
Select Method	The algorithm that the WAN load balancer is using when determining which resource to select.
Orphan Timeout	The length of time in seconds that a WAN load balancer session can exist without having any data transmitted on it. After this period, the session is declared an orphan and will close.
Current Sessions	The total number of current sessions on all resources.
Total Resources	The total number of resources configured on the WAN load balancer.
Debug	Whether debugging for the WAN load balancer is enabled or disabled.
Max WANLB Sessions	The maximum number of WAN load balancer sessions that can be created. This parameter is displayed when WAN load balancer is enabled.
Healthchecks	Indicates whether resource healthchecks are enabled or disabled.
Resolution	The duration in milliseconds used to detect the resources' weight (bandwidth).
Update Interval	The interval, in minutes, between updates to a resource's maximum weight (bandwidth) setting. This occurs only when the resource's weighting method is perfectautomatic.

Table 52-2: Parameters in the output of the **show wanlb** command (Continued)

Parameter	Description
Decrease Threshold	The maximum percentage that the bandwidth can decrease in one update interval and still be updated as the resource's new weight. If the maximum bandwidth detected for the last update interval has decreased beyond the threshold, then the resource's weight is not updated.
Traffic	The resource traffic that is measured by automatic bandwidth detection; one of total, inbound, or outbound.

Example To display the current configuration and status of WAN load balancer, use the command:

```
sh wanlb
```

Related Commands
disable wanlb debug
enable wanlb debug
enable wanlb healthcheck
set wanlb
set wanlb abd

show wanlb debug

Syntax `SHow WANLB DEBug`

Description This command lists the types of WAN load balancer debugging that are currently enabled (Figure 52-4, Table 52-3).

Figure 52-4: Example output from the **show wanlb debug** command

```
WAN Load Balancer Debug
-----------------------------------------------
Debug ..................... RESOURCE, SELECT
```

Table 52-3: Parameters in the output of the **show wanlb debug** command

Parameter	Description
Debug	The types of WAN load balancer debugging that are currently enabled; one of All, None, or a list of the enabled types.

Example To display the types of WAN load balancer debugging currently enabled, use the command:

```
sh wanlb deb
```

Related Commands
disable wanlb debug
enable wanlb debug

show wanlb healthcheck

Syntax `SHow WANLB HEALthcheck`

Description This command displays information about wan load balancer healthcheck resources (Figure 52-5, Table 52-4).

Figure 52-5: Example output from the **show wanlb healthcheck** command

```
WAN Load Balancer Healthcheck configuration
-----------------------------------------------------------
State ............................ ENABLED
Interval ......................... 60 seconds
Consecutive Success Checks ....... 2
Consecutive Failed Checks ........ 3

Number   Host
-----------------------------------------------------------
     1   172.20.156.100
     2   www.vpn-site.com
     3   www.critical-site.com
-----------------------------------------------------------
```

Table 52-4: Parameters in the output of the **show wanlb healthcheck** command

Parameter	Description
State	The state of the WAN load balancer healthchecks; one of enabled or disabled.
Interval	A fixed interval (in seconds) during which the WAN load balancer sends a separate healthcheck message to each of its configured hosts.
Consecutive Success Checks	The number of consecutive successful healthchecks to a specific host before it is deemed to be reachable.
Consecutive Failed Checks	The number of consecutive failed healthchecks to a host before that host is deemed unreachable.
Number	The number of the configured healthcheck host.
Host	The healthcheck host's IP address or domain name.

Example To display all parameters of healthchecks use the command:

```
sh wanlb heal
```

Related Commands **set wanlb healthcheck**

show wanlb resource

Syntax `SHow WANLB RESource[={ALL|`*interface*`}][HEALthcheck]`

Description This command displays information about all resources for the WAN load balancer (Figure 52-6, Figure 52-7, Table 52-5 on page 52-36). If a resource name is specified, the output displays detailed information about the particular resource (Figure 52-8 on page 52-37, Table 52-6 on page 52-38).

Parameter	Description
Resource	The resource whose information is to be displayed, where interface is a valid interface name formed by concatenating an interface type and an interface instance. Valid interfaces are: ● eth (such as eth0, eth1) ● PPP (such as ppp0, ppp1) To see a list of current valid interfaces, use the **show interface** command on page 9-72 of Chapter 9, Interfaces.
HEALthcheck	Displays detailed information about healthchecks for the specified resource. Healthchecks are periodic checks of the health of a connection between a resource and a selected remote host. The healthcheck method involves transmitting an ICMP echo request and monitoring its response.

Figure 52-6: Example output from the **show wanlb resource** command

```
WAN Load Balancer Resources

Resource            Status              State
-----------------------------------------------------------
ppp0                DISABLED            CLOSING
eth0                ENABLED             UP
eth1                DISABLED            DOWN
-----------------------------------------------------------
```

Figure 52-7: Example output from the **show wanlb resource** command if no resources are defined

```
WAN Load Balancer Resources

Resource            Status              State
-----------------------------------------------------------
There are no resources
-----------------------------------------------------------
```

Table 52-5: Parameters in the detailed output from the **show wanlb resource** command

Parameter	Description
Resource	The resource whose information is to be displayed.
Status	The current status of the resource; one of enabled or disabled.
State	The current state of the resource; one of up, down, or closing. The state of a resource will have the same state as its associated IP Interface. So if the IP interface is up, the resource state will also be up. If the IP interface is down, then the resource state will also be down. If the interface is in the disabled state and there are still session active, then the resource state will be in the closing state. Note that a resource whose healthcheck sites are all unreachable will move to the down state whereupon all user data will be redirected to alternative ports. The resource will continue to issue its healthchecks and will return the up state when the required number of **successchecks** have been received.

Figure 52-8: Example output from the **show wanlb resource=all** command

```
WAN Load Balancer Resource Configuration
------------------------------------------------------
Resource...................ppp0
Status.....................ENABLED
State......................UP
Weight.....................3000
Weight type ...............Manual
Total Sessions ............34123
Current Sessions............24

Healthchecks
   Avg overall response time ....40 ms
   Resource up events .......... 1
   Resource down events ........ 0
   Unreachable host events ..... 1
   Source IP address ........... None

   Number  Average Delay  Host
   ------------------------------------------------------
        1  Unreachable    202.36.8.9
        2  20 ms          www.vpn-site.com
        3  60 ms          www.critical-site.com
   ------------------------------------------------------

------------------------------------------------------
Resource  ..................... ppp1
Status ........................ ENABLED
State ......................... UP
Weight ........................ 3100
Weight type ................... Perfect Automatic
Total Sessions ................ 34123
Current Sessions............... 26

Adaptive Bandwidth Detection
   Current throughput .......... 3150 kbps
   Current maximum ............. 3950 bps

Healthchecks
   Avg Response Time ........... 30 ms
   Resource up events .......... 1
   Resource down events ........ 0
   Unreachable host events ..... 0
   Source IP address ........... 172.204.1.8

   Number  Average Delay  Host
   ------------------------------------------------------
        1  20 ms          202.36.8.9
        2  20 ms          www.vpn-site.com
        3  50 ms          www.critical-site.com
   ------------------------------------------------------
```

Table 52-6: Parameters in the detailed output from the **show wanlb resource=all** command

Parameter	Description
Resource	The resource interface.
Status	The current state of the interface; one of enabled or disabled.
State	The current state of the resource; one of up, down, or closing. The state of a resource will have the same state as its associated IP Interface. So if the IP interface is up, the resource state will also be up. If the IP interface is down, then the resource state will also be down. If the interface is in the disabled state and there are still session active, then the resource state will be in the closing state.
Weight	The weight that the WAN load balancer applies to this resource when selecting resources for a session. This parameter is only used and displayed when using the weighted lottery or weighted least connect algorithms. To set the WAN load balancer algorithm, use the **set wanlb** command on page 52-27.
Weight type	How the resource weight was determined; one of manual, automatic, or perfect automatic.
Total Sessions	The total number of successful sessions that have been made to this resource while in the up state.
Current Sessions	The total number of sessions currently running on the resource.
Adaptive Bandwidth Detection	Bandwidths calculated by adaptive bandwidth detection. These bandwidths are only displayed when the weight is determined by the perfectautomatic method.
Current throughput	The current throughput (in kbps) for the resource's IP interface, as calculated by adaptive bandwidth detection. It is the most most recently calculated value for the resolution period average.
Current maximum	The maximum throughput (in kbps) for the resource's IP interface, detected by adaptive bandwidth detection for the current update interval. The maximum throughput is used to update the resource's weight for the next update interval.
Healthchecks	
Avg overall response	The combined average response time from all the healthcheck host(s). This figure is displayed when the WAN load balancer uses the weighted fast response selection method. If healthchecks are disabled, the response time displayed is N/A.
Resource Up events	The number of times the resource's state has changed from down to up due to healthchecks, i.e. because one or more hosts became reachable.
Resource Down Events	The number of times the resource's state has changed from up to down due to healthchecks, i.e. because all the hosts became unreachable.
Unreachable host events	The number of separate times a host has become unreachable.
Source IP address	The source IP address used for the healthcheck packets.

Table 52-6: Parameters in the detailed output from the **show wanlb resource=all** command (Continued)

Parameter	Description
Number	The index number of a particular healthcheck host. These numbers are used when adding or deleting healthcheck hosts.
Average Response	The average response time in milliseconds (for the particular host) as calculated since the last healthcheck response was received, This is a moving average based on the last four response times for the particular healthcheck host. Unreachable hosts will show as unreachable.
Host	The IP address or domain name of the configured healthcheck host.

Figure 52-9: Example output from the **show wanlb resource=ppp0 healthcheck** command

```
WAN Load Balancer Resource Healthchecks
-------------------------------------------------------------
Resource ..................... ppp0
Avg overall response......... 40 ms
Resource up events ........... 1
Resource down events ........ 0
Unreachable host events ..... 1
   Host ..................... 202.36.8.11
   Status ................... Unreachable
   Avg response ............. N/A
   Total sent ............... 200
   Total not sent ........... 2
   Total failed ............. 7
   Total unreachable ........ 2
   Current  successful ...... 0
   Current failed ........... 5

   Host ..................... www.vpn-site.com
   Status ................... Reachable
   Avg response ............. 20 ms
   Total sent ............... 200
   Total not sent ........... 0
   Total failed ............. 2
   Total unreachable ........ 0
   Current successful........ 198
   Current fail ............. 0

   Host ..................... www.critical-site.com
   Status ................... Reachable
   Avg response ............. 60 ms
   Total sent ............... 200
   Total not sent ........... 0
   Total failed ............. 0
   Total unreachable ........ 0
   Current  successful....... 200
   Current failed ........... 0
-------------------------------------------------------------
```

Table 52-7: Parameters in the detailed output from the **show wanlb resource=ppp0 healthcheck** command

Parameter	Description	
Resource	The resource interface.	
Avg overall response	The combined average response time from all the healthcheck host(s). This figure is displayed when the WAN load balancer uses the weighted fast response selection method. If healthchecks are disabled, the response time displayed is N/A.	
Resource up events	The number of times the resource's state has changed from down to up due to healthchecks, i.e. because one or more hosts became *reachable*.	
Resource down Events	The number of times the resource's state has changed from up to down due to healthchecks, i.e. because all of the hosts became *unreachable*.	
Unreachable host events	The number of separate times a host has become *unreachable*.	
	Host	The IP address or domain name of the configured healthcheck host.
	Status	The status of the healthcheck host for the resource; one of reachable or unreachable. A host is reachable when the resource has consecutively received from it the configured number **successchecks**. A host is unreachable when the resource cannot receive from it the configured number **failchecks** responses. To configure **successchecks** and **failchecks** use the **set wanlb healthcheck** command on page 52-30.
	Avg response	The average response in milliseconds from the specified host, calculated since the last healthcheck response was received, or N/A if the host is unreachable. This is a moving average based on the last four response times for a healthcheck host.
	Total sent	The total number of healthchecks sent to the host.
	Total not sent	The number of healthchecks that failed because the WAN load balancer was unable to send the healthcheck. This may occur if the IP interface is down, for example, or if a DNS lookup fails to resolve a domain name.
	Total failed	The total number of failed healthchecks.
	Total unreachable	The total number of failures that occurred while the host was unreachable. Depending on the configured number of consecutive successful responses and failures, many failures could occur without the host actually becoming unreachable.
	Current successful	The current number of consecutive successful healthchecks since the last failed response occurred.
	Current failed	The number of consecutive failed healthchecks since the last successful response occurred.

Example To display general information for all of the resources, use the command:

```
sh wanlb res
```

Related Commands

add wanlb resource
delete wanlb resource
disable wanlb resource
enable wanlb resource
set wanlb resource

show wanlb sessions

Syntax `SHow WANLB SEssions [RESource=`*`interface`*`]`

Description This command displays information about all of the sessions currently open on WAN load balancer for a specified resource, or for all resources.

The **resource** parameter specifies the interface of the resource to display sessions for. If no resource is specified, all WAN load balancer sessions are displayed. Valid interfaces are:

- eth (such as eth0, eth1)
- PPP (such as ppp0, ppp1)

To see a list of current valid interfaces, use the **show interface** command.

Figure 52-10: Example output from the **show wanlb sessions** command

```
WAN Load Balancer Sessions
Resource  Source IP         Destination IP   Prot    Expiry
-------------------------------------------------------------
ppp10
          192.168.1.1       212.72.1.246      TCP      3599
          192.168.1.2       215.73.1.33       UDP      2350
eth0
          192.168.1.10      212.72.10.246     TCP       590
          192.168.1.20      215.73.10.33      UDP      1250
-------------------------------------------------------------
```

Table 52-8: Parameters in output of the **show wanlb sessions** command

Parameter	Description
Resource	The resource whose sessions are to be displayed.
Source IP	The source IP address used for the WAN load balancer session.
Destination IP	The destination IP address for the WAN load balancer session.
Protocol	The transport protocol used for the WAN load balancer session.
Expiry	The number of seconds left before this session expires. Each time the router receives a packet, the corresponding session is refreshed and the expiry time is reset. When the time expires, the session is deleted from the session table

Example To display all the WAN load balancer sessions, use the command:

```
sh wanlb se
```

Related Commands **show wanlb**